

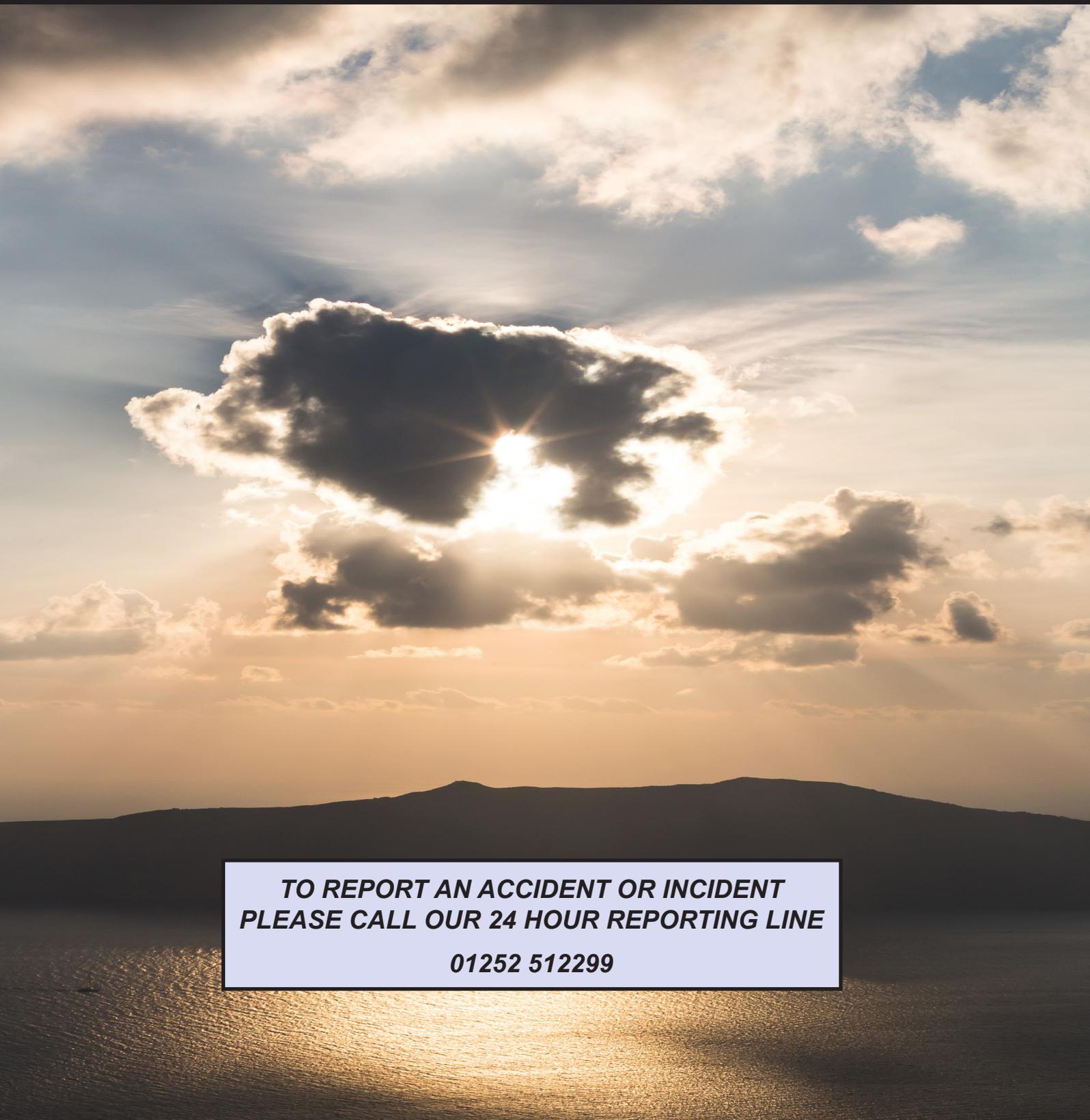
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# ***AAIB Bulletin***

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***11/2016***

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## **AAIB Field Investigation Reports**

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

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

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



**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-46-350P Malibu Mirage, N186CB	
<b>No &amp; Type of Engines:</b>	1 Lycoming TIO-540-AE2A piston engine	
<b>Year of Manufacture:</b>	1990 (Serial no: 46-22085)	
<b>Date &amp; Time (UTC):</b>	14 November 2015 at 1134 hrs	
<b>Location:</b>	Buttles Farm, Churchinford, Somerset	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 3
<b>Injuries:</b>	Crew - 1 (Fatal)	Passengers - 3 (Fatal)
<b>Nature of Damage:</b>	Aircraft destroyed	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	56 years	
<b>Commander's Flying Experience:</b>	600 hours (of which 260 were on type) Last 90 days - 17 hours Last 28 days - 4 hours	
<b>Information Source:</b>	AAIB Field Investigation	

**Synopsis**

The aircraft was approaching Dunkeswell Airfield, Devon after an uneventful flight from Fairoaks, Surrey. The weather at Dunkeswell was overcast, with rain. The pilot held an IMC<sup>1</sup> rating but there is no published instrument approach procedure at Dunkeswell. As the aircraft turned onto the final approach, it commenced a descent on what appeared to be a normal approach path but then climbed rapidly, probably entering cloud. The aircraft then seems to have stalled, turned left and descended to "just below the clouds", before it climbed steeply again and "disappeared into cloud". Shortly after, the aircraft was observed descending out of the cloud in a steep nose-down attitude, in what appears to have been a spin, before striking the ground. All four occupants were fatally injured.

The investigation was unable to determine why the aircraft made the initial rapid climb but there was some evidence to suggest that the pilot may have manually overridden the autopilot, during the initial descent, without realising it was still engaged. This would have caused an out-of-trim condition that could have contributed to the aircraft pitching up rapidly. Evaluation flights showed that the pitch attitude achieved during this manoeuvre would have been disorientating for the pilot and may explain why control was not regained.

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**Footnote**

<sup>1</sup> An IMC rating allows a pilot to fly in Instrument Meteorological Conditions (IMC), such as in cloud, but it is not a full Instrument Rating and its restrictions include: no flight in IMC in Class A, B or C controlled airspace; no takeoff or landings with a flight visibility of less than 1800 m, and no flight in IMC outside UK airspace.

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## History of the flight

At approximately 0930 hrs, the pilot, who was the owner of the aircraft, telephoned Dunkeswell Airfield to let them know that he was planning to fly there and to enquire about the weather. He was informed by an air/ground radio operator that Dunkeswell had a 500 ft agl cloudbase, with rain. The radio operator recalled the pilot asking if the weather had been “coming and going in patches” and advising him that “it had been constantly raining throughout the morning”. The pilot replied that he would delay his departure and planned to arrive at Dunkeswell at about 1130 hrs.

The weather at Fairoaks Airport was good for flying with over 10 km visibility, and at 1041 hrs the aircraft departed for Dunkeswell. The flight proceeded uneventfully via the Southampton VOR, with the aircraft climbing progressively to an altitude of 5,000 ft amsl. At 1106 hrs, the pilot called Bournemouth ATC and was provided with a Traffic Service<sup>2</sup>. Subsequently, he requested a descent to 3,000 ft to “TRY AND BECOME VISUAL”.

At 1113 hrs, ATC passed the pilot the following unofficial<sup>3</sup> weather observation from Dunkeswell: “VISIBILITY TO THE NORTH OF THE AIRFIELD IS FIVE KILOMETRES, TO THE SOUTH-WEST ITS FOUR KILOMETRES, ITS OVERCAST BETWEEN EIGHT HUNDRED AND A THOUSAND FEET, MODERATE RAIN, SURFACE WIND IS ONE NINE ZERO DEGREES TWELVE KNOTS, THEIR QNH ONE ZERO TWO FOUR.” At 1117 hrs, the pilot reported he was going to “DESCEND TO TWO THOUSAND FEET TO TRY AND REMAIN VISUAL.” ATC advised him that on descending below 2,300 ft he would be “BELOW THE MINIMUM TERRAIN LEVEL<sup>4</sup>” for the controller’s radar and would be responsible for his own terrain separation. At 1123 hrs, the pilot reported that he was VMC<sup>5</sup> and was changing radio frequency, to speak to Dunkeswell.

When contact had been established, the air/ground radio operator at Dunkeswell advised the pilot that Runway 22 was in use and provided him with the QFE pressure setting of 994 hPa and the circuit direction. The pilot informed ‘Dunkeswell Radio’ that he was intending to join left base for Runway 22 and subsequently requested a wind check. He was advised that the wind was from 220° at 16 kt. The last transmission the operator recalled hearing from the pilot was that he was joining “for a three mile finals to Runway 22”. After several minutes, during which the aircraft did not appear, the operator tried calling the pilot but there was no response. To establish if the aircraft had diverted to Exeter Airport, a radio was tuned to the Exeter Approach frequency. When the radio operator heard that a police helicopter was en-route to investigate reports of an aircraft accident to the north of Dunkeswell, he suspected that the aircraft had crashed.

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### Footnote

<sup>2</sup> Air Traffic providers in the UK offer different levels of Air Traffic Service: Basic, Traffic, Deconfliction and Procedural. These are described in the UK CAA Publication CAP 774.

<sup>3</sup> This unofficial weather was obtained by telephoning a second air/ground operator at Dunkeswell who made a visual observation.

<sup>4</sup> Minimum terrain level refers to the Minimum Vectoring Altitude which is the lowest altitude, expressed in ft amsl, to which a radar controller may issue aircraft altitude clearances during vectoring/direct routing except if otherwise authorized for radar approaches, departures and missed approaches.

<sup>5</sup> VMC, in the airspace and at the altitude and speed of N186CB at the time of this call, was a minimum of 5 km flight visibility, clear of cloud and in sight of the surface.

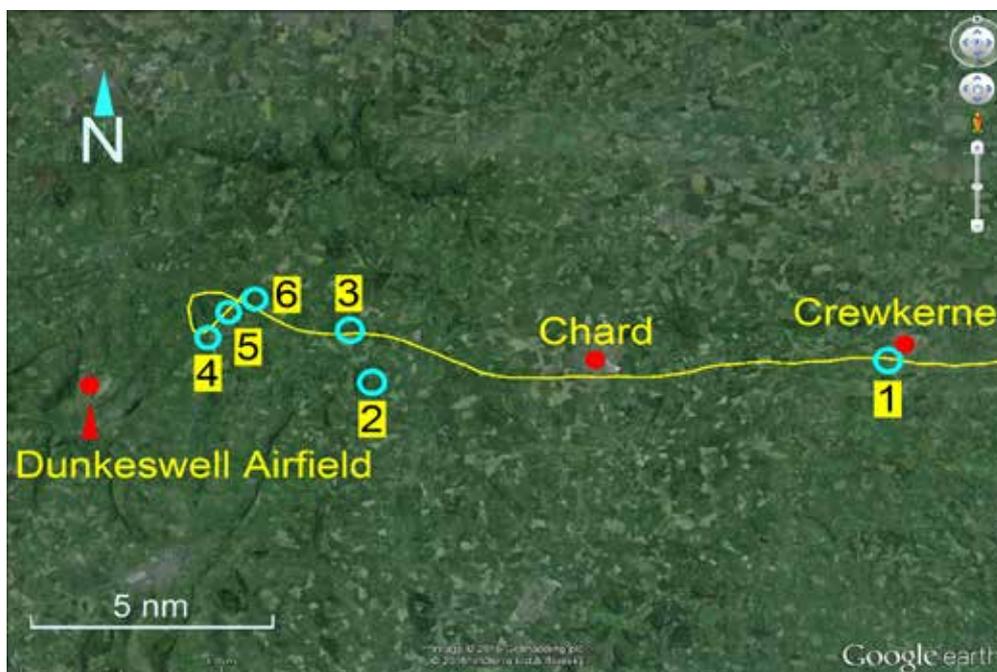
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During the latter part of the flight, the aircraft was observed and heard by a number of witnesses in the area between Crewkerne and Dunkeswell. The sounds from the aircraft during its final manoeuvres were likened to the noise of an aircraft performing aerobatics, before it was seen descending at a steep angle and high rate of descent into a field. All four occupants in the aircraft were fatally injured in the impact.

Since the phone call from the pilot that morning, all Dunkeswell's planned training flights had been cancelled as a result of the weather, which the air/ground radio operator considered had deteriorated.

#### *Witness information*

A map showing the location of several of the witnesses is at Figure 1.



**Figure 1**

Witness locations and radar track of the accident flight

The witness at location 1 was an experienced general aviation pilot. He described seeing an aircraft at “around 1130 [hrs]”, matching the description of N186CB, flying straight and level in a westerly direction. He estimated the aircraft was flying “below 500 feet” agl and the engine sounded loud, as though it was operating normally at a high power setting.

In locations 2 and 3, at about 1130 to 1140 hrs, witnesses reported seeing a small aircraft flying in a westerly direction at a height of approximately 300 ft agl, close to the base of cloud.

In location 4, many people reported hearing an aircraft performing what they perceived as aerobatics, overhead. They assumed the aircraft was above the clouds, as the weather was “bad” and they could not see it.

In location 5, a witness was working in his garden. He described hearing what he thought was an aircraft performing aerobatics. He looked up and saw an aircraft fly low over his head, then pitch up steeply to an estimated 70° nose-up, before disappearing into cloud.

In location 6, another witness was working in his yard with a young assistant. He described the weather conditions at the time as “not good, it was raining and there was low cloud”. He heard the “sound of an aircraft that sounded as though it was doing aerobatics”. Then he saw an aircraft appear from the base of the clouds, about 500 m from his position. It was in a steep nose-down attitude, descending rapidly. It then disappeared below the horizon and, on hearing a noise, he realised the aircraft must have crashed. His young assistant described the aircraft as rotating as it descended. The elder witness ran to the scene whilst telephoning the emergency services. When he arrived, it was apparent that none of the occupants had survived.

An air ambulance and police helicopter arrived at the accident site shortly afterwards. The pilots of these helicopters later described there being poor weather conditions in the area.

### **Dunkeswell**

Dunkeswell Aerodrome is situated in the Blackdown Hills, approximately 4 nm north-west of Honiton. At 839 ft amsl, it is the highest licensed airfield in the United Kingdom. The airfield is situated in uncontrolled airspace and has no published instrument approach procedures. It is equipped with an air/ground radio, which is used to provide airfield information to aircraft. The air/ground radio operators are not, nor are they required to be, trained meteorological observers. There is an automated weather station at the aerodrome, which produces a Surface Synoptic Observation (SYNOP) of the weather on the hour, every hour. These SYNOPs are available on several weather information websites. They were not routinely accessed by the air/ground operators at Dunkeswell.

### **Meteorology**

At the time of the accident, the region between Fair Oaks and Dunkeswell was being affected by an approaching warm sector and large amounts of cloud were being generated ahead of the surface front.

At Exeter and Yeovilton, light rain was being reported with visibility greater than 10 km. Surface winds were reported to be from the south west at between 9 and 14 kt, with scattered cloud at 2,000 ft and a broken layer at 3,500 ft.

The conditions at Dunkeswell were worse. The 1100 hrs Dunkeswell SYNOP gave the weather as: 7 km visibility in moderate rain, with  $\frac{7}{8}$ <sup>th</sup> broken cloud cover at 300 ft aal. The surface wind was reported as being south-westerly at 9 kt and the QNH was 1024 hPa. The 1200 hrs SYNOP was the same, except the south-westerly wind had increased to 17 kt.

## Recorded information

### *Sources of recorded information*

RTF recordings relating to the flight were obtained from Farnborough and Bournemouth ATC. Communications between the aircraft and the air/ground operator at Dunkeswell were not recorded.

Recorded radar information (Mode A, C and S<sup>6</sup>) was available from ground-based sites located at Clee Hill, Bovington, Burrington, Heathrow Airport and Pease Pottage. When combined, the radar provided an almost complete record of the accident flight, with the data starting shortly after the aircraft had taken off from Fair Oaks and ending shortly before it struck the ground. The aircraft's approach to Dunkeswell was recorded by two radars located at Burrington (31 nm to the west of the accident site); these radars are referred to as Burrington Comb and Burrington SSR. Due to their relative alignment, the aircraft's position and altitude were recorded at a rate of up to four data points every ten seconds.

A GPS unit<sup>7</sup> installed in the aircraft's instrument panel was examined with the assistance of the manufacturer. Evidence indicated that it had been powered by the aircraft's electrical system until the aircraft struck the ground. The GPS has a touch-screen colour display (5.27 inches high and 4.46 inches wide), which provides, among other information to the pilot, the aircraft's horizontal position on a moving map display that includes topographical features, airports and waypoints. To aid navigation on to the final approach to a runway, a dashed line extending 5 nm along the runway centreline can be displayed for airfields that are stored in the GPS database. The GPS database included Dunkeswell. Upottery disused airfield, which is 2.7 nm to the north-east of Dunkeswell, was not in the GPS database. The GPS unit had been installed in the aircraft in September 2014.

The GPS unit contained a flight plan<sup>8</sup> from Fair Oaks to Dunkeswell. This correlated closely with the aircraft's route recorded on radar. A waypoint had also been manually entered into the GPS. This was positioned on Runway 22's extended centreline just less than 2 nm from the runway threshold. This GPS unit did not record track logs.

A tablet computer<sup>9</sup> belonging to the pilot was recovered from a bag found inside the aircraft and downloaded. The tablet computer contained records of a number of previous flights recorded by a flight navigation software application<sup>10</sup>. It did not contain a record of the accident flight, indicating that the navigation software application was not in use

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### Footnote

<sup>6</sup> Mode A refers to the four-digit 'squawk' code set on the transponder. Mode C refers to the aircraft's pressure altitude which is transmitted in 100 ft increments. Mode S provided parameters of groundspeed and track angle from the aircraft's GPS unit.

<sup>7</sup> Garmin model GTN 750.

<sup>8</sup> A GPS flight plan consists of sequentially ordered waypoints to assist in horizontal navigation. A typical flight plan consists of the departure airport, a series of turning points, such as radio navigation beacons or topographical features, and the final destination. If a flight plan is selected, the GPS displays a track line on the moving map display that the pilot can follow.

<sup>9</sup> Apple manufactured iPad mini, model A1455.

<sup>10</sup> Skydemon.

during the accident flight. Historical records included 25 flights to Dunkeswell between September 2013 and October 2015, of which 14 had departed from Fairoaks. Evaluation of these flights and the software application showed:

- The pilot was familiar with the route between Fairoaks and Dunkeswell and had made regular use of the software application on the tablet computer.
- The pilot had flown within 2 nm of Upottery disused airfield during 24 of the 25 approaches to Dunkeswell and had flown almost directly over Upottery during four of these approaches.
- Over half of the 25 landings at Dunkeswell were on Runway 22.
- The pilot typically positioned onto the final approach between 2 nm and 3 nm from the runway threshold when landing at Dunkeswell.

#### *Interpretation of recorded data*

Figure 2 provides the track of the flight from Fairoaks to Dunkeswell. Figures 3, 4 and 5 provide the aircraft's track and salient parameters during the final minutes of the flight. The aircraft's altitude amsl is derived from Mode C, corrected for a QNH pressure of 1024 hPa, with a tolerance of  $\pm 50$  ft.



**Figure 2**

Combined radar track of the flight from Fairoaks

At 1120 hrs, 32 nm to the east of Dunkeswell, the aircraft was flying level at about 2,000 ft amsl and at a groundspeed of 130 kt (Figure 2). It maintained an altitude of between 1,900 ft and 2,000 ft amsl whilst following a course towards Dunkeswell, consistent with

the flight plan found in the GPS. As the aircraft overflew the town of Chard, which is 10 nm to the east of Dunkeswell, the aircraft altered course towards the GPS waypoint positioned on Runway 22's extended centreline, just less than 2 nm from the runway threshold. As the aircraft closed to within 3 nm of the waypoint, and approximately 1 nm from Uptonery disused airfield, it altered course to the right before starting a gradual left turn towards the final approach course for Runway 22.

At an altitude of about 2,000 ft amsl<sup>11</sup> (about 1,375 ft agl) and a range of 3 nm from the runway threshold (consistent with a vertical approach path of 3.5°), the aircraft proceeded to close to within approximately 150 m of the extended centreline (Figures 3, 4 and 5). However, rather than establishing onto the final approach, the aircraft continued to turn to the left whilst also descending. The aircraft's groundspeed at this point was 144 kt and its estimated airspeed was 153 KIAS, based on the reported wind of 220° at 16 kt. During the turn towards the extended centreline, the turn rate progressively increased from 0.25°/sec to 1.8°/sec over a 24 second period.

Over the next 16 seconds, the rate of turn increased to an average of 3.8°/sec and then reached 8.1°/sec, whilst the aircraft descended about 300 ft to an altitude of 1,700 ft amsl (about 1,030 ft agl), at an average descent rate of 1,125 ft per minute (fpm) (±375 fpm). The aircraft then climbed rapidly, at an average vertical speed of 3,660 fpm, whilst continuing to turn to the left. Eighteen seconds later the aircraft reached a peak recorded altitude of 2,900 ft amsl, which coincided with the groundspeed having reduced to approximately 32 kt (an estimated airspeed of 33 KIAS). Shortly after, the aircraft descended rapidly at an average vertical speed of 6,000 fpm over a period of 16 seconds, before reaching a minimum recorded altitude of 1,300 ft amsl (about 460 ft agl). As the aircraft descended, its groundspeed increased rapidly to a recorded maximum of 176 kt (an estimated airspeed of 160 KIAS) and the turn to the left was arrested, with the aircraft tracking north-east. The aircraft then climbed again at an average rate of 1,600 fpm. Twenty-four seconds later, at 1134:36 hrs, the final radar return was recorded; the aircraft's altitude was 1,900 ft amsl (about 1,075 ft agl) and its groundspeed was 84 kt (an estimated airspeed of 68 KIAS). The final radar point was close to where the aircraft struck the ground; the calculated direct flightpath angle between the two positions was 60°.

#### *Descent rate following final radar return*

After 1134:36 hrs, there were no further radar returns from the aircraft. This could be because it was not detected by the radars during their next scan of the area, it had descended below the radar floor or the aircraft had already struck the ground by the time of the next radar scan.

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#### **Footnote**

<sup>11</sup> The Mode C altitude recorded by radar is referenced to the international standard atmospheric pressure of 1013.25 hPa. A correction of 293 ft (27.3 ft per hPa) for the QNH of 1024 hPa has been applied to the Mode C altitude (ie 1,700 ft Mode C + 293 ft QNH correction = 1,993 ft). The corrected altitude has then been rounded to the nearest 100 ft (ie 1,993 ft has been rounded to 2,000 ft).

The radar data was analysed to determine the aircraft's descent rate during the final seconds, based on the radar scan period and radar floor coverage. Although it was found that coverage from the Burrington radars extended almost to ground level in the area of the accident site, evidence obtained during the evaluation flight (see section 'Evaluation flights') showed that it was possible for an aircraft of the same size as N186CB occasionally not to be recorded by radar when its flightpath is altered quickly. Therefore, it could not definitively be concluded when N186CB struck the ground. However, from the witness accounts, the close proximity of the final radar position to the accident site and the aircraft's low forward speed, it is likely that the aircraft struck the ground shortly after the final radar return at 1134:36 hrs. Table 1 provides average rates of descent for different possible times of impact, based on the three preceding scan times (a period of 14 seconds) of the two radars at Burrington.

<b>Time of ground impact (hrs)</b>	<b>Average rate of descent (fpm)</b>
1134:42	10,750
1134:44	8,060
1134:50	4,600

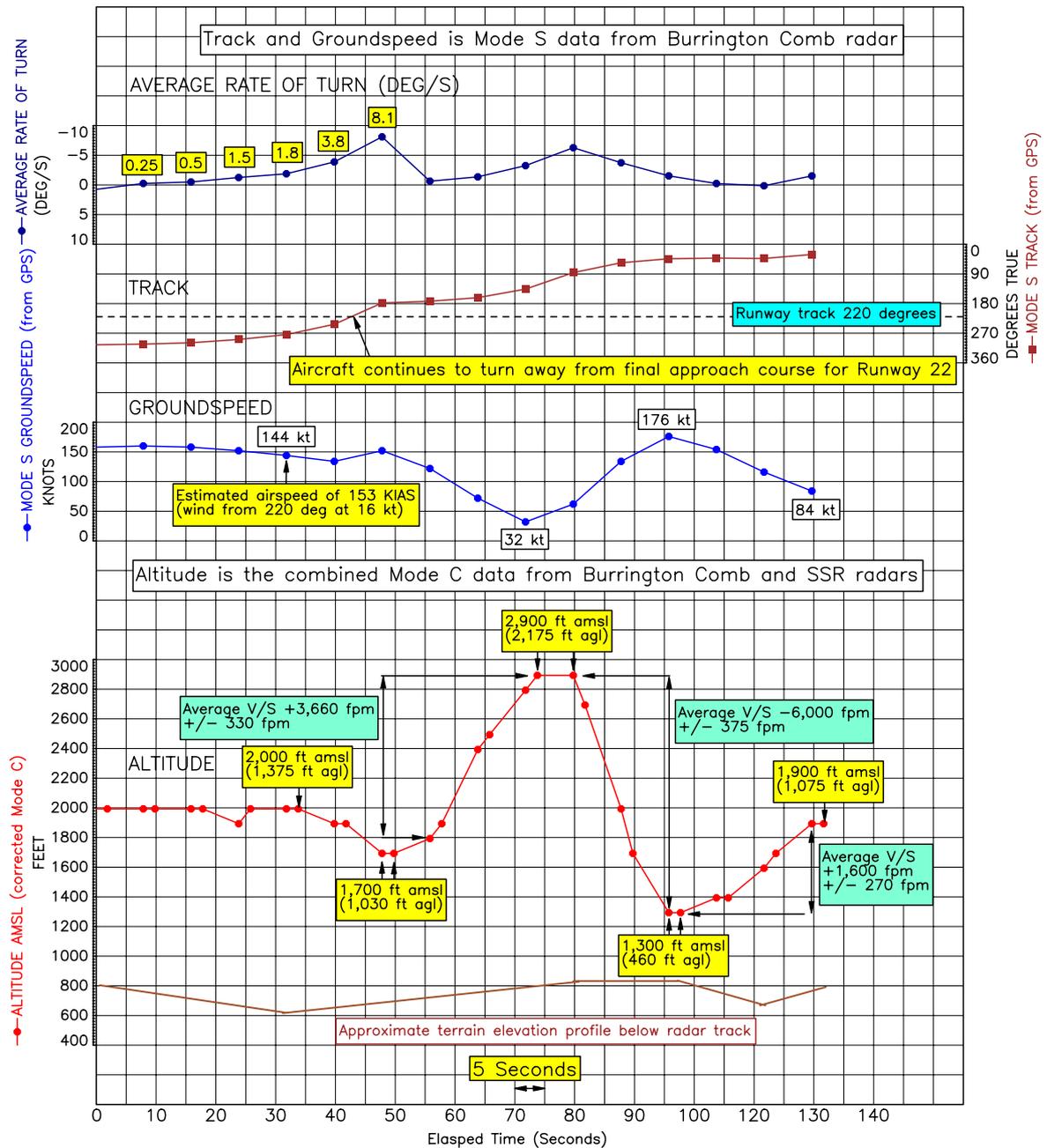
**Table 1**

Possible final average descent rates based on radar scan timings

#### *Transponder altitude data validity*

The altitude input to the transponder was provided by the primary altimeter installed in the left instrument panel. This encoding altimeter was removed and examined at an approved facility under AAIB supervision. The barometric function of the altimeter could not be tested due to damage sustained during the accident, however there was no evidence of a pre-existing defect. Analysis of the encoder's electrical output signals, wiring to the transponder and radar data revealed no evidence of a pre-accident fault.

During the series of final manoeuvres shortly before the aircraft struck the ground, the aircraft had descended to a minimum indicated height of about 460 ft agl. The aircraft did not strike the ground at this time and therefore, if a discrepancy had existed within the altimeter or its static input that caused it to overread, the maximum error could not have been greater than 460 ft.



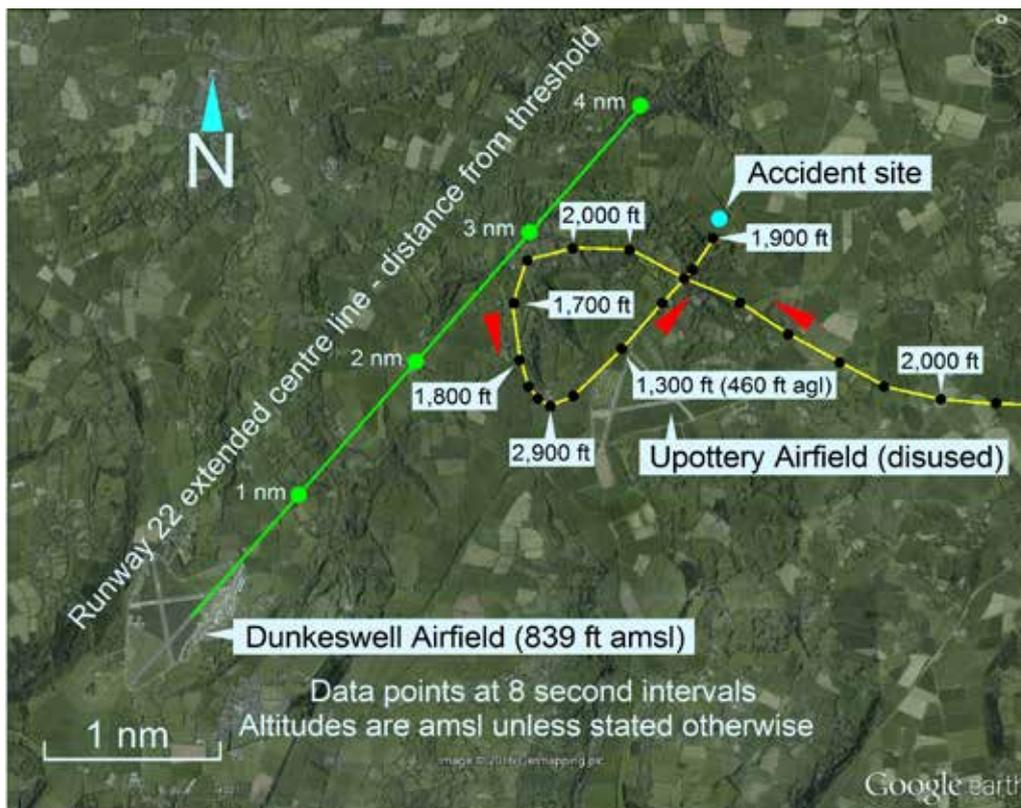
**Figure 3**  
Accident flight radar data from Burrington Comb and SSR radar heads

**Bulletin correction**

When this report was originally published, the above plot of recorded radar data for the accident flight contained an incorrect height measurement.

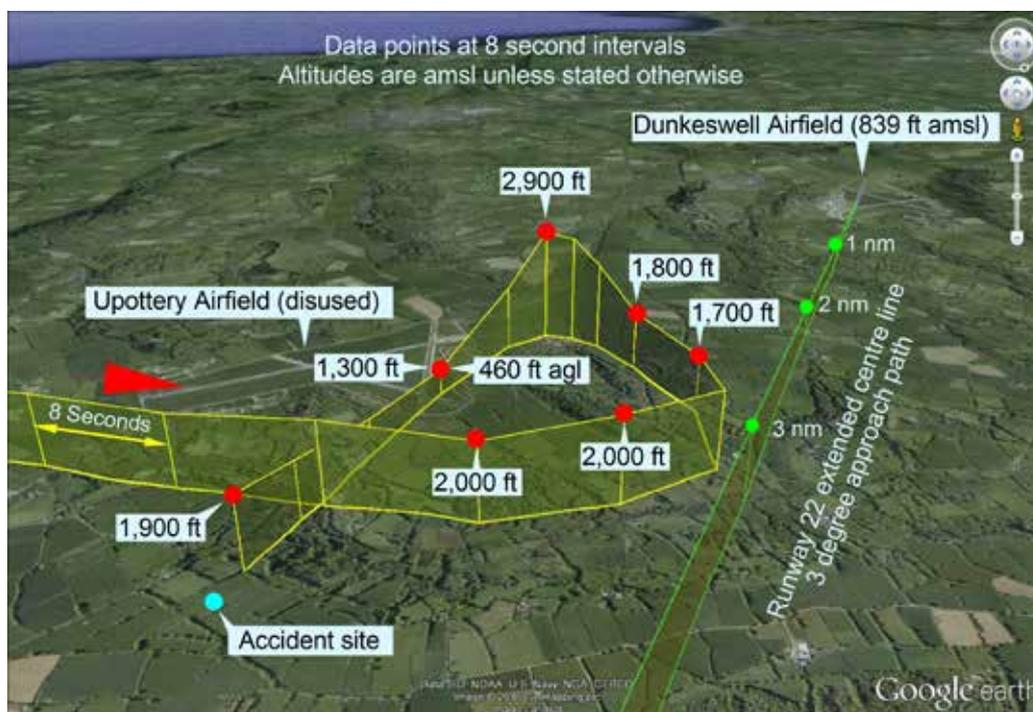
In the middle of the figure, under the altitude '2,900 ft amsl', the height should read '**2,175 ft agl**', not '1,175 ft agl' as originally stated. The supporting text, analysis and conclusions were unaffected by this error.

The online version of this report was corrected on 22 November 2016.



**Figure 4**

Approach to Dunkeswell (Burrington Comb radar) – plan view



**Figure 5**

Approach to Dunkeswell (Burrington Comb radar) – view looking south

## Aircraft information

### General

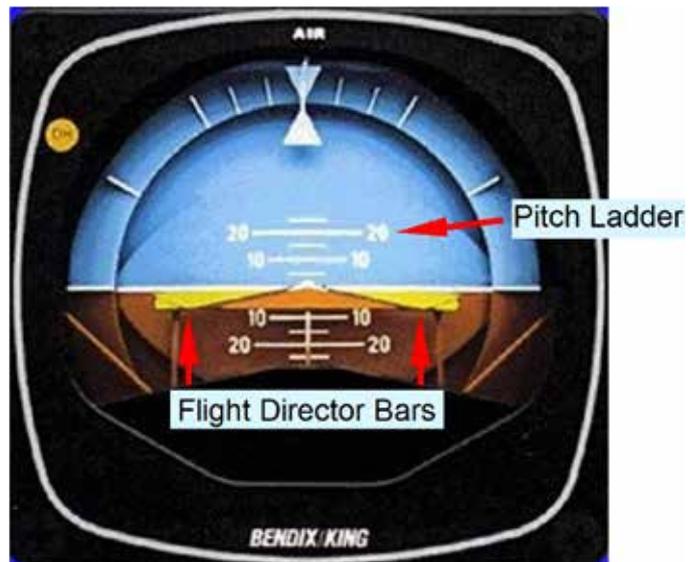
The Piper PA-46-350P Malibu Mirage is a six-seat, pressurised aircraft of conventional aluminium construction powered by a Lycoming TIO-540-AE2A piston engine. N186CB was fitted with a two-bladed constant speed propeller<sup>12</sup>. The aircraft has a maximum takeoff weight of 4,300 lb and a cruise speed of 215 KTAS at 25,000 ft. The published power-off stall speed at maximum takeoff weight, with the flaps and gear retracted, is 69 KIAS. Usable fuel tank capacity is 120 US gallons. The flying controls are conventional, with the ailerons, elevator and rudder operated by cables and pulleys. The elevator trim tab is controlled by a trim wheel in the cockpit, which operates a screw-jack in the tail of the aircraft via cables. The elevator trim (pitch trim) can also be operated electrically, using trim switches mounted on each of the dual control wheels which power a pitch trim servo beneath the aft cabin. The aircraft had electrically-controlled flaps and an after-market SP9000 spoiler system fitted.

The aircraft's seating configuration consisted of three rows of two seats, with the centre row of seats facing aft.

### Instruments

The aircraft was fitted with two vacuum-driven attitude indicators for redundancy. The attitude indicator on the left side of the instrument panel was a Bendix/King KI256 Flight Command Indicator with flight director bars (Figure 6). The pitch ladder on this instrument reads up to 25° nose-up and the movable face of the instrument meets a physical stop between about 50° and 60° nose-up<sup>13</sup>.

For navigation the aircraft was fitted with a Bendix/King ED462 Electronic Horizontal Situation Indicator and a Garmin GTN 750 GPS with moving map display.



**Figure 6**

Bendix/King KI256 Flight Command Indicator  
(attitude indicator)

### Footnote

<sup>12</sup> The propeller rotates clockwise as viewed from the pilot's seat.

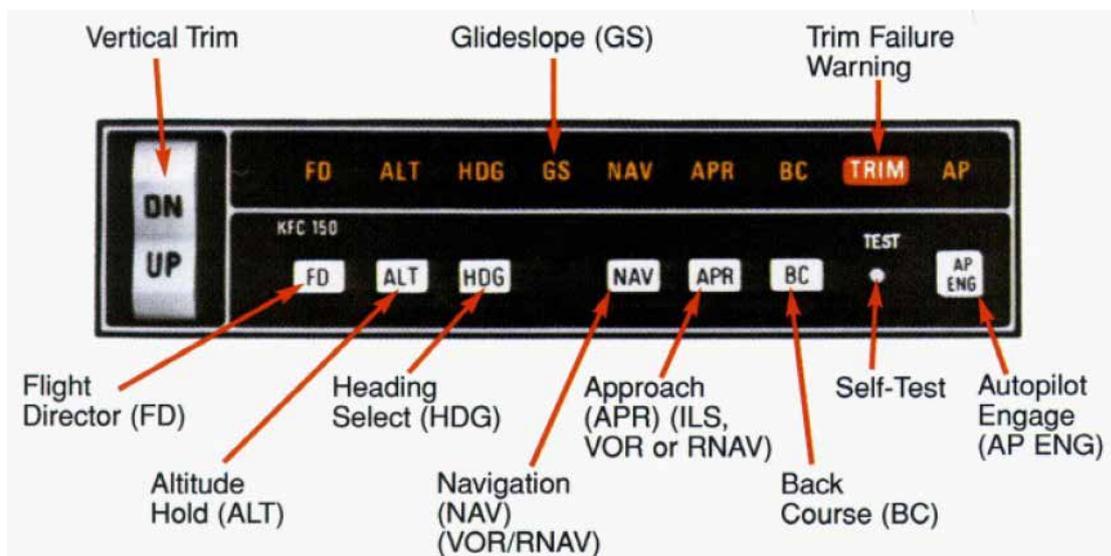
<sup>13</sup> This instrument is designed to FAA Technical Standard Order TSO-C4c which requires the range of indication in pitch to be at least  $\pm 25^\circ$ . The instrument must also be operable following manoeuvres of  $360^\circ$  in pitch. Above  $+25^\circ$  the instrument must show blue sky but the pitch angle indication need not be accurate.

## Autopilot

A Bendix/King KFC150 3-axis autopilot system was fitted. This system incorporated a KC192 Flight Computer (Figure 7) and four servos controlling the elevator, elevator trim, aileron and the rudder. The rudder servo provided a yaw damper function. The aircraft was also fitted with the optional KAS297B Altitude/Vertical Speed (VS) Selector. The autopilot was engaged by pressing the AP ENG button on the KC192 which engaged the autopilot in an attitude hold mode unless another mode button was also pressed. Selecting 'ALT' engaged the altitude hold mode and the autopilot maintained the selected altitude. Selecting 'HDG' engaged the heading mode and the autopilot turned the aircraft to the pilot's selected heading<sup>14</sup>.

In HDG mode the autopilot will turn the aircraft to a newly selected heading with a maximum bank angle of about 22°. At an airspeed of 150 kt, a bank angle of 22° will result in a turn rate of 3.0°/sec. The maximum bank angle of 22° is commanded whenever the heading bug is moved more than about 15° away from the current heading. If a smaller heading change is selected a reduced bank angle is used, resulting in a reduced turn rate.

The separate KAS297B Altitude/VS Selector was used to select a climb or descent rate and could be set to capture a selected altitude. The maximum climb rate that could be selected was 3,000 fpm. The KAS297B received its barometric correction from the setting on the pilot's primary encoding altimeter. Another way of changing altitude with the autopilot engaged was to press the Vertical Trim UP/DN button on the KC192 (Figure 7) – a single press commands a 500 fpm change in altitude in the selected direction. The third way of changing altitude with the autopilot engaged was to press and hold the Control Wheel Steering (CWS) button on the control wheel and manoeuvre to a new altitude, then release the button.



**Figure 7**

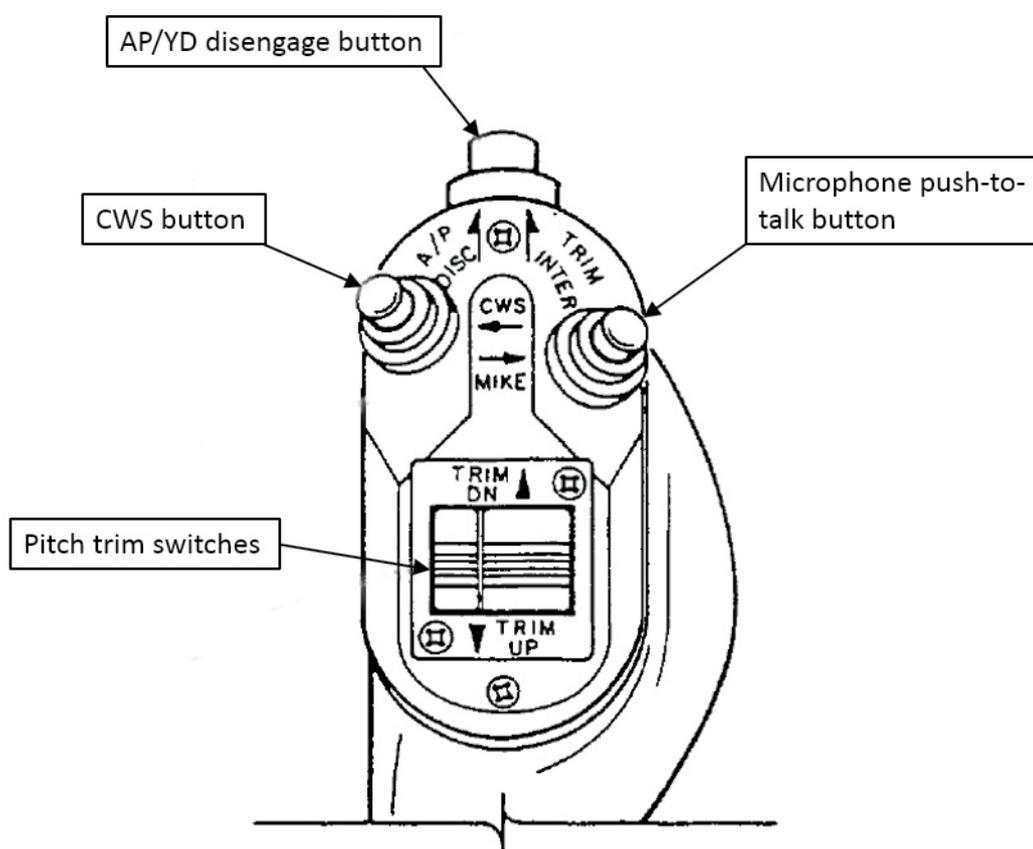
KC192 Flight Computer (autopilot control panel)  
 (YD yaw damper caption not shown but it was to the left of the FD caption)  
 (image copyright Honeywell)

### Footnote

<sup>14</sup> The heading was selected using a rotary knob in the centre of the instrument panel.

N186CB was fitted with an optional yaw damper switch to operate this system independently of the autopilot.

The primary means of disengaging the autopilot was by pressing the Autopilot/Yaw Damper (AP/YD) disengage button<sup>15</sup> on the control wheel (Figure 8). Pressing this button would disengage the autopilot, yaw damper and the flight director. Pressing the pitch trim switches on the control wheel or the 'AP ENG' button on the KC192 would also disengage the autopilot but would leave the flight director and yaw damper on, together with any associated modes (eg ALT, HDG, NAV). Pitch rates in excess of 8° per second (between pitch angles of ±15°) or roll rates in excess of 14° per second, for a period of 1 second, would also cause the autopilot to disengage and would leave the flight director and yaw damper engaged<sup>16</sup>.



**Figure 8**

Control wheel switches  
(image copyright Honeywell with AAIB annotations)

#### Footnote

- <sup>15</sup> This button is referred to in the flight manual as the 'A/P DISC/TRIM INTER switch' but the term Autopilot/Yaw Damper disengage button is used in this report because the button serves to disengage both the autopilot and the yaw damper.
- <sup>16</sup> If the CWS button is pressed while these pitch or roll rates are exceeded the autopilot will not disengage. If a pitch rate of 8°/s is exceeded above an angle of 15° the autopilot may not disengage because the pitch angle data sent by the KI256 attitude indicator to the KC192 flight computer is not sufficiently accurate above 15°.

The flight manual supplement for the KFC150 includes the following warning:

*'Do not help the autopilot or hand-fly the airplane with the autopilot engaged as the autopilot will run the pitch trim to oppose your control wheel movement. A mistrim of the airplane, with accompanying large elevator control forces, may result if the pilot manipulates the control wheel manually while the autopilot is engaged.'*<sup>17</sup>

If, for example, the autopilot is engaged in ALT hold mode at 2,000 ft and the pilot pushes the control wheel forward to descend, the autopilot will command nose-up pitch trim in an attempt to regain 2,000 ft. This nose-up pitch trim will continue until either the autopilot is disengaged or 2,000 ft is reached.

The manual for the KFC150 states that the autopilot must be disengaged below 200 ft agl during approach operations and below 800 ft agl for all other phases of flight. The yaw damper must be disengaged before landing.

The KFC150 has a trim monitor which will emit an aural warning and cause the TRIM failure warning light to flash if it detects uncommanded pitch trim movement. The KFC150 manual contains a procedure for a TRIM failure which involves grasping the control wheel firmly while pressing and holding the autopilot disengage switch (which also interrupts power to the trim servo), and then locating and pulling the 'pitch trim' and 'autopilot' circuit breakers. The Radio Master switch can be used to remove power from the autopilot and trim servo while the circuit breakers are located.

### *Maintenance history*

The aircraft was maintained by a Federal Aviation Administration (FAA) approved maintenance organisation in the UK, in accordance with FAA regulations. The aircraft had logged 1,751 hours and its last maintenance was an altitude encoder fault investigation on 11 November 2015. This investigation did not find any fault with the altitude encoding system after connectors and pins had been cleaned.

There were no deferred defects in the pilot's defect log found in the wreckage. The aircraft's last 100 hour inspection was on 24 August 2015 and included an altimeter calibration check. On 22 June 2015, the aircraft's lift transducer, part of the stall warning system, was replaced and was noted in the pilot's logbook as having been tested on 23 June 2015.

In 2007, the aircraft's fuselage was replaced due to a landing accident in Germany in 2003<sup>18</sup> that resulted in damage to the forward section of the fuselage assembly. The replacement

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### **Footnote**

<sup>17</sup> Explanation of 'mistrim': An aircraft is considered 'in-trim' in pitch if, when you release pressure on the controls, the aircraft does not pitch up or down. The elevator trim tab can be positioned manually by the pilot or automatically by the autopilot to cause the elevator to stay steady in the position that results in trimmed flight. An 'out-of-trim' or 'mistrim' condition exists when releasing pressure on the controls results in a pitch up or down.

<sup>18</sup> German Federal Bureau of Aircraft Accident Investigation (BFU) report 3X001-01/03, aircraft registration D-EXCC.

fuselage, from aircraft serial number 46-36196, had also been involved in an accident, although according to the accident report there was no damage to the fuselage<sup>19</sup>. This fuselage had originally been fitted with a KFC225 autopilot system, but it was supplied without avionics. The original fuselage's avionics, including the KFC150 autopilot system, were refitted during the replacement.

### Accident site and initial wreckage examination

The aircraft wreckage was found in a field, 175 m north-east of the aircraft's last radar position. The aircraft had struck the ground at an elevation of 820 ft amsl, in a nose-down attitude, with a high rate of descent and at low forward speed (Figure 9). The orientation of the fuselage was in the direction 123°(M) and the fractured forward fuselage was resting at a nose-down attitude of about 25°. Damage to the undersides of the wing was consistent with the aircraft's flight path having been steeper than its nose-down attitude, suggesting that the wing was at a high-angle-of-attack, probably stalled, on impact. The aircraft had missed 6.5 m high power lines, which were 2.1 m aft of the aircraft's tail, and the left wing had travelled forward about 1 m from its initial impact point. The right wing had failed at the rear attachment and was angled forward. The tail section had failed in downward bending and the vertical tail had failed in forward and sideways bending. All external components of the aircraft were accounted for.



**Figure 9**  
Accident site

The propeller hub had fractured and its mounting flange had failed at the engine crankshaft attachment due to impact forces. One blade, which had detached from the failed hub, had suffered significant damage and was buried in the ground underneath the nose of the aircraft. The remaining blade, still attached to the hub, had suffered minimal damage with some chordwise scoring. The flaps and landing gear were in the retracted position.

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#### Footnote

<sup>19</sup> Accident Investigation Board Denmark report HCL16/02, aircraft registration OY-JAM.

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Both fuel tanks had ruptured and were empty but there was a distinct smell of fuel at the site. A ground survey found that about 20 tonnes of soil was contaminated with fuel, but an accurate fuel quantity could not be determined from this.

### **Weight and balance**

The pilot occupied the front left seat and the three passengers were sitting in one of the centre seats and both of the aft row seats. The exact fuel state of the aircraft at the time of the accident was not known, so a probable fuel load was calculated based on estimated fuel burn and previous fuel uplift records. Combining this with the weight of the passengers and the recovered baggage, the minimum weight was estimated at 3,951 lb with a CG of 146.3 inches (aft of datum) and the maximum weight was estimated at 4,383 lb with a CG of 146.7 inches. The maximum takeoff weight, as indicated in the Pilot's Operating Handbook (POH), was 4,300 lb with a CG range of 143.3 to 147.1 inches.

### **Detailed wreckage examination**

#### *Flying controls examination*

An examination of the pitch, roll and yaw flying control systems revealed a few breaks but these were all consistent with overload failures associated with impact. There were no obvious control restrictions and there were no pre-impact failures in the elevator or elevator trim tab systems. The elevator trim actuator was found set to 19 mm (full nose-up trim was 40.6 mm, neutral was 24.1 mm and full nose-down trim was 5.8 mm).

#### *Powerplant examination*

The throttle, mixture and propeller control runs were examined and there were no disconnections, apart from some overload failures caused by impact.

A complete strip examination of the engine did not reveal any pre-impact mechanical failures or evidence of heat distress. The left magneto was bench-tested and operated normally. The right magneto was destroyed in the impact but an internal visual inspection did not reveal any defects. The fuel servo, the engine-driven fuel pump, fuel flow divider and injector nozzles were all tested and were within limits. The propeller governor was tested and was found to be slightly outside the specification for a new or overhauled unit but within the normal range for a used unit.

The propeller hub was also strip examined and the propeller manufacturer assisted in the analysis of the propeller blade damage and hub witness marks.

Blade 1 had remained attached to the hub and had suffered limited damage compared to blade 2, which had detached from the hub. Blade 1 had tip chordwise scoring on its forward face, which indicated rotation at impact, and no scoring on its aft face which indicated that the blade struck the surface at a negative angle of attack, indicating no or low power. The tip also showed slight twisting, leading edge down, and aft bending which also supported a negative angle of attack.

Blade 2 had suffered significant bending, twisting and leading edge damage, in a manner that was indicative of high rotational energy and a negative angle of attack at impact. It also had distinct chordwise scoring from mid-blade to the tip and it showed some tip tearing and fractures which, according to the propeller manufacturer, is almost always indicative of power. There was a witness mark on the pre-load plate of blade 1, which indicated that it was struck by the pitch change knob of blade 2 when blade 2 was at an angle of 17.5°, the angle of the low-pitch stop.

The difference in damage between blades 1 and 2 was probably due to blade 1 striking the ground first and coming to a stop in less than one full revolution. According to the propeller manufacturer sudden stoppage, even at moderate power, was not uncommon in soil.

With the propeller blade on the low-pitch stop, power could be estimated from the altitude, airspeed and propeller rpm. Only the altitude at impact was accurately known; however, the engine tachometer was found stuck at 2,100 rpm. From the manufacturer's performance tables, if the rpm had been 2,000 rpm and the airspeed 100 KTAS, then power would have been 24%. At 2,000 rpm and 80 KTAS the power would have been 32%. In both cases, the tip angle of attack would have been negative. At 60 KTAS and 2,000 rpm the tip angle of attack would have been positive, which was not seen in the damage.

#### *Instrument examinations*

The cockpit was fitted with a Caution and Warning Panel (CWP) which contained caption lights for 18 different cautions and warnings. These included Alternator 1 Inop, Alternator 2 Inop, Fuel Pressure, Oil Pressure, Low Vacuum, Low Bus Voltage and Stall Warner Fail. Each caption contained two filament light bulbs. Microscope analysis of these bulbs revealed a number of broken filaments but none of the filaments had been stretched. A stretched filament would have indicated that it was probably hot at impact and, therefore, that the light was on<sup>20</sup>. The fact that some of the filaments had broken and that some of the filaments in light bulbs from the Flight Computer had stretched (see next section) indicated that the g-forces at impact were sufficient to stretch a hot filament. Therefore, it was concluded that it was unlikely any of the CWP bulbs were illuminated at impact.

The KI256 Flight Command Indicator (Attitude Indicator) was too badly damaged to test so it was strip-examined by the manufacturer under the AAIB's supervision. The rotor inside the gyroscope did not exhibit any rotational scoring, which would have been indicative of rotation at impact, nor did it exhibit any static witness marks which would be indicative of a stationary rotor at impact. No anomalies inside the instrument were noted and the as-found indication of the instrument was 30° nose-down and 2° left wing low, which was similar to the forward fuselage's final resting attitude. Both engine-driven vacuum pumps driving the KI256 instrument were strip examined and neither had any indications of a pre-impact failure.

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#### **Footnote**

<sup>20</sup> Hot filaments are more ductile than cold filaments which makes them more likely to stretch than break. Cold filaments are brittle and are likely to break without any stretch.

The primary altimeter examination is described in the 'Transponder altitude data validity' section earlier in this report. The altimeter pressure setting was found at 994 hPa, which was the QFE setting for Dunkeswell at the time of the accident.

Many of the switches in the instrument panel, including the radio master switch, were destroyed and their pre-impact position could not be determined.

#### *Autopilot system examination*

The following components of the autopilot system were removed from the aircraft and examined by the manufacturer under the supervision of the AAIB: KC192 Flight Computer, KS271A Roll Servo, KS271A Yaw Servo, KS270A Pitch Servo, KS272A Pitch Trim Servo, KAS297B Altitude/VS Selector, KG102A Directional Gyro, KRG331 Rate Gyro, KC296 yaw computer, and the left control-wheel-mounted trim switches and autopilot disengage button. The KI256 Flight Command Indicator (examination previously described) also formed part of the autopilot system, providing the pitch and roll reference.

The KC192 Flight Computer was too badly damaged to test. The circuit boards were examined and no anomalies were detected that could not be attributed to impact damage. The bulbs which provide the YD, FD, ALT, HDG, GS, NAV, APR, BC, TRIM and AP captions were examined under the microscope. The YD and FD bulbs had filaments which were significantly stretched and the ALT bulb had a filament with three areas of stretch. The HDG bulb filament exhibited some crossover and some minor stretch. All the remaining bulb filaments had no indications of stretch and all had broken, except for the TRIM bulb. It was concluded that the YD, FD, ALT and HDG bulbs were likely all illuminated at impact and the other bulbs, including the AP, were extinguished.

The KAS297B Altitude/VS Selector contained a memory chip with non-volatile memory which revealed that the last selected vertical speed was 0 fpm and the last selected altitude was 2,000 ft.

The pitch trim servo had seized due to a bent servo mount, the bending of which was impact-related. When the servo was removed from its mount and bench-tested, it passed all tests. There were no faults detected within the pitch trim servo that would have caused a pitch-trim runaway.

The pitch servo was bench-tested and passed all tests except for the torque switch test, revealing that the torque switches were set slightly outside the specification on the low torque side. These switches serve to detect the servo load required to deflect the elevator. The effect of the low torque setting would have been to cause the autopilot to command pitch trim movement earlier than necessary. It would not have caused the pitch trim to move to an out-of-trim position.

The roll servo had suffered impact damage and some internal repairs were required before it passed bench tests. The yaw servo could not be tested because the internal motor had seized as a result of impact damage. A donor motor was installed but could not be powered due to impact-related damage of two circuit board components.

The slip clutches on the servo mounts for the roll and pitch servos were within specification. The force required to slip the clutches of the pitch trim and yaw servos were slightly above specification.

The directional and yaw rate gyros and yaw computer passed their functional tests.

The left control-wheel-mounted autopilot disengage button and pitch trim switches were tested and functioned correctly. The autopilot disengage button is a simple open/close circuit switch to ground, which, when pressed, provides power to an autopilot disconnect relay. This relay, when powered, removes power to the pitch trim servo and provides an electrical signal to the flight computer, causing the autopilot and yaw damper to disengage. This relay had a large dent in its side and did not function correctly when powered. The internal contacts which enable autopilot disengagement were stuck in the 'autopilot disengage' position. The relay connects to six wires, five of which had separated at the soldered pins on the relay and one had separated mid-wire. The wire separations were consistent with the large impact force that had caused the dent in the side of the relay.

The autopilot and pitch trim systems obtain power via a 10-amp autopilot circuit breaker and a 5-amp pitch trim circuit breaker respectively. These circuit breakers were incorrectly labelled in N186CB<sup>21</sup>. The 10-amp autopilot circuit breaker was labelled 'A/P Servos' and the 5-amp pitch trim circuit breaker was labelled 'Autopilot'. N186CB's fuselage, which was previously fitted with a KFC225 autopilot system, would have had circuit breakers labelled 'A/P Servos' and 'Autopilot' and no separate pitch trim circuit breaker.

The pitch trim circuit breaker (labelled 'Autopilot') located on the cockpit's right side panel was found tripped. In total, 10 out of 23 circuit breakers on this panel had tripped. On the cockpit's left side panel 17 out of 44 circuit breakers had tripped. Circuit breakers tripping during impact is not uncommon, particularly when there is significant disruption to wiring, as found in N186CB. The wire from the pitch trim circuit breaker to the autopilot disconnect relay had failed mid-wire. Contact between this wire and the aircraft structure could have caused the pitch trim circuit breaker to trip at impact.

### **Evaluation flights**

The AAIB organised a series of three evaluation flights in another Piper PA-46-350P fitted with a KFC150 autopilot. One of the flights was conducted with a qualified test pilot. The purpose of the flights was to:

- gain a better understanding of the use of the KFC150 autopilot in the PA-46-350P
- experience and appreciate the handling and stall characteristics of the aircraft
- determine the speed at which the aircraft would be 'in trim' with the elevator trim actuator positioned at 19 mm (as found at impact)
- establish the required pitch attitude to achieve the rate of climb indicated by the recorded radar data

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#### **Footnote**

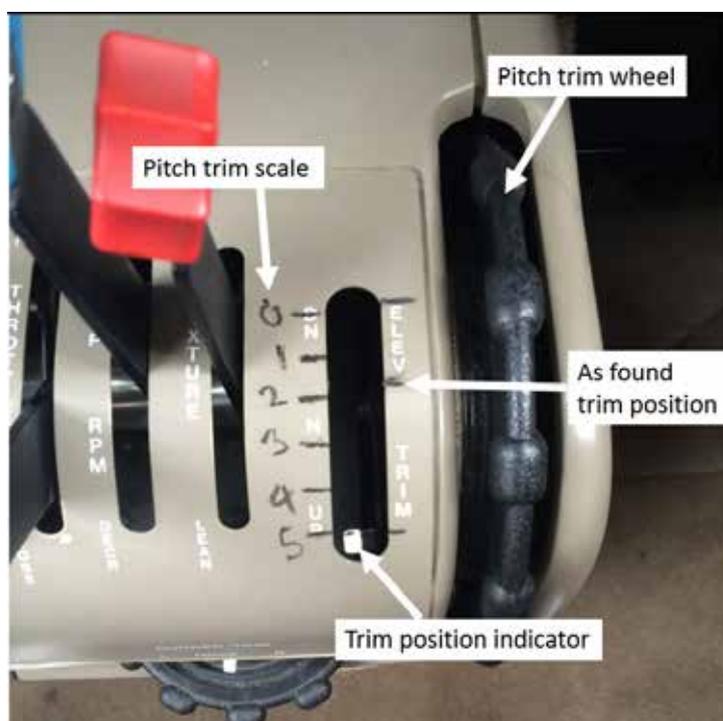
<sup>21</sup> The circuit breakers were identified by tracing the routing of their wires.

- establish engine power settings required to achieve the 1,200 ft height gain, and corresponding rate of climb, recorded after the aircraft turned away from the final approach
- establish the effect of over-riding the autopilot in pitch
- establish if the Uptonery disused airfield could be mistaken for Dunkeswell Aerodrome
- establish the base of radar cover near the town of Crewkerne

The aircraft used for the evaluation flights was fitted with an Attitude and Heading Reference System (AHRS) sensor, to record pitch attitude and pitch rate, and three GPS units which recorded track and altitude. The aircraft was ballasted so that the weight and CG was similar to that estimated for the accident flight.

### *Elevator trim*

In order to determine the corresponding trim position relative to the aircraft's airspeed, the trim wheel in the cockpit was graduated with five positions, evenly distributed across the range of trim movement available. Position 0 was full forward (nose-down) trim and position 5 was full aft (nose-up) trim (Figure 10). It was found that 19 mm extension of the elevator trim actuator equated to a position of 1.7 on the trim wheel scale. The flight evaluation revealed that, with an aft CG, in level flight, at a stabilised airspeed of 150 KIAS (which was the estimated airspeed of N186CB shortly before it climbed rapidly) and the aircraft 'in trim', the trim wheel position was about 0.9.



**Figure 10**

Pitch trim wheel and scale used on the PA-46-350P aircraft for the flight evaluation

In straight and level flight, it was found that 19 mm extension of the elevator trim actuator equated to a trimmed airspeed of about 115 KIAS. At an airspeed of 150 KIAS, this extension of the elevator trim actuator caused the aircraft to enter a steep nose-up climb when the pressure on the control column was released.

#### *Autopilot disengaged evaluation*

The aircraft was flown manually, in trim at 150 KIAS, and the recorded vertical profile of the accident aircraft was followed. The test pilot noted that as the airspeed reduced, an increasing pull force was required on the control column to maintain the aircraft's nose-high attitude (indicative of the aircraft's stable longitudinal static stability). A relaxation of the pull force allowed the aircraft's pitch attitude to reduce and the airspeed to increase. To stall the aircraft in this configuration required the increasing pull force on the control column to be maintained deliberately for a sustained period. The test pilot concluded that the aircraft did not have a tendency to stall when initiating a pull up with the autopilot disengaged and the aircraft in trim. It was observed that, to achieve an average rate of climb of about 3,700 fpm and an altitude gain of 1,200 ft, as recorded during the accident flight, required a nose-up attitude of about 35° and an increase in engine power to above the normal approach power setting (Figure 11).

The stalling characteristics of the aircraft were then explored. The POH for the Malibu states:

*'The stall characteristics of the Malibu are conventional. An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above stall speed. Mild airframe buffeting and pitching may also precede the stall.'*

Despite testing normally<sup>22</sup>, the aural stall warning did not sound during the evaluation flight as the aircraft approached the stall. The other stall characteristics described in the POH were found to be accurate, with stalls flown in a variety of configurations described by the test pilot as 'generally benign and controllable'.

#### *Autopilot engaged evaluation*

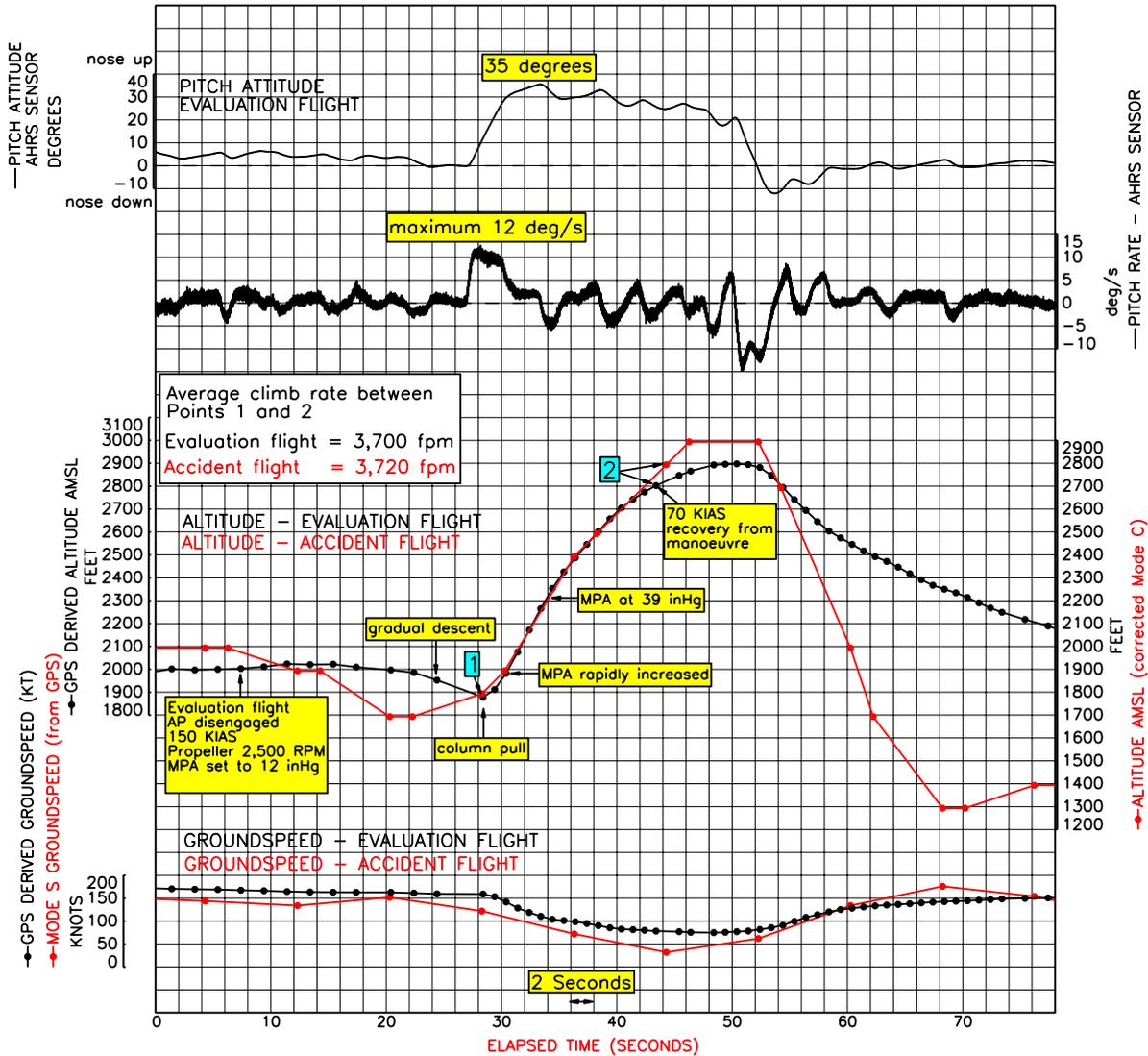
From level flight, with the autopilot engaged, the aircraft was placed into a descent by manually overriding the altitude hold mode. As the aircraft descended, the control column forces increased as the autopilot automatically applied nose-up pitch trim to return the aircraft to the set altitude. When the forward pressure on the control column was released, the aircraft pitched rapidly to a high nose-up attitude. The test was repeated a number of times, with similar results. During several of these tests, the pitch rate exceeded 8° per second, but the autopilot did not disengage<sup>23</sup>.

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#### **Footnote**

<sup>22</sup> The stall warner was successfully tested immediately before the manoeuvre but had not tested normally on the ground.

<sup>23</sup> According to the autopilot manufacturer this was due to the pitch rate exceeding 8° per second (for at least 1 second) above 15° where the pitch-rate monitor is not designed to work.



**Figure 11**  
 Comparison of accident and evaluation flight  
 (autopilot disengaged then climb at same rate as accident flight)

The test pilot considered that the high nose-up attitudes and pitch rates achieved during these manoeuvres would be extremely disorientating for a pilot, especially in IMC conditions. He also considered that the control column forces required to override the autopilot quickly became so large, that it was unlikely a pilot would continue to oppose them without re-trimming.

On subsequent tests, the test pilot pressed the pitch trim switches, disengaging the autopilot, when he considered the control column force was excessive. This occurred at approximately 300 ft below the set altitude. It was noted that the pitch trim had reached a setting of 3.5, which equated to a significant nose-up trim position for the weight and CG.

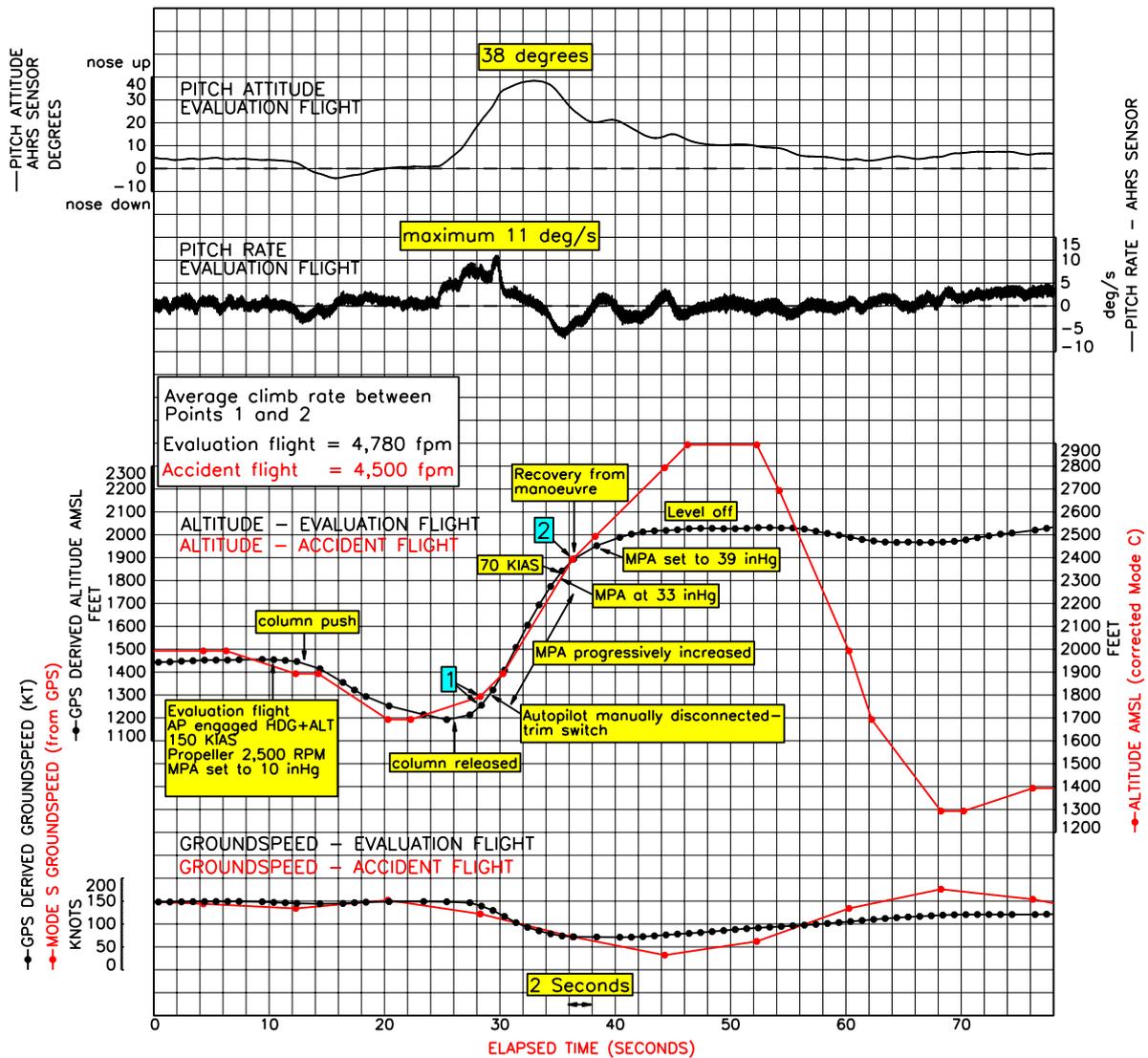


Figure 12

Comparison of accident and evaluation flight (autopilot engaged in heading and altitude hold, with control column pushed and then released)

Figure 12 provides a plot of salient parameters, showing the effect of the pitch trim during one of the autopilot engaged 'push-and-release' tests. Parameters from the accident flight are overlaid for comparison. Following the initial pitch-up, engine power was progressively increased as the aircraft climbed. The rate of climb closely matched the accident flight, with a nose-up attitude of 38° recorded during the evaluation. Having climbed about 800 ft, the aircraft was levelled off to prevent it from stalling. The test pilot considered that, had the engine power been applied more rapidly as the aircraft started to climb, and the airspeed been allowed to reduce further, the 1,200 ft gain recorded during the accident flight would have been achieved.

During the evaluation flight, the aircraft overflew the disused airfield at Upottery. It appeared to be in such a state of disrepair that it was considered unlikely to have been mistaken for Dunkeswell Aerodrome.

### *Radar coverage near Crewkerne*

The radar recordings corroborated the evidence that N186CB had overflowed a witness near Crewkerne (location 1 in Figure 1) at a time close to that reported. However, the aircraft's altitude, recorded from its transponder, indicated that it was at 2,000 ft amsl (+/- 50 ft) when observed, which was 1,100 ft higher than the witness's estimate.

To ascertain if a PA-46-350P could be recorded on radar when overflying the witness's location at a height of about 500 ft agl, as reported, a series of overhead passes were carried out at different altitudes. The lowest altitude at which the radar detected the aircraft was 1,335 ft amsl, about 950 ft agl.

### **Medical and pathological information**

A post-mortem examination revealed evidence that the pilot had severe coronary artery disease and that his medical history included a recent bout of dizziness, which was believed to have been caused by a temporary blockage in one of his Eustachian tubes. Although it was not possible to rule out either medical condition as being causal or contributory to the accident, the pathologist concluded that the pilot was alive at the time of the accident and, from the pattern of his injuries, his hands were in contact with the flying controls. Toxicological results indicated he was not under the influence of alcohol or drugs at the time of the accident and there was no evidence of carbon monoxide poisoning. The pathologist concluded that the pilot died as a result of multiple injuries.

### **Pilot's history**

The pilot commenced his flying training in early 2012 and shortly afterwards purchased a Cessna 172 aircraft. He passed his PPL(Aeroplanes) skills test in June 2012 and passed the skills test for an IMC rating in October 2012. He continued flying regularly in his Cessna 172 until he purchased N186CB in the Summer of 2013. His logbook indicated that he flew N186CB frequently, visiting Dunkeswell at least 25 times between September 2013 and October 2015 and flying 60 instrument approaches in the aircraft during the same period. In March 2015, he commenced training for an FAA Instrument Rating (IR)<sup>24</sup> and was due to take the test for this rating the week after the accident. The pilot had logged over 120 hours of instrument flying, including 55 hours in N186CB.

Other pilots and instructors who flew with him regularly recalled that his normal way of operating the aircraft, when en-route, was to use the autopilot. He would use the 'ALT' mode to maintain his selected altitude and the 'HDG' mode, which he would manipulate as required to ensure the desired track. For instrument approaches, the pilot had been taught to intercept the final approach path at 120 kt and configure the aircraft with the landing gear extended and a single stage of flap. He would then select more flap once he was visual with the required landing references. The pilot's normal method of disengaging the autopilot was to use the AP/YD disengage button on the control wheel.

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#### **Footnote**

<sup>24</sup> The FAA IR is a full Instrument rating without any of the restrictions of the IMC rating.

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The autopilot manufacturer commented that “a typical small airplane autopilot user” would, during a visual landing, disengage the autopilot at 800 ft agl using the manual electric trim switch, leaving the yaw damper engaged, especially during poor weather conditions including turbulence. They would then use the AP/YD disengage button, just prior to landing, to disengage the yaw damper. However, examiners in the UK advised the AAIB that, in their experience, pilots they flew with in the PA-46, including the accident pilot, disconnected the autopilot using the AP/YD disengage button on the control wheel. They had not seen any instances where the accident pilot had disengaged the autopilot with the trim switch, leaving the yaw damper engaged.

The pilot was described by his instructors as being quite good at “doing things by numbers” but he was considered to be less able than average pilots at multi-tasking and poor at prioritising, especially when under pressure. One of his instructors stated that “he would often have difficulty in dealing with an unusual or unexpected condition”.

The FAA examiner who had been due to conduct the IR test in the week following the accident, had flown with the pilot twice in May 2015 in simulated IMC conditions. At that time, he considered the pilot was not ready for test and on two occasions during these flights the examiner reported that he had had to intervene to prevent an unsafe condition from worsening. Since then, the pilot had flown over 48 hours, including over 12 hours of instrument flying training, and his instructor considered that he was ready for his planned test.

On 10 October 2015, N186CB, piloted by the owner, landed on Runway 22 at Dunkeswell, having flown from Fairoaks. The pilot had gone around from his first approach, as he was unable to see the airfield, and landed after his second approach. Witnesses at the time reported that they were surprised to see an aircraft arrive in such poor weather. An observation from the Dunkeswell SYNOP showed the visibility at the time to have been 2,700 m, with an overcast cloudbase at 300 ft aal.

## **Analysis**

### *Aircraft examination*

The accident site revealed that the aircraft had struck the ground in a steep nose-down attitude and at a high angle of attack, consistent with an aerodynamic stall. The aircraft’s final trajectory was probably about 60° to 70° below the horizon, as indicated by it missing the nearby power lines, its negligible forward movement after impact and the accident site’s close proximity to the final radar point. The evidence suggested that the aircraft was probably in a spin when it struck the ground, although there were insufficient indications in the ground marks and fuselage damage to identify the spin direction.

The investigation found no evidence of any pre-impact structural or flight control failures in the aircraft and the powerplant examination did not reveal any faults. The damage to the propeller indicated that the engine was probably producing low power at impact.

In addition, no evidence was found of any fault with the KI256 Flight Command Indicator or the primary altimeter. The encoded altitude information from this altimeter, as recorded

by the Mode C radar, appeared to be higher than that estimated by some witnesses. However, confirmation of the base of radar cover at the location of the Crewkerne witness supported the validity of the Mode C altitude data. Furthermore, there was no evidence of any pre-impact fault within the altimeter or its encoder.

With this in mind, the engineering investigation focussed on the autopilot and the pitch trim systems as possible causes for the sudden and prolonged pitch-up during the approach.

#### *Analysis of the radar data*

The radar data was analysed to determine if the pilot was using the autopilot to control the aircraft's flightpath during the latter stages of the flight. The evidence showed that the aircraft's track varied throughout the flight and analysis of the rates of turn, after the aircraft had descended to an altitude of 2,000 ft amsl in the latter stages of the flight, indicated that the heading changes could have been achieved with the autopilot engaged, using the HDG mode, or by flying manually with the autopilot disengaged. The aircraft maintained an altitude of about 2,000 ft amsl until shortly before turning towards the extended centreline for Runway 22 at Dunkeswell, which was consistent with the last selected altitude set in the KAS297B Altitude/VS Selector. It was also known that the pilot's normal practice was to use the autopilot ALT mode in combination with the HDG mode.

As the aircraft turned towards the extended centreline, the derived rate of turn progressively increased. For the first 24 seconds of the turn, the maximum calculated rate was 1.8°/sec. This turn rate was within the capability of the autopilot but may have been flown manually, with the autopilot disengaged. With the autopilot engaged and HDG mode selected, this could have been achieved by progressively altering the selected heading less than 15° at a time. Had the pilot made just one adjustment on the heading selector, to establish the aircraft on the runway centreline, the turn rate should have been more constant, at about 3°/sec. Therefore, the turn may have been flown manually, with the autopilot disengaged, or with the autopilot engaged and the ALT and HDG modes selected.

As the aircraft turned away from the extended centreline, the rate of turn increased beyond 3°/sec, indicating that the pilot was either overpowering the autopilot or flying the aircraft manually, with the autopilot disengaged. This increase in turn rate beyond 3°/sec occurred as the aircraft was also descending, and shortly before it climbed rapidly.

#### *Autopilot and pitch trim system evidence*

A pitch trim runaway was considered as a possible cause of the aircraft pitching up. The trim actuator was found in a nose-up trim position for the aircraft's estimated CG and airspeed of about 150 KIAS. However, this pitch trim position was not significantly nose-up, with 44% nose-up travel remaining (1.7 units on the trim wheel scale used in the evaluation flight). Furthermore, the pitch trim servo passed all functional tests, with the clutch disengaging cleanly when the power was removed. Although not conclusive in itself, the un-stretched bulb filament in the TRIM warning caption was also consistent with a normal functioning trim system. In addition, it was noted that the aircraft manufacturer

was not aware of any previous occurrences of un-commanded pitch trim runaways on this aircraft type. For all these reasons, an un-commanded pitch trim runaway was considered unlikely.

An un-commanded pitch servo movement was also considered as a cause of the pitch-up but this servo passed its functional tests. In addition, the pitch rate monitor is designed to disengage the autopilot following an un-commanded pitch servo movement because it is likely that such a condition would exceed the 8° per second pitch rate threshold.

The KC192 flight computer could not be tested due to its impact damage, so an internal fault could not be ruled out. However, the component manufacturer reported that it was not aware of any pitch trim runaways being caused by this unit.

An examination of the KC192 flight computer's control panel revealed that the bulbs associated with the YD, FD, ALT and HDG captions were likely to have been illuminated at impact and the AP caption was likely to have been off. This meant it was probable that the autopilot had disengaged prior to impact but that the yaw damper and flight director had remained engaged.

The evidence suggested that the pilot had been operating the aircraft with the autopilot engaged and with the ALT and HDG modes selected, as was his usual practice. In this configuration, the YD, FD, ALT, HDG and AP captions would most likely have been illuminated as the aircraft approached Dunkeswell (the yaw damper and flight director are automatically engaged when the autopilot is on).

Prior to landing, the autopilot and yaw damper *'must'* be disengaged and the normal and simplest way to achieve this is by pressing the AP/YD disengage button on the control wheel. However, this also results in all captions on the flight computer control panel being extinguished. Therefore, for the YD, FD, ALT and HDG captions to have remained illuminated at impact, it was possible that either:

- the AP ENG button on the KC192 control panel was pressed<sup>25</sup>
- the pilot had pressed the trim switches
- the pitch or roll rate monitors had caused the autopilot to disengage

According to the pilot's instructors, the pilot disengaged the autopilot using the AP/YD disengage button on the control wheel. They did not think he was aware of the technique using the trim switches, leaving the yaw damper engaged. Therefore, it was considered unlikely that the pilot had intentionally used the trim switches to disengage the autopilot. Similarly, it was considered unlikely that the pilot had disengaged the autopilot by pressing the AP ENG button, which would have involved reaching across to the KC192 control panel.

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#### Footnote

<sup>25</sup> Pressing the AP ENG button on the KC192 engages the autopilot when it is off and will disengage the autopilot when it is on.

It was possible that the pilot intended to take manual control but, unknowingly, tried to override the autopilot with it still engaged. He might then have pressed the trim switches to reduce the control forces that would have started to increase as the aircraft's flightpath changed, thereby disengaging only the autopilot. Alternatively, the pitch rate monitor may have disengaged the autopilot during one of the pitch-up or pitch-down manoeuvres.

For the above reasons, the investigation considered that the pilot may have initiated a descent manually from 2,000 ft, without first pressing the AP/YD disengage button on the control wheel (or he pressed it and it did not function), and started to overpower the autopilot, causing it to trim in the opposite direction. The Altitude/VS selector showed 2,000 ft and 0 fpm as its final settings, so there were only two other ways to descend below 2,000 ft without disengaging the autopilot. One method would have been to press the Vertical Trim DN button on the KC192 (Figure 7), which would have targeted a 500 fpm descent. However, the actual descent rate was about 1,100 fpm, so this was unlikely. Alternatively, the pilot could have pressed and held the CWS button to initiate a descent but, according to his instructor, he did not use this feature.

It was possible that the pilot pressed the AP/YD disengage button on the control wheel, before initiating his descent, but that the button did not operate correctly. The button was tested and functioned normally. However, the AP disconnect relay could not be tested due to impact damage, so a pre-impact fault preventing AP disengagement could not be ruled out.

#### *Circuit breaker anomaly*

The 'Autopilot' and 'Pitch Trim' circuit breakers were incorrectly labelled. This probably occurred when the fuselage was replaced in 2007, when all the circuit breakers would have been removed from the old fuselage and installed in the new one. The new fuselage was originally fitted with a different KFC225 autopilot system and would have had holes in the circuit breaker panel for an 'Autopilot' and an 'AP Servos' circuit breaker. These labels should have been changed but were not. The FAA's Designated Airworthiness Representative who signed off the fuselage replacement work has been made aware of this anomaly, as has the maintenance organisation. It was considered unlikely to have been a factor in the accident.

#### *Operation of the aircraft*

The pilot was flying an aircraft, with which he was familiar, on a route he had flown at least 14 times before. The flight proceeded uneventfully until the aircraft turned left to establish on the final approach for Dunkeswell at three miles. This would normally have involved a relatively high workload, with the pilot manoeuvring the aircraft on to the runway extended centre line, slowing it down and extending the flaps and landing gear.

The evidence indicated that the aircraft started its descent, turned through the inbound heading and then suddenly pitched up. At this stage, the aircraft was flying into deteriorating weather and may have flown into cloud as it turned onto the final approach (the cloudbase at Dunkeswell before and after the accident was 300 ft aal). Having entered cloud, the

pilot may have attempted to climb to a safe altitude and inadvertently pulled the control wheel back too much, causing the aircraft to pitch up excessively. However, this seemed unlikely, given the benign handling characteristics of the aircraft and the pilot's recent currency of flying on instruments, including time in actual IMC conditions.

The evidence from the autopilot system examination suggested that, as the pilot turned onto the final approach and started to descend, the autopilot may not have been disengaged due to a mental lapse, incorrect button selection or a technical fault. With the pilot manually overriding the autopilot, to turn and descend, the control forces required to prevent the aircraft pitching up would have become excessive, as the autopilot trimmed nose-up to regain the 2,000 ft set in the Altitude/VS Selector. The pilot may then have pressed the trim switches to reduce this force. However, if he had not trimmed sufficiently nose-down, which would have taken some time, the remaining nose-up trim could still have been sufficient to pitch the aircraft excessively nose-up, achieving a rate of climb similar to that seen in the recorded data.

The aircraft was found with 1.7 units of trim on the trim wheel but it is possible that the initial pitch-up event was caused by a pitch trim of up to 3.5 units and, in the subsequent manoeuvres prior to the impact with the ground, the trim was reduced to the position in which it was found.

Evaluation flights during the investigation established that a pitch attitude of about +35° nose-up would have been required to achieve the rate of climb seen in the data. This would have been disorientating for the pilot, especially in IMC with the pitch attitude in excess of the pitch ladder on the attitude indicator, which only extended to +25° nose-up. The altitude achieved at the top of this climb suggested that additional power had been applied at some point during the manoeuvre, possibly to achieve a safe altitude. The aircraft's calculated airspeed of 33 KIAS at the top of this climb was consistent with the aircraft having stalled, and the change in direction to the left was consistent with a left-wing drop, which is more likely in a power-on stall due to the clockwise rotation of the propeller (as viewed from the pilot's seat).

Following this manoeuvre, the aircraft maintained a generally constant track during its rapid descent, before aggressively pitching up again. It appeared that the engine power was subsequently reduced prior to impact.

The investigation considered whether either of the medical conditions detected by the pathologist may have contributed to the accident. It was concluded that, whilst the possible effects of the medical conditions could not be excluded entirely, the aircraft's final manoeuvres and the changes of engine power were unlikely to have occurred without control inputs from a conscious pilot. Therefore, it was probable that the pilot was manipulating both the control wheel and the power lever.

The investigation determined that, in the circumstances, recovery from the unusual aircraft attitude required to replicate the accident flight's initial rapid pitch-up and climb may have been beyond the training, experience and, whilst in IMC, the capabilities of the pilot.

## Conclusion

Whilst positioning for an approach to Dunkeswell Airfield, the aircraft suddenly pitched nose-up and entered cloud. This rapid change in attitude would have been disorientating for the pilot, especially in IMC, and, whilst the aircraft was probably still controllable, recovery from this unusual attitude may have been beyond his capabilities. The aircraft appears to have stalled, turned left and descended steeply out of cloud, before climbing rapidly back into cloud. It probably then stalled again and entered a spin from which it did not recover. All four occupants were fatally injured when the aircraft struck the ground.

The investigation was unable to determine with certainty the reason for the initial rapid climb. However, it was considered possible that the pilot had initiated the preceding descent by overriding the autopilot. This would have caused the autopilot to trim nose-up, increasing the force against the pilot's manual input. Such an out-of-trim condition combined with entry into cloud could have contributed to an unintentional and disorientating pitch-up manoeuvre.

## INCIDENT

<b>Aircraft Type and Registration:</b>	Sud Aviation SA342J Gazelle, YU-HET	
<b>No &amp; Type of Engines:</b>	1 Turbomeca Astazou XIVH turboshaft engine	
<b>Year of Manufacture:</b>	1975 (Serial no:1204)	
<b>Date &amp; Time (UTC):</b>	06 July 2015 at 1205 hrs	
<b>Location:</b>	Stapleford Aerodrome, Essex	
<b>Type of Flight:</b>	Event occurred during maintenance check	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Damaged beyond economic repair	
<b>Commander's Licence:</b>	N/A	
<b>Commander's Age:</b>	N/A	
<b>Commander's Flying Experience:</b>	N/A	
<b>Information Source:</b>	AAIB Field Investigation	

## Synopsis

The helicopter inadvertently became airborne during a hydraulic system check with the engine running. It was not possible to determine why the helicopter became airborne. During the investigation it was found that the pressure switch was not fitted to the hydraulic pack and hence the low hydraulic pressure warning would not activate. A safety concern relating to the overhaul of the engine was also identified.

## Introduction

This event occurred during a maintenance check on the hydraulic system with the engine running. The AAIB was notified and decided to investigate, since there was the perceived potential for aviation safety benefit.

## Description of the incident

The helicopter was undergoing a maintenance check near to the maintenance organisation's hangars. The engineer was ground running YU-HET and checking the hydraulic system when the incident occurred. According to his report the collective lever was fully down and he had applied full friction to the lever. He commenced the low hydraulic pressure check by activating the hydraulic test switch on the instrument panel; his left hand was on the collective lever and his feet were on the yaw pedals. On activating the test switch the collective lever "came up violently", the helicopter lifted about 10 ft into the air, and yawed to the right. It turned through 180° and a main rotor blade struck the ground. The helicopter then landed heavily, causing significant damage to the canopy, cabin floor, tail boom, the right skid and a main rotor blade.

## **Aircraft information**

The SA341 Gazelle is a single-engine helicopter which has hydraulically-assisted flying controls to reduce the pilot's control loads. A hydraulic pack, driven from the Main Rotor Gearbox, supplies hydraulic power to three main servo controls mounted below the rotor head.

YU-HET was originally constructed as a SA341G and was converted to the faster and more powerful SA342J in the 1980s. There is a mandatory Service Bulletin SB 29-02, applicable to the SA342J, which requires the fitting of three accumulators (one on each of the main servo controls), a pressure switch to detect low hydraulic pressure, a warning light and warning horn. This SB was optional on the SA341G variant.

In the event of low hydraulic pressure, the pilot is alerted by the warning horn and the warning light. The accumulators provide a reserve of hydraulic power to allow the pilot to reduce the airspeed so that the control forces are more manageable.

The pilot is required to test the low hydraulic pressure warning system prior to each flight to verify that the system is operational. This forms part of the pre-flight checks.

## **Inspection and test**

YU-HET was inspected by the AAIB and a test of the hydraulic system was performed with a specialist from the helicopter manufacturer present. The hydraulic pack and the accumulators were found to operate satisfactorily, however it was found that there was no pressure switch fitted to the hydraulic pack; hence the low pressure warning light and the warning horn would not operate. Without these warnings the pilot would not become aware of a loss in hydraulic pressure until he was presented with significantly increased control forces.

Moreover, it would not have been possible to comply with the pre-flight checks, which required the pilot to test that the low hydraulic pressure warnings are operational prior to each flight.

## **Maintenance records**

### *Airworthiness Review Certificate*

YU-HET held an Airworthiness Review Certificate, issued by the Serbian Civil Aviation Department on 25 March 2015.

### *Service Bulletin SB 29-02*

The helicopter's maintenance records were reviewed as part of the investigation. It was not possible to be certain, but it is likely that SB 29-02 was carried out by the manufacturer on this helicopter when they converted it from a SA341G to a SA342J in the 1980s.

YU-HET was registered in France as F-GFDG and was brought to the UK in early 1999. At that time, the SA342J model was not type certified in the UK and the helicopter remained

on the French register. It was then transferred onto the Serbian register in November 2004 as YU-HET.

In 2000, the helicopter had its 12-year inspection, during which the hydraulic pack was removed and fitted to another Gazelle helicopter. It is likely that the hydraulic pack was removed, along with the pressure switch and associated wiring. When the replacement hydraulic pack (the hydraulic pack fitted at the time of the incident) was installed, it would have arrived without a pressure switch, as this is how the hydraulic packs were supplied. It is probable that the pressure switch was not installed at that time and the helicopter may therefore have been operating without the pressure switch since 2000.

#### *Engine overhaul approval*

The engine fitted to YU-HET was an Astazou XIVH, a civilian version. It was overhauled in 2005 by an organisation in Serbia and issued with a Serbian Certificate of Release to Service. This organisation held Serbian approval MO-003. The organisation was approved to overhaul the military version of the engine (Astazou IIIB), but it was not authorised by the engine manufacturer to overhaul civilian versions of the engine. Manufacturer's approval ensures that the organisation performing the engine overhaul has access to the most up to date technical information on the engine.

As part of the investigation into the accident to a Gazelle with the registration YU-HEW in 2009, the AAIB made the following Safety Recommendation:

#### **Safety Recommendation 2009-084**

It is recommended that the Serbian Civil Aviation Department review its oversight and audit system to ensure that aviation maintenance organisations in Serbia release to service only items for which they have the correct approvals.

Following this recommendation the Serbian Civil Aviation Department (CAD) responded to the AAIB in writing, stating that *'the maintenance approval MO-003 had been revoked on 15 September 2008'*.

During this investigation the Serbian CAD informed the AAIB that they had audited the organisation which held Maintenance Organisation Approval Certificate MO-003. In 2011 the Serbian CAD issued this organisation a Maintenance Organisation Approval Certificate number RS.N.145.0035 with rating B1 which gave privilege for, amongst others, Astazou IIIA, IIIB, XIV H and XIV M engines. The Serbian CAD also ruled that the documents previously issued under approval MO-003 were valid. However, at no stage has this organisation been authorised by the engine manufacturer to overhaul civilian versions of the engine.

The absence of the engine manufacturer's approval to overhaul civilian versions of the engines may be a concern for airworthiness authorities in other States. Accordingly the AAIB will write to the EASA and the UK CAA to bring this issue to their attention.

## Discussion

The inspection of the aircraft revealed nothing that would explain why the helicopter inadvertently became airborne. Hence the cause of this incident could not be determined.

The investigation established that the hydraulic low pressure switch was not installed on the helicopter, rendering the low hydraulic pressure warning system ineffective. Although the helicopter would be controllable after a loss in hydraulic pressure, the warning is essential to allow the pilot to reduce airspeed so that the control forces become more manageable.

The manufacturer was not aware of any other occurrences when the hydraulic low pressure switch was not installed. Such an omission is a deviation from the maintenance procedures and hence no Safety Recommendation is required.

This incident occurred during maintenance and would not normally be investigated by the AAIB. However, the investigation was justified in that it identified safety concerns relating to the failure to install the hydraulic low pressure switch and to the release of the engine to service after overhaul.

## Appendix

Chapter 6.3 of Annex 13 to the Convention on International Civil Aviation provides that the State conducting the investigation shall send a copy of the draft Final Report to all States that participated in the investigation, inviting their significant and substantiated comments on the report as soon as possible. If the State conducting the investigation receives comments within the period stated in the transmittal letter, it shall either amend the draft Final Report to include the substance of the comments received or, if desired by the State that provided comments, append the comments to the Final Report.

The Centre for Investigation of Accidents in Transport, representing the Republic of Serbia as the State of Registry, wishes the following comments to be appended to the AAIB Final Report on the incident involving SA342J Gazelle (YU-HET), at Stapleford Aerodrome, on 06 July 2015:

*'a. Approval for maintenance of aircrafts, engines and/or components is under jurisdiction of Civil aviation authority, so Civil Aviation Directorate of the Republic of Serbia (CAD RS) accepted all previous issued Certificates of release to service (Form No. 1) for engines, about which CAD RS informed interested parties (EASA and AAIB UK primarily).*

*b. Since airworthiness of all aircraft that do not fulfill all requirements defined by Regulation on the continuing airworthiness of aircraft and aeronautical products, parts and appliances, and on the approval of organizations and personnel involved in these tasks, Annex II, part 145 ("Official Gazette of the Republic of Serbia", No 32/11, 23/12 u 27/12-correction and 10/14; in accordance with EC 2042/2003 and Amendments) in which belong*

*helicopters that are in UK, of user ``M. W. Helicopters ltd, Beograd``, is done in accordance with national regulation, that means that all works and documentation is acceptable to CAD RS if they are in accordance with national regulation and Air transport law of the Republic of Serbia; on this way, airworthiness was returned to all helicopters, after Initial aircraft inspection was carried out, in accordance with Article 159. of Air transport law of the Republic of Serbia, during Years 2011. and 2012.'*

## ACCIDENT

<b>Aircraft Type and Registration:</b>	EV97 Teameurostar UK, Eurostar, G-CDNI
<b>No &amp; Type of Engines:</b>	1 Rotax 912-UL piston engine
<b>Year of Manufacture:</b>	2005 (Serial no: 2321)
<b>Date &amp; Time (UTC):</b>	27 February 2016 at 1128 hrs
<b>Location:</b>	Peterborough/Conington Airport, Cambridgeshire
<b>Type of Flight:</b>	Training
<b>Persons on Board:</b>	Crew - 1                      Passengers - None
<b>Injuries:</b>	Crew - 1 (Serious)      Passengers - N/A
<b>Nature of Damage:</b>	Damaged beyond economic repair
<b>Commander's Licence:</b>	N/A
<b>Commander's Age:</b>	41 years
<b>Commander's Flying Experience:</b>	39 hours (of which 39 were on type) Last 90 days - 4 hours Last 28 days - 2 hours
<b>Information Source:</b>	AAIB Field Investigation

## Synopsis

The student pilot was flying solo visual circuits when the aircraft experienced an upset, probably as result of a gust of wind, at a low height that caused the left wing to rise. The student elected to go-around during which the aircraft track diverged across a field of crops that bordered the runway. The aircraft subsequently pitched nose-up followed by the left wing dropping. The aircraft rolled inverted before impacting the ground and the student was seriously injured.

## History of the flight

The student pilot had flown with the same instructor on all his previous instructional flights over the preceding 13 months, other than an air experience flight in January 2015. This included being sent on his first solo on 17 January 2016.

Prior to the accident flight the student pilot conducted a flight with a different instructor to consolidate his visual circuits. Before getting airborne, the instructor read his training notes and briefed the student not to do anything different from what he had previously been taught. Runway 10 was in use and the instructor reported that the wind was from 070° to 110° at 8 to 10 kt.

The start-up, taxi, take off and climb into the circuit were all flown by the student pilot without event. On the first approach the aircraft encountered two areas of 'sink' at about 300 ft and

50 ft agl in which the aircraft descended unexpectedly. As a result the instructor advised the student to add 5 mph to the threshold speed of 65 mph. The next circuit and final approach were better with the aircraft landing “on the numbers” albeit a little fast. The third circuit and landing were better than the previous one. Consequently the instructor directed the student to taxi the aircraft back to the tower, where he briefed him to fly some solo visual circuits, and made his way up to the tower to monitor his flying.

The student stated that his first takeoff was, as the instructor had advised, steeper and faster than with two people on-board, due to the reduced takeoff weight. He found this circuit challenging, due to the wind, but landed without any problems. The instructor commented the first takeoff, positioning downwind and on finals, all appeared to be good and the landing looked “perfect” with a “nice hold-off” prior to touching down. However, on the touch-and-go, as engine power was applied, the aircraft yawed slightly to the left. The instructor then went to his office, on the first floor of the tower, and initially monitored the student’s progress around the circuit by listening to a hand-held transceiver. Upon hearing the student’s “FINALS” transmission he went to the window at the end of the corridor to monitor the next approach. The student stated that the second circuit was easier than the first. The instructor described this second circuit as “textbook”.

The student described the third approach as “reasonable” at an IAS of just under 70 mph with the aircraft in trim. At about 100 ft he felt a strong gust of wind which lifted the left wing and he decided to go around. He believed he applied full power and applied right rudder to compensate for the effect of the propwash. The student stated that the aircraft continued to bank left, and the nose lifted, before rolling left to an angle of bank of approximately 60°. The instructor described seeing the nose of the aircraft lower slightly with the aircraft then flying level and accelerating across the field of crops that border the runway, at about 20 ft. Shortly thereafter the aircraft’s nose started to rise. When the aircraft attitude reached approximately 40° nose-up, and at about 50 ft agl, the left wing dropped. The aircraft impacted the ground inverted at an angle of approximately 45°, coming to rest inverted in the field of crops.

The student released his seatbelt but realised his legs were trapped under the aircraft’s instrument panel. The airfield’s fire tender was quickly on the scene. The first responders rolled the aircraft upright and freed the student from the wreckage. The local emergency services arrived on the scene soon thereafter. The pilot was subsequently taken to hospital by road.

### **Student pilot’s comments**

The student pilot commented that while he was happy with his flying performance during the three circuits, as he had an instructor with him, he was a little surprised to go solo.

On the go-around he believed he did not lower the nose to increase the IAS as he had been taught. While he believes the aircraft stalled, he did not feel any buffet through the airframe.

He added that in hindsight the wind may have been too strong to fly solo with his level of experience. Until the day of the accident he had only flown one solo circuit in very calm

conditions. Having not flown for a month, he felt he would have benefited from a refresher lesson, with revision of emergencies in the circuit, as he became “rusty” if he had not flown for a few weeks, but did not suggest this to his instructor.

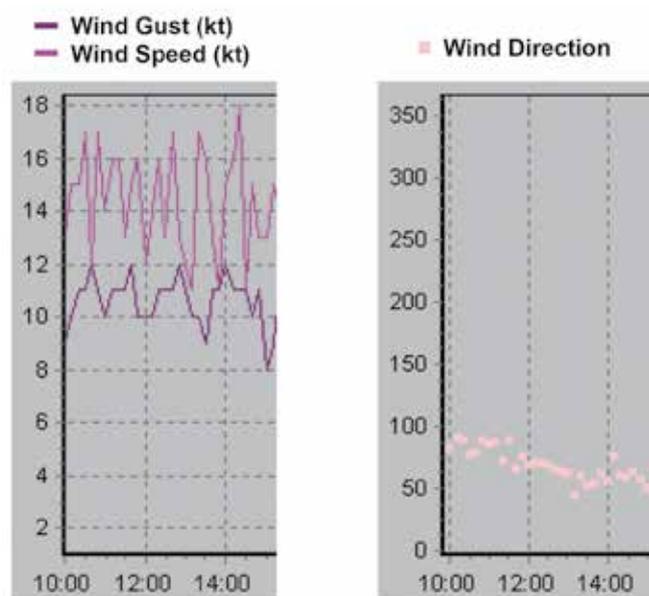
### Instructor’s comments

The instructor stated that, being aware of the student’s previous performance and not having cause to take control during any of the circuits on the flight prior to the accident flight, it was appropriate to send the student pilot solo. He added that in doing so he hoped the student’s confidence may have been increased, and that the student seemed to be content with the prospect of flying solo and expressed no concerns or surprise at being sent solo.

### Meteorological information

A Met Office aftercast for the time of the accident stated that the weather conditions were generally good, with little significant low cloud. Winds were mostly from 020° to 080° at initially 4 to 7 kt and then steadily increased to between 12 to 14 kt by 1300 hrs. RAF Wittering, 12 nm north-west of Conington, recorded the wind from 080° at 10 kt at 1050 hrs, and from 060° at 11 kt at 1150 hrs. Cambridge, 22 nm south-east, recorded the wind from 060° at 9 kt at 1050 hrs and from 060° at 10 kt at 1120 hrs.

The tower, where the Aerodrome Flight Information Service Officer was located, was equipped with an uncalibrated computer-based weather station that recorded the wind speed and direction every 10 minutes, as measured by an anemometer located on a pole at the eastern boundary of the airport. A copy of the wind’s strength and direction over the period of the two flights is shown at Figure 1. During the instructional flight it recorded wind from about 050 to 060° at 10 to 12 kt gusting 17 kt. During the accident flight it was from about 080° at 11 to 12 kt with gusts up to 16 kt.



**Figure 1**

Recorded wind speed and direction at Peterborough Airport

## Flying school orders

The flying school's Standing Orders stated:

### **'4. RESTRICTION OF FLYING**

*(viii) Flying Conditions - Under no circumstances may aircraft be flown ... when wind is gusting over 15 knots or with a crosswind component of more than 10 knots<sup>1</sup>...*

## Flight trial

A flight trial was carried out by a test pilot in a similarly powered EV97 and observed by the AAIB. Its purpose was to assess the aircraft's handling qualities, particularly with respect to touch-and-go landings and go-arounds.

The stall characteristics were also assessed. The test pilot reported that there was a distinct and obvious pre-stall buffet about 4 mph above the stall. At the stall the aircraft could be controlled conventionally in roll and while there was a small amount of wing rock there was no tendency to drop either wing. The stall speeds ( $V_s$ ) were:

Configuration	Power	Scheduled $V_s$ mph	$V_s$ mph
Clean	Idle	44	44
Flap One	Idle	42	43
Flap 30	Idle	38	40
Flap Full	Idle	36	38

The go-around was assessed with the aircraft in all configurations. The aircraft was trimmed at 70 mph in an idle power descent with the controls in an open loop<sup>2</sup> condition; this required nose-up trim. The throttle was then opened fully in 2 seconds. In each configuration there was only a subtle tendency for the aircraft to yaw and in each case the application of power caused the nose to pitch up. With each additional stage of flap the tendency to pitch-up was increased, and as flap was lowered it caused the aircraft to pitch nose-down. This required more nose-up trim at idle power which, with power re-applied, created a greater tendency to pitch nose-up.

The accident occurred during a baulked landing close to the ground with FLAP 30 selected. A rapid application of power without paying attention to the aircraft attitude would result in the aircraft pitching nose-up at about 20°/sec. Forward pressure on the controls could prevent the pitch-up. The force required to maintain a speed of 65 mph in this full power situation was 8 lbf which, although not a large force, was much greater than the very light forces required to fly the aircraft normally.

## Footnote

- <sup>1</sup> The aircraft's *Pilot's Operating Handbook* stated that 10 kt was the maximum demonstrated crosswind limit.
- <sup>2</sup> In this context, 'open loop' means not interfering in the feedback process from the flying controls. This was achieved by relaxing the touch on the control column so as not to restrict its movement following the touch-and-go.

If the pilot was distracted and applied power rapidly without simultaneously pushing the stick firmly forward the aircraft would pitch up to an excessively high nose-up attitude, which would cause airspeed to decay. With full power applied in a high nose-up attitude the aircraft would be more likely to drop a wing at the stall.

The test pilot concluded that the 80 hp version of the EV97 had reasonable handling qualities and stall characteristics albeit exhibiting weak longitudinal static stability. Takeoffs and landings were generally easy to perform with both FULL and FLAP 30. Applying full power on an approach with FLAP 30 selected (when trimmed at 70 mph/idle power) caused the nose to pitch up smartly and required a firm and positive push forward on the stick to prevent the nose getting higher than a safe climb attitude.

Although the EV97 was generally straightforward to fly, the tendency to pitch nose-up when performing a go-around could potentially catch out an inattentive pilot.

### **Accident site**

The aircraft came to rest inverted in a field of crops approximately 144 m from the threshold and 70 m north of Runway 10. First responders advised that the aircraft was subsequently turned upright as part of the emergency response to release the pilot. A single large ground mark indicated the initial contact point of the aircraft. The aircraft was largely intact although significantly damaged, with fragments of the damaged canopy scattered around the ground mark. Two blades of the propeller had also detached, one of which was located within the ground mark.

### **Aircraft examination**

Damage to the aircraft was consistent with a nose-down inverted impact with the ground. This resulted in extensive buckling and tearing of the fuselage and forward rotation of the wings around the leading edge attachment, with associated damage at the wingtips from contact with the ground. There was evidence on the damaged propeller blades of engine rotation at impact. No evidence was identified of a pre-impact mechanical or structural problem. It was not possible to assess the flap position or throttle setting prior to contact with the ground, due to the impact forces and subsequent damage. To the extent it could be assessed given the damage to the fuselage, no evidence was found of a pre-impact flying control continuity problem.

### **Analysis**

As there was no evidence found of a pre-existing fault with the aircraft which may have been causal or contributory to the accident the analysis focusses on the operational aspects of the accident.

The wind during the period of the two flights was from about 050 to 080° at 10 to 12 kt with gusts up to 16 kt. While the exact wind at the time of the accident is not known, the recorded wind information in the tower indicated that during the instructional flight the crosswind component was about 11 to 14 kt and during the accident flight about 6 to 7 kt. This is similar for the wind recorded at RAF Wittering soon after the accident. Although the

crosswind during the instructional flight may have been greater than that stated in the flying club's standing orders, it was probably below the limit during the accident flight, except that the gust limit may just have been exceeded.

The instructor commented that the student had demonstrated his ability to fly three circuits safely in the prevailing conditions, and continued to do so during the first two solo circuits.

On the third circuit the aircraft was probably upset by a gust of wind prior to touch down. The left wing rose and the student decided to execute a go-around. However, as the aircraft track diverged from the runway heading and across the crops at low height, the student may have been distracted from maintaining the required forward pressure on the control column, allowing the aircraft to pitch nose up. He then did not lower the nose as taught. As the angle of attack approached the stall the left wing dropped and the aircraft adopted an attitude that could not be recovered in the height available.



## **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**

<b>Aircraft Type and Registration:</b>	Boeing 757-28A, G-OOBE	
<b>No &amp; Type of Engines:</b>	2 Rolls-Royce RB211-535E4-37 turbofan engines	
<b>Year of Manufacture:</b>	2003 (Serial no: 33100)	
<b>Date &amp; Time (UTC):</b>	1 February 2016 at 1842 hrs	
<b>Location:</b>	Bristol Airport	
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 8	Passengers - 162
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	57 years	
<b>Commander's Flying Experience:</b>	17,956 hours (of which 6,730 were on type) Last 90 days - 40 hours Last 28 days - 31 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot, and safety report by the operator	

**Synopsis**

On the return sector from Las Palmas Airport to Bristol Airport on a windy day the approach to Runway 27 become de-stabilised and during the subsequent go-around a significant speed decay occurred. The aircraft landed safely from the subsequent approach.

**History of the flight**

The flight was a chartered holiday flight, taking passengers from Las Palmas Airport, Gran Canaria to Bristol Airport. For the co-pilot, it was the second of four planned sectors of supervised line flying following his return to flying after a five and a half month period of sick leave, and consequently the commander was qualified as a Type Rating Examiner. Prior to this flight, the co-pilot had successfully completed a three hour refresher flight in a simulator, and he had operated as the PF for the outbound sector from Bristol to Gran Canaria, which was uneventful.

The flight from Gran Canaria proceeded normally and the aircraft was positioned for an approach to Runway 27 at Bristol Airport. The weather conditions included strong winds, which strengthened with altitude. The Bristol METAR and ATIS reported gusty conditions, but gusts were not indicated in the last surface wind report passed by the tower to the aircraft on its final approach, so the crew set  $V_{APP}^1$  to 142 kt, adding 10 kt to the  $V_{REF}$  for

**Footnote**

<sup>1</sup>  $V_{APP}$  (Velocity for approach) is  $V_{REF}$  with a correction added to account for the wind conditions of the day.

the steady wind component, without any additional gust factor. The co-pilot was the PF, and the approach was stable<sup>2</sup> until approximately 300 ft agl.

Thereafter, the airspeed started to increase in the gusty conditions. The PF was advised by the commander of the speed trend, however, shortly afterwards, the aircraft started to drift high and to the left of the correct approach path, so the commander called for a go-around.

The initial go-around actions were carried out by the PF, whilst the commander selected the flaps to the two-engined go-around position and raised the landing gear. The PF then engaged the autopilot, with the aircraft climbing and in trim, using the company mnemonic 'TAGL'<sup>3</sup> but he did not verbalise this action, and the commander was unaware that the autopilot had been engaged. The commander then noticed that a high pitch attitude was developing, and the speed was reducing, so he began to coach the PF to lower the nose, but as the autopilot was engaged, the PF did not immediately correct the aircraft's attitude. The situation evolved rapidly as the aircraft approached the missed approach altitude of 3,000 ft with the power reducing as the Automatic Flight Control System (AFCS) tried to level-off the aircraft. The lowest airspeed the commander could recall seeing was 121 kt.

ATC then cleared the aircraft to climb to 5,000 ft. The aircraft was accelerated, and the flaps were fully retracted as the aircraft climbed. ATC were now reporting increased gusts of wind, so the commander elected to become the PF and he took control of the aircraft downwind. The second approach was uneventful, and the aircraft landed safely.

## Recorded data

### *Approach phase*

The approach commenced at approximately 1840 hrs with the autopilot and autothrottle engaged, and the  $V_{REF}$  was set to 142 kt. The relevant stabilised approach criteria were met at 1,400 ft aal, for landing with flap 25 set. The autopilot was disengaged at 600 ft aal, and the go-around was commenced at 119 ft aal, with the aircraft left of the centreline at an indicated airspeed of 172 kt. The lowest recorded height on the radio altimeter during the go-around was 94 ft.

### *Go-Around*

After pressing the go-around (GA) switches, the autothrottle and AFDS (autopilot flight director system) GA mode activated in the normal manner, and this was annunciated on the Flight Mode Annunciator (FMA). The aircraft pitch then increased from 2° to 12° nose-up, recording a vertical acceleration of +1.72g. The aircraft continued to pitch up, following the Flight Director (FD) pitch commands, to 21° nose up. Shortly after the landing gear was selected up there was a slight reduction in the pitch attitude, which was followed by the aircraft pitch attitude increasing to 22°, above the 19° commanded by the FD. The annunciation

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## Footnote

<sup>2</sup> Operators specify speed, flightpath and configuration criteria for the continuation of an approach to land. If these criteria are met the approach is considered to be 'stable'.

<sup>3</sup> TAGL is the Mnemonic for Trim, Autopilot, Go Around, and Lateral Mode.

ALT CAP illuminated on the FMA at 1,460 ft, indicating that the autopilot was starting to level the aircraft at the missed approach altitude of 3,000 ft<sup>4</sup>. The airspeed decreased rapidly through 160kt, with thrust reducing. Immediately after activation of the ALT CAP mode the centre autopilot was engaged, with the corresponding indication illuminating on the FMA.

The pitch attitude continued to increase through 27° with airspeed reducing through 151 kt. The GA mode of the autopilot was activated again. The selected airspeed remained 142 kt and a nose-up pitch exceeding the FD command persisted, reaching a maximum pitch of 30.76° with a climb rate in excess of 6,000 ft/min. The airspeed then reduced below  $V_{APP}$ . The pitch attitude remained high for a further 4 seconds before reducing steadily, while the airspeed continued to decrease, reaching 119 kt.

Pitch attitude then decreased rapidly from 26° as the aircraft reached the missed approach altitude of 3,000 ft and the ALTITUDE HOLD mode of the AFCS was activated. The airspeed reduced further, to a minimum of 110 kt before it began increasing again. The stick-shaker<sup>5</sup> was not activated. The nose-up pitch continued to reduce further to 8° and the autopilot was disconnected. The airspeed began to recover through 120 kt, however, thrust was then reduced which slowed acceleration until the aeroplane descended back towards 3,000 ft having peaked at an altitude of 3,100 ft.

Flap 5 was selected at an airspeed of 150 kt. However, an acceleration was not commanded until 10 seconds later when the selected speed was increased to 196 kt. The aeroplane then accelerated normally from this point to 220 kt. A right hand circuit was flown to a further ILS approach followed by a normal landing.

## Analysis

This was the first line training flight for the co-pilot after approximately five and a half months away from flying on medical grounds, and the wind conditions were challenging.

The approach flown by the co-pilot became de-stabilised and a go-around was initiated. During the go-around a low-level ALT CAP occurred. The speed at which the go-around was initiated meant the flight directors commanded a high nose-up attitude. The rapidly increasing wind speed with altitude, turbulence and full go-around thrust combined to create a high rate of climb with an ever increasing nose-up attitude. The ALT CAP annunciation occurred a short time before the autopilot was engaged and initially went unnoticed by the crew, and the AFCS was unable to recover the nose-high upset<sup>6</sup>. The commander was unaware that the autopilot had been engaged so his coaching of the co-pilot to reduce the aircraft's pitch attitude was ineffective and, with autothrottle and autopilot engaged, the airspeed reduced to a minimum of 110 kt.

The operator's safety investigation considered that, during the high workload period of a go-around, there was a degradation in the situational awareness of the crew. The crew

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### Footnote

<sup>4</sup> The Altitude Capture activated at this altitude because of the high rate of climb.

<sup>5</sup> Stick-shaker is a device fitted to most large aircraft, to warn the crew that the aircraft is approaching a stall.

<sup>6</sup> The Boeing 757 QRH definition of 'upset' includes unintentionally exceeding a pitch attitude of 25° nose-up.

were “startled” and their performance was affected, as confirmed by their subsequent selection of FLAP 5 whilst the aircraft was not accelerating. This was eventually corrected and the aircraft landed safely.

The commander commented that the incident highlighted the importance of FMA monitoring by the PM. With hindsight, he also considered that he should have intervened earlier, and taken control of the aircraft for the go-around.

### **Safety Action**

As a result of the operator’s safety investigation both pilots received additional training before returning to flying duties. The operator’s annual refresher training was modified to include a module to refresh all its Boeing 757 pilots on procedures for go-arounds with both engines operating. The operator’s training department will also be reviewing how it develops the intervention skills of its training pilots.

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Boeing 767-322, N642UA	
<b>No &amp; Type of Engines:</b>	2 Pratt & Whitney PW-606R turbofan engines	
<b>Year of Manufacture:</b>	1991	
<b>Date &amp; Time (UTC):</b>	12 July 2016 at 0729 hrs	
<b>Location:</b>	En route Heathrow to Chicago	
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 11	Passengers - 120
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	59 years	
<b>Commander's Flying Experience:</b>	13,332 hours (of which 2,790 were on type) Last 90 days - 159 hours Last 28 days - 38 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further inquiries by the AAIB	

**Synopsis**

The flight crew were advised that a fuel leak had been observed from the right over-wing fuel filler cap. The crew declared an emergency and diverted to Edinburgh, where the aircraft landed uneventfully. The fuel filler cap was replaced and the aircraft departed Edinburgh the following day, but during the climb a fuel leak was once again observed from the same location on the right wing. The aircraft returned to Edinburgh, where further maintenance investigation revealed a damaged O-ring in the over-wing fuelling port as the cause of the fuel leak.

**History of the flight**

The aircraft was operating a scheduled passenger flight from London Heathrow Airport to Chicago O'Hare Airport, when approximately 35 minutes into the flight, the flight crew were notified that a passenger had observed a fuel leak on the right wing. The flight crew confirmed the leak was coming from the over-wing fuel filler cap. They declared a MAYDAY and elected to divert to Edinburgh Airport, coordinating with Air Traffic Control to dump fuel in order to reduce the aircraft weight to below the maximum landing weight. The subsequent landing at Edinburgh was uneventful. The Airport Rescue Fire Fighting Service (ARFFS) was in attendance and evaluated the right wing and right engine area after landing. The aircraft was subsequently towed to a remote parking stand where the passengers and crew disembarked normally.

Maintenance engineers at Edinburgh replaced the over-wing fuel filler cap after which the fuel tank was fuelled to maximum capacity; no leaks were observed. The aircraft was then allowed to sit overnight in this condition and no further leaks were observed.

The following day, the aircraft departed Edinburgh on a ferry flight to Chicago. The same flight crew and flight attendants were assigned to the flight, but there were no passengers on board. During the climb-out from Edinburgh flight attendants again observed fuel streaming from the over-wing fuel filler cap on the right wing. The flight crew declared a MAYDAY and returned to Edinburgh. Fuel dumping was not necessary on this occasion as the aircraft was already below the maximum landing weight. The landing at Edinburgh was uneventful and following evaluation by the ARFFS, the aircraft was towed to a remote parking stand where further maintenance investigation revealed that an O-ring in the over-wing fuelling port was damaged (Figure 1).



**Figure 1**

Damaged O-ring from over-wing fuelling port

### **Background information**

The aircraft maintenance records showed that the last heavy maintenance check was accomplished in June 2015, but there was no reference to maintenance having been performed on the over-wing fuelling port at that time, nor since.

### **Comment**

The damage to the O-ring indicates that it may have been pinched or improperly seated when it was last installed. There was no record of recent maintenance to the over-wing fuelling port which may have precipitated this damage. It is likely that once damaged, the condition of the O-ring degraded over time to the point where it was no longer able to form an effective seal between the fuelling port and the fuel filler cap, leading to the fuel leaks described in this incident.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Bombardier Global Express BD-700-1A10, N683GA	
<b>No &amp; Type of Engines:</b>	2 Rolls-Royce BR 700 series engines	
<b>Year of Manufacture:</b>	2003 (Serial no: 9134)	
<b>Date &amp; Time (UTC):</b>	25 March 2016 at 0345 hrs	
<b>Location:</b>	Owen Roberts International Airport, Cayman Islands	
<b>Type of Flight:</b>	Commercial Air Transport (Passenger)	
<b>Persons on Board:</b>	Crew - 2	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Another aircraft, a Saab 340B, registration VP-CKI, suffered damage to its outboard left underwing surface and left engine spinner and propeller	
<b>Commander's Licence:</b>	Not known	
<b>Commander's Age:</b>	Not known	
<b>Commander's Flying Experience:</b>	17,500 hours (of which 600 were on type) Last 90 days - Not known Last 28 days - Not known	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and a report from the internal investigation conducted by the airport operator	

**Synopsis**

The Global Express manoeuvred out of a parking stand between two other aircraft and its jet exhaust caused an adjacent, parked Saab 340B to move and collide with ground equipment, which had been left on the stand.

The Airport Authority has identified four areas in which it can take safety action.

**Background**

On 22 March 2016, the Cayman Islands Airport Authority (CIAA) granted permission, by e-mail, for N683GA to operate a private late-hours flight into Grand Cayman, to arrive at 0305 hrs UTC on 25 March 2016 (2205 hrs local time on 24 March 2016).

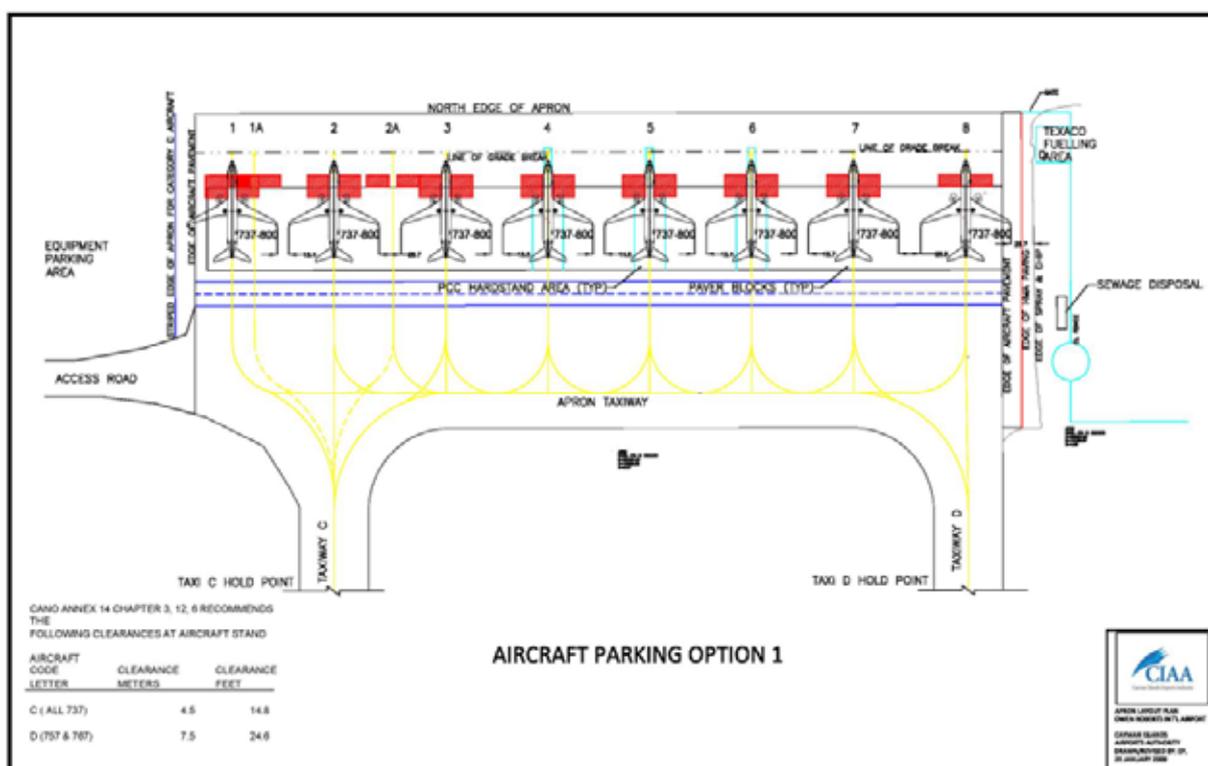
On 24 March, 8 hours before the flight was due, a follow up e-mail was sent from the operator of N683GA to correct a possible misunderstanding about the date of the flight. The title of the earlier e-mail request showed arrival on 25 March, because the translation to local time had not been made (UTC minus 5 hours). The amended e-mail was copied to a number of interested parties, but this did not include the ramp manager of the handling company at the airport.

## History of the flight

The aircraft arrived at Grand Cayman at 0322 hrs UTC on 25 March (2222 hrs local time on 24 March) and the commander was advised by ATC to proceed to the Commercial Apron. It was dark but the weather was clear. ATC advised that they did not have parking instructions for the aircraft but to expect to park on Stand 8 (see Figure 1).

As the aircraft approached the apron it was marshalled towards Stand 2. A parked Saab 340 was occupying Stand 1, on the left, and a parked Boeing 737 occupied Stand 3, on the right. Both aircraft had been parked for more than 3 hours, and were staying overnight. All the other stands on the apron were clear.

A member of staff of the contracted handling company, a ramp dispatch agent, marshalled N683GA on to the stand, without the presence of wingmen. He stopped the aircraft short, to avoid conflict with any possible obstacles and to ensure clearance from the wings of the two parked aircraft on either side. Additionally, this allowed space for the aircraft to self-manoeuvre off the stand, once the passengers had disembarked.



**Figure 1**

Aircraft parking geometry, commercial ramp, Owen Roberts International Airport

When the aircraft arrived, the Airport Duty Officer (ADO) was finishing off paperwork at the end of a nine-hour duty period, which was due to finish at 0400 hrs UTC. She noticed that the aircraft had been incorrectly parked, with its tail infringing the taxiway, and went to the apron to instruct the aircraft to be repositioned.

As the passengers were disembarking, the ADO advised the commander that the aircraft had to be moved immediately. After some discussion, it was decided that the ramp dispatch agent would assist the passengers to the Terminal, with their bags, and the flight crew would move the aircraft, before completing their own immigration procedures. The commander requested the ADO to remove the chocks and warning cones and monitor the wing clearance. He then started the right engine, expecting to make a turn to the left. The ADO picked up a set of marshalling wands, only one of which was lit, and proceeded to assist the commander. He taxied ahead prior to making the turn to the left and received a signal to stop. He then understood that he was being given a signal to turn right. The signal to turn right persisted, so he increased power on the right engine, which was now on the inside of the turn, to make the sharp turn required in that direction. The jet blast from the engine caused the SAAB 340 on Stand 1 to rotate to the right and its left wing struck a set of passenger steps which had been left on the stand. The commander of N683GA was not aware of the incident and proceeded to reposition to Stand 8.

### Organisational information

The commercial apron at Owen Roberts International Airport has eight designated stands. Stand assignment plans are published in advance and any updates are made, as required, by the ramp manager. The original plan for 24 March did not include N683GA and it was not updated, thus a stand had not been pre-assigned when the aircraft landed.

Stand allocation and marshalling procedures are provided in the Cayman Islands Airports Authority Apron Management and Procedure Manual (CIAA AMPM), which includes the following instruction:

*'It is the policy of the CIAA that all aircraft utilizing the commercial aprons will be marshalled in to aircraft stand. For aircraft being diverted from the General Aviation Ramp it is the responsibility of the organization making that decision to ensure notification is given to Cayman Airways Ramp Control in order to ensure proper equipment and personnel are assigned to meet the aircraft. Marshalling crew will consist of 1 marshal and two wing men (one on each wing) at all times.'*

Ground equipment is required to be removed from stands once aircraft servicing has been completed, as stated in the CIAA AMPM:

*'Once the aircraft has been serviced and either secured for the evening or pushed back to the taxi line for departure- ALL GHE [ground handling equipment] SHALL BE RETURNED TO THE APPROPRIATE PARKING SPOT IN THE GHE STAGING AREA!'*

The ADO had received training in ramp handling procedures, which included aircraft marshalling, in 2013.

## Analysis

The revision to the date of arrival of the aircraft was not communicated to the ramp manager, so a parking stand had not been assigned when the aircraft arrived unexpectedly. In the absence of any other information, the ramp dispatch agent decided to park the aircraft on Stand 2. However, Airport Authority stand allocation and parking procedures, provided in the CIAA AMPM, were not followed, possibly because of a lack of appropriate personnel available at short notice at night.

N683GA was parked so that its tail infringed the taxiway, a situation which the ADO considered to be a safety risk that should be addressed immediately. She attempted to resolve the situation by asking the commander to move the aircraft. The required personnel were not present for the task to be completed safely, so, on being asked by the commander, she decided to assist him herself. Communication between the ADO and the aircraft was not effective and the commander believed he was receiving signals to turn to the right, which required high engine power. It is common procedure when taxiing a short distance to use one engine but doing so may create a high power requirement in confined areas, with an associated risk to personnel and equipment. On this occasion, the jet blast caused the adjacent SAAB 340 to move substantially on its stand and collide with ground equipment which should have been removed.

The arrival of the aircraft was not clearly notified and the personnel on duty were not expecting it. This, and the lack of a pre-assigned stand, led the on-duty staff to use a sequence of *ad hoc* procedures to accommodate the aircraft.

The ramp dispatch agent and the ADO both gave manoeuvring instructions to the aircraft without a marshalling crew in attendance, which is in contravention of the requirements of the Apron Management and Procedure Manual. Handling equipment was also left on Stand 1, when it should have been removed.

## Safety actions/Recommendations

The Airport Authority conducted an investigation into the circumstances of the accident and made four safety recommendations:

- 1. A systematic review of the process and criteria for approving flights after the normal working hours of the airport, with special emphasis placed on General Aviation operations, should be conducted and used to create a clear policy for this activity.*
- 2. Apron Management Training and annual recurrence is a requirement for all ATC, Ground Handling, Ramp control personnel and Airport Duty Officers and should be strictly enforced.*
- 3. Airport Duty Officers and other ramp personnel must be focused on ensuring the proper placement and subsequent timely removal of Ground Handling Equipment used on aircraft stands.*

4. *Establishment of a Training course and CAA approved Operators Certificate for aircraft Marshal and Wing Walkers.'*

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Acrosport 2, G-DAGF
<b>No &amp; Type of Engines:</b>	1 Lycoming O-360-A1D piston engine
<b>Year of Manufacture:</b>	2013 (Serial no: PFA 072A-11129)
<b>Date &amp; Time (UTC):</b>	16 August 2016 at 1530 hrs
<b>Location:</b>	New Farm Airstrip, near Bristol
<b>Type of Flight:</b>	Private
<b>Persons on Board:</b>	Crew - 1                      Passengers - 1
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	Damage to left landing gear and propeller
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence
<b>Commander's Age:</b>	50 years
<b>Commander's Flying Experience:</b>	9,714 hours (of which 55 were on type) Last 90 days - 197 hours Last 28 days - 41 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot

The aircraft had touched down and had settled on the runway. After approximately 20 m the left landing gear leg collapsed and the aircraft came to rest on its left wing. There were no injuries. Subsequently the landing gear support strut was found to have had failed, causing the left landing gear leg to collapse.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Cessna 172P Skyhawk, G-NWFC	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-320-D2J piston engine	
<b>Year of Manufacture:</b>	1985 (Serial no: 172-76305)	
<b>Date &amp; Time (UTC):</b>	10 July 2016 at 1535 hrs	
<b>Location:</b>	North Weald Airfield, Essex	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Nose landing gear fork bent, damage to firewall and lower fuselage skin	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	49 years	
<b>Commander's Flying Experience:</b>	387 hours (of which 161 were on type) Last 90 days - 11 hours Last 28 days - 4 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The aircraft was on final approach to Runway 30 at 65 kt IAS and with 20° of flap set. The pilot reported that the wind was from 200° at 20 kt and that the approach was normal until, during the flare, the aircraft experienced a gust of wind. The aircraft "dropped suddenly" onto the runway, bounced back into the air before settling back onto the runway and coming to a halt. Because he considered that the aircraft nose landing gear might have been damaged during the landing, the pilot shut down on the runway and asked for assistance to move the aircraft.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	DR 107 One Design, G-CEPZ	
<b>No &amp; Type of Engines:</b>	1 Lycoming IO-360-B1B piston engine	
<b>Year of Manufacture:</b>	1996 (Serial no: 38)	
<b>Date &amp; Time (UTC):</b>	5 June 2016 at 1235 hrs	
<b>Location:</b>	Membury Airfield, Berkshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Damage to propeller, main landing gear, main spar and surface of underside of both wings	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	32 years	
<b>Commander's Flying Experience:</b>	200 hours (of which 1 was on type) Last 90 days - 13 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

## Synopsis

After a short cross-country flight to Membury the aircraft joined the circuit downwind to land on grass Runway 13. On final approach the pilot misidentified the runway threshold and confused it with the Runway 17/35 intersection. The pilot now had a significantly reduced landing distance available (LDA). After touchdown she applied maximum braking to stop the aircraft. As a result the aircraft tipped forward on its nose, causing the landing gear to collapse and bringing the aircraft to a stop.

## History of the flight

After a short cross-country flight from Thruxton to Membury the aircraft joined the circuit downwind to land on grass Runway 13. Although the join and circuit were uneventful, the angle of view during final approach caused the pilot to lose sight of the actual threshold, confusing it with the Runway 17/35 intersection. As the aircraft touched down she immediately became aware of her mistake and realised that the LDA was now significantly reduced. She decided against a go-around because there was insufficient runway remaining. She was also aware of another stationary aircraft and trees at the end of the runway and so applied maximum braking. The lightweight 'tail-dragger' design of this particular aircraft type meant the extreme braking resulted in the aircraft tipping nose forward, causing damage to the propeller and landing gear.

**Discussion**

In the pilot's own analysis after the event, the misidentification was caused by two factors. These were: unfamiliarity with the airfield, and the runway after the intersection appearing more defined, when viewed during the final approach, than the wider and less defined preceding section.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Piel CP301B Emeraude, G-AZGY	
<b>No &amp; Type of Engines:</b>	1 Continental Motors Corp O-200-A piston engine	
<b>Year of Manufacture:</b>	1968 (Serial no: 122)	
<b>Date &amp; Time (UTC):</b>	16 April 2016 at 1300 hrs	
<b>Location:</b>	RAF Henlow, Bedfordshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Left landing gear, wing skin and propeller	
<b>Commander's Licence:</b>	Light Aircraft Pilot's Licence	
<b>Commander's Age:</b>	56 years	
<b>Commander's Flying Experience:</b>	971 hours (of which 497 were on type) Last 90 days - 2 hours Last 28 days - 2 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further inquiries by the AAIB	

## Synopsis

The left landing gear collapsed while the aircraft was taxiing on a grass taxiway. Subsequent examination revealed that the landing gear leg had failed as a result of a thread failure on one of the landing gear attachment bolts. The pilot considered that the poor construction of the bolt was the primary cause of the failure.

## History of the flight

While taxiing from the hangar at RAF Henlow, shortly after the aircraft moved from the paved surface onto the grass taxiway, the pilot described hearing a "loud pop". On preparing to stop the aircraft he heard another loud pop and the left wing slowly sank to the ground, as the left landing gear leg folded forwards under the wing. The pilot was uninjured and exited the aircraft without assistance. The aircraft was subsequently recovered to the hangar for further examination.

## Background information

The main landing gear leg is of tubular steel construction and is attached to the respective wing main spar by means of two steel plates, secured by three long bolts. Two of the bolts are installed forward of the spar, and one aft of the spar.

The pilot commented that it had been his practice to check the tightness of the nuts on the landing gear attachment bolts approximately every six months. He stated that access to

the area was limited, but that he had been able to get a spanner onto the nuts to tighten them, although the access was not sufficient to use a torque wrench. The pilot further commented that the CP301B Emeraude normally has access panels on the wings to facilitate inspection of the landing gear attachments, but that was not the case on this aircraft. He suspected that the wings may have been re-skinned at some point prior to his ownership, covering the original access holes, although there was no record of such activity in the aircraft log books.

The pilot recalled a landing on grass runway a number of months previously, where the last few metres of the runway were particularly rutted. This was approximately 12 landings prior to the accident.

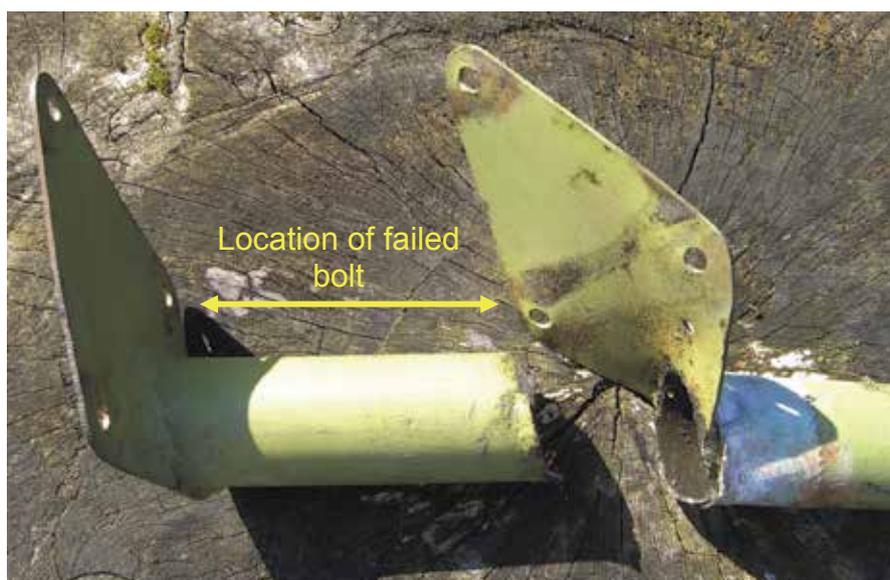
### Examination of the aircraft

The pilot reported that the threads on the inboard forward attachment bolt appeared to have been stripped and the nut had been pulled off the end (Figure 1). In this condition the landing gear was not adequately restrained. This caused the lower attachment plate to bend, allowing the landing gear leg to twist outboard until it failed just above the lower attachment plate (Figure 2).



**Figure 1**

Failed landing gear attachment bolt



**Figure 2**

Damage to landing gear leg and attachment plates

The pilot reported that the failed bolt appeared to have been homemade. He commented that it seemed to have been poorly manufactured and with a poorly cut thread, that occupied only a small portion of its length. The nut was a half-thickness nut, offering limited thread engagement with the bolt. The nut did not offer a good fit with the threads of the bolt and appeared to have been locked by staking the nut/bolt thread interface with a number of centre punch strikes. No washers were installed. All the landing gear attachment bolts were of a similar construction.

The left wing skin was damaged near the landing gear attachment point and one of the wooden propeller blades broke at the tip as it contacted the ground. The pilot considered that a large compression spring, which forms part of the landing gear, allowed the wing to fall slowly to the ground when the landing gear collapsed, minimising damage to the aircraft.

### **Discussion**

The pilot commented that the landing gear attachment bolts, which had been fitted at some time prior to him acquiring the aircraft, appeared to have been poorly manufactured, with insufficient nut depth to assure good locking. He was not aware until after the accident of the locking technique that had been used, and commented that this locking technique precludes subsequent torque tightening without compromising the locking method. His attempts to tighten the nuts may therefore have been ineffective. The pilot has since replaced all the landing gear attachment bolts with newly manufactured homemade studs and added 'Nyloc' lock nuts and washers. He has also restored what he believed to be original access panels in each wing to facilitate future inspection access.

The pilot considered that poor construction of the landing gear attachment bolts was the primary cause of the bolt failure. He also considered that the previous landing on a rutted runway may have served to accelerate the failure of the bolt, but it was unlikely to have to have been causal.

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Pierre Robin DR400/180R Remorqueur, G-ELUN	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-360-A3A piston engine	
<b>Year of Manufacture:</b>	1975 (Serial no: 1102)	
<b>Date &amp; Time (UTC):</b>	3 July 2016 at 1115 hrs	
<b>Location:</b>	Warton Aerodrome, Lancashire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	61 years	
<b>Commander's Flying Experience:</b>	224 hours (of which 136 were on type) Last 90 days - 10 hours Last 28 days - 4 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

**Synopsis**

Following a cross-country flight, the pilot of G-ELUN misidentified Warton Aerodrome for Blackpool Airport and conducted an approach and landing at Warton, before being instructed to go-around and reposition to Blackpool.

**History of the flight**

The pilot was flying from Fishburn Airfield, County Durham, to Blackpool Airport; his first flight into Blackpool. On arriving in the Blackpool area, from the north-east, the pilot reported east abeam Blackpool High Tower where he was instructed to orbit due to other traffic. He entered an orbit just north of Inskip disused airfield, before being instructed to continue for a right base join for Runway 28 at Blackpool. The Blackpool circuit was active with at least two other aircraft at the time.

On exiting the orbit, he identified an airfield and positioned to land at it while looking for traffic which he believed would be on the downwind leg in the circuit. The pilot had incorrectly identified Warton, instead of Blackpool, and made an approach to Warton's Runway 25.

The Warton radar controller had noticed the aircraft track across an area of restricted airspace, just north of Warton, and advised Warton Tower of an unknown contact that may be approaching the airfield. The Tower controller shone a red Aldis lamp at the aircraft and varied the runway light settings in an attempt to make contact with the pilot, without success.

As the aircraft touched down, Blackpool ATC instructed it to go-around and the pilot converted his landing to a touch-and-go. He then repositioned to land at Blackpool, without further incident.

### **Comment**

Although the Warton Approach was unable to communicate with the pilot of G-ELUN, the radar controller was able to monitor the aircraft's progress and alert the Warton Tower controller of its presence. This demonstrated the value of the radar service at Warton in providing an additional safety barrier.

This is not the first aircraft to misidentify Warton for Blackpool. In early 2016, the operator of Warton Aerodrome produced a video to assist pilots in the correct identification of the two airfields. It can be located at:

<https://www.youtube.com/watch?v=CQC7JnwdY84&feature=youtu.be#>

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper J3C-65 Cub, G-BDHK	
<b>No &amp; Type of Engines:</b>	1 Continental Motors Corp A65-8F piston engine	
<b>Year of Manufacture:</b>	1946 (Serial no: 261)	
<b>Date &amp; Time (UTC):</b>	14 August 2016 at 1800 hrs	
<b>Location:</b>	Eastbach Airfield, near Coleford, Gloucestershire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Undercarriage collapsed and propeller damaged	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	53 years	
<b>Commander's Flying Experience:</b>	288 hours (of which 106 were on type) Last 90 days - 6 hours Last 28 days - 2 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and additional enquiries made by the AAIB	

After a local flight, the pilot returned to Eastbach Airfield, with which he was familiar as the aircraft was based there. He joined overhead for a left-hand circuit to land on Runway 06, a 340 m grass runway with an upslope and, as noted on airfield documentation, a bump inset some 100 m from the threshold. He observed that the windsock indicated no significant wind and configured the aircraft for a normal landing. On final approach, he realised that he was low and added power, aiming to touch down just after the numbers. However, upon touchdown the undercarriage immediately collapsed. He was able to vacate the aircraft without assistance and sustained no injury.

In an open and honest discussion with the AAIB, the pilot considered that his positive landing may have contributed to the accident.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-24-250 Comanche, G-ARLB	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-540-A1D5 piston engine	
<b>Year of Manufacture:</b>	1960 (Serial no: 24-2352)	
<b>Date &amp; Time (UTC):</b>	11 June 2016 at 1330 hrs	
<b>Location:</b>	Old Buckenham Airfield, Norfolk	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 2
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Propeller blades, lower engine cowl, nose leg, left wing damaged and engine shock-loaded	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	54 years	
<b>Commander's Flying Experience:</b>	1,541 hours (of which 1 was on type) Last 90 days - 5 hours Last 28 days - 5 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The aircraft was on approach to Runway 25 in conditions of good visibility and with a light and variable wind. The pilot reported that, at about 20 ft above the runway, he allowed the speed to begin to reduce and began to flare the aircraft. Shortly afterwards the aircraft touched down heavily on its main landing gear and the nose of the aircraft "sank lower than expected". The propeller hit the runway. The aircraft came to a halt on the runway and the occupants vacated it uninjured.

The creasing on the underside of the left wing (Figure 1) indicated that there was a higher-than-normal rate of descent on touchdown. The orientation of the nose landing gear drag brace (extended and slightly over-centre) (Figure 2) indicated that the nose landing gear was locked down during the approach. Figure 3 shows that the nose gear piston broke towards its top which suggested that it broke immediately on touchdown before the piston began to move into the nose gear cylinder under the weight of the aircraft's nose section.



**Figure 1**

Creasing on the underside of the left wing



**Figure 2**

Nose landing gear drag brace



**Figure 3**

Break in the nose gear jack

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-28-140 Cherokee, G-NHRH	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-320-E2A piston engine	
<b>Year of Manufacture:</b>	1967 (Serial no: 28-22807)	
<b>Date &amp; Time (UTC):</b>	30 May 2016 at 1650 hrs	
<b>Location:</b>	Compton Abbas Airfield, Dorset	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Nose landing gear collapsed, propeller blades bent and engine frame damaged	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	70 years	
<b>Commander's Flying Experience:</b>	190 hours (of which 132 were on type) Last 90 days - 3 hours Last 28 days - 1 hour	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB	

**Synopsis**

The aircraft landed heavily, more than halfway along a dry grass runway, and the nose landing gear assembly collapsed, causing the propeller to strike the ground. The pilot had logged three hours flying in the previous 18 months and had not flown with an instructor during this period.

**History of the flight**

Earlier in the day the pilot flew his aircraft from Compton Abbas to Dunkeswell Airfield, Devon with one passenger on board. A go-around was flown from the first approach, because of observed parachuting activity, but the pilot stated that his subsequent landing was uneventful. Following that flight, he left the aircraft parked for several hours and then flew it back to Compton Abbas, accompanied by the same passenger. After checking-in with '*Compton Radio*' for air/ground communication, the pilot chose to make a straight-in approach for grass Runway 08, which was dry. This runway has an available landing distance of 803 m and the surface slopes down from the threshold towards the mid-point before sloping up towards the Runway 26 threshold.

Visibility was good but the wind was northeasterly at 20 kt, so the pilot approached at 75 kt<sup>1</sup> which he said was faster than normal, because of the wind strength. He did not

**Footnote**

<sup>1</sup> The PA-28-140 pilot's operating handbook provides landing performance based on an indicated approach speed of 61 kt.

believe his approach was unusual in any other way, although he said he touched down more than halfway along the runway. He realised the landing was heavier than intended because, shortly after touchdown, he and his passenger felt a jolt and were “jerked” against their seatbelts. It was apparent that the nose landing gear had collapsed and as a result both propeller blades then struck the ground. Once the aircraft had come to a halt, in a nose-down attitude, the pilot and his passenger both vacated, uninjured and without assistance.

The nosewheel had detached and one leg of the fork assembly had broken off, with the other fork bent through approximately 60°. Both propeller blades were also bent and the engine had been pushed back and upwards, causing distortion of the engine mounting. The pilot could not understand what went wrong during the landing and stated he would seek assistance from a flying instructor when he next flew.

### **Witness information**

A witness at Dunkeswell watched the aircraft’s arrival and observed all three wheels make contact with the runway at the same time, in what was described as a “hard landing”, but apparently without any obvious damage occurring.

An official at Compton Abbas reported that the airfield remained open later than usual to facilitate the aircraft’s return. Details of the wind velocity and the landing runway were passed over the air/ground radio and the aircraft’s approach was watched by an experienced PA-28 pilot. He judged the aircraft to be higher than expected when it overflew the threshold; by his estimation it was then at 100 ft agl.

According to this witness, the pilot did not appear to flare the aircraft before it made ground contact in a nose-down attitude, 500 m from the start of the runway. The nose landing gear seemed to collapse immediately but the aircraft continued along the grass runway for 64 m and then came to rest, in a nose-down attitude, pointing 45° left of the runway centreline.

### **Pilot’s experience**

The pilot’s log book indicated that he commenced flying training in 1990 and was subsequently issued with an NPPL(A) in November 2012. Since that date he had recorded 16 hours flying time, all of which was flown in his own PA-28 aircraft, and this included one flight with an instructor, on 9 November 2014 for renewal of his SSEA (land) rating. He did not record any flying time in the periods from March 2013 to August 2014 or from November 2014 to April 2016. From 8 April 2016 until the accident flight on 30 May 2016 he flew four times and recorded three hours flying.

### **AAIB comment**

The CAA publishes Safety Sense Leaflets and Leaflet 1e ‘*Good Airmanship*’ provides advice to general aviation pilots, recommending they revise their ‘*basic knowledge and skills by having a regular flight, at least every year, with an instructor*’.

The '*Good Airmanship*' leaflet also offers guidance for landings and advises pilots to plan to touch down at the right speed, close to the runway threshold, unless the field length allows otherwise, and to '*go-around if not solidly on in the first third of the runway, or the first quarter if the runway is wet grass*'.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Piper PA-28-161 Cherokee Warrior II, G-CGDJ	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-320-D3G piston engine	
<b>Year of Manufacture:</b>	1981 (Serial no: 28-8116256)	
<b>Date &amp; Time (UTC):</b>	11 August 2016 at 1620 hrs	
<b>Location:</b>	Perranporth Airfield, Cornwall	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - 1 (Minor)	Passengers - 1 (Minor)
<b>Nature of Damage:</b>	Aircraft destroyed by post-impact fire	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	64 years	
<b>Commander's Flying Experience:</b>	210 hours (of which 75 were on type) Last 90 days - 3 hours Last 28 days - 0 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

## Synopsis

On departure from Runway 27 at Perranporth Airfield the aircraft briefly became airborne but sunk back to the ground, impacting the upwind end of the runway. Both occupants sustained minor injuries in the accident, but managed to vacate the aircraft before fire consumed the majority of the fuselage. The cause of the accident was not determined.

## History of the flight

The pilot was flying from the Scilly Isles to Blackbushe Airport and decided to land at Perranporth Airfield to refuel. Refuelling was completed normally, with 30 litres of Avgas 100LL added to each of the left and right wing fuel tanks. The pilot reported that the surface wind was from 300° at 15 kt. He taxied to the departure end of Runway 27 using the left fuel tank, before changing to the right fuel tank and completing power and pre-takeoff checks, with no abnormalities noted. The pilot confirmed that the auxiliary electric fuel pump was selected to ON prior to takeoff.

The pilot described the initial part of the takeoff as normal, with the aircraft becoming airborne and climbing normally for 3 - 4 seconds. He reported that the aircraft then started to descend, in a nose-high attitude, and that he felt as if there was a loss of engine power, although he did not recall whether the engine rpm had reduced. Neither the pilot, nor his passenger, recalled hearing the stall warning horn during the takeoff.

The pilot checked that the fuel was selected ON, the mixture was set to RICH, the carburettor heat was COLD and the primer was locked closed, but the aircraft continued to descend, stalling just prior to impacting the runway nose-first, close to the upwind end of Runway 27. The aircraft came to rest on grass, a short distance to the north of Runway 27. The pilot reported that he saw smoke coming from under the engine, and that he switched the master switch to OFF and that he believed he had also turned the fuel selector to OFF.

Both pilot and passenger sustained minor injuries in the impact, but both were able to vacate the aircraft via the right cabin door. The aircraft continued to burn, with fire consuming the majority of the fuselage before fire-fighting appliances arrived and extinguished the fire.

### **Airfield information**

Perranporth Airfield is located on the north Cornish coast 6.5 nm southwest of Newquay, and has an elevation of 330 ft amsl. The airfield is adjacent to sea cliffs, and a popular UK VFR airfield guide contains the following warning in respect of the airfield:

***Warning: RWY 27 – Expect wind shear and severe turbulence in strong winds.***

### **Fuel**

The airfield operator confirmed that fuel from the bowser used to refuel the aircraft was tested and met the quality requirements specified for the daily fuel check. He also stated that aircraft receiving fuel before and after G-CGDJ refuelled had not reported any fuel-related problems.

### **Aircraft examination**

Photographs of the aircraft wreckage and runway impact marks were supplied to the AAIB. These showed that the aircraft had struck the runway in a right-wing low, nose-down attitude. The propeller and spinner assembly had detached from the aircraft during the ground impact. Both blade tips of the fixed-pitch metal propeller exhibited marked rearwards tip-curling, consistent with rotation under power at impact.

### **Discussion**

Damage to the aircraft's propeller indicates that at impact the engine was running and producing power, although it is not possible to determine accurately the power level based on propeller damage alone. As the takeoff and initial climb performance was described as normal, any power reduction that might have occurred must have happened during the latter stages of the takeoff. It is also possible that downdraft turbulence from the upwind sea cliffs may have caused, or contributed to, the descending flight path during the latter stages of the takeoff.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Piper PA-28-161 Cherokee Warrior II, G-SVEA	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-320-D3G piston engine	
<b>Year of Manufacture:</b>	1979 (Serial no: 28-7916082)	
<b>Date &amp; Time (UTC):</b>	25 June 2016 at 1423 hrs	
<b>Location:</b>	On the A40 trunk road between Abergavenny and Raglan, Monmouthshire	
<b>Type of Flight:</b>	Training	
<b>Persons on Board:</b>	Crew - 2	Passengers - 1
<b>Injuries:</b>	Crew - 2 (Minor)	Passengers - 1 (Minor)
<b>Nature of Damage:</b>	Substantial	
<b>Commander's Licence:</b>	Commercial Pilot's Licence	
<b>Commander's Age:</b>	44 years	
<b>Commander's Flying Experience:</b>	1,909 hours (of which 800 were on type) Last 90 days - 88 hours Last 28 days - 22 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

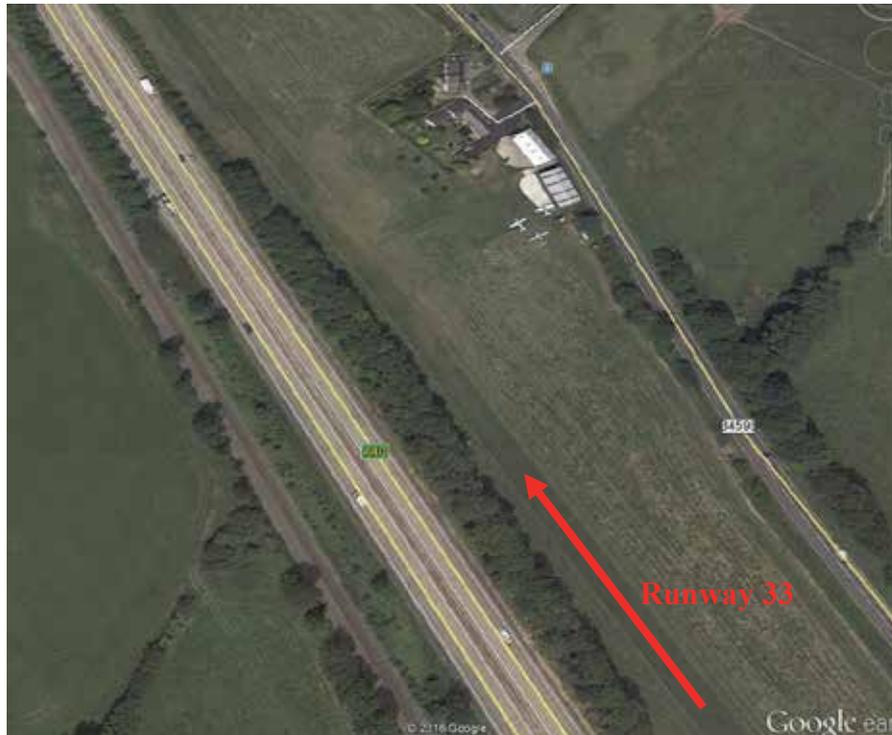
## Synopsis

During takeoff, with the student in control, the aircraft started to veer to the left, towards a line of trees adjacent to the left edge of the runway. Although the instructor took control, he was unable to prevent the left wing from contacting the trees. This caused the aircraft to yaw to the left, ultimately rotating through 180° into the trees and out the other side, before landing on the nearby A40 road.

## History of the flight

This was intended to be a training flight, with the student conducting the takeoff. After completing the appropriate checks, 10° of flap was set and full power was selected. The pilot released the brakes and commenced the takeoff roll on Runway 33. As the aircraft passed over the crest of a small hill, approximately halfway along the grass strip, it started to veer to the left. The left side of the runway is located close to a line of trees that borders the A40 trunk road and, in the instructor's words, "there is not much room for error". (See Figure 1.) The instructor took control and applied right rudder and aileron in an attempt to steer the aircraft away from the trees. The aircraft became prematurely airborne at around this time and the instructor pitched the nose down slightly and continued the climb, but the left wing started to contact some tree branches. Despite the application of more right rudder and aileron, the instructor felt the wing contact more branches. His intention was to try to fly the aircraft away into the circuit but the wing continued to contact the trees. Finally, there

was a loud bang from the left wing and the aircraft was violently rotated through 180° in a level attitude into the trees; it then exited the trees travelling backwards and landed nose first, right wing slightly down, on the A40 trunk road. The cabin of the aircraft was in the right-hand lane of the southeast-bound carriageway and the tail in the central reservation. Fortunately no road traffic collided with the aircraft and the occupants exited the aircraft having received only minor injuries.



**Figure 1**

Aerial view of airfield, showing proximity of trees to mown strip

## Conclusion

The instructor's assessment was that the accident occurred after the aircraft was allowed to drift into the trees close to the left side of the runway during takeoff. The left wing's contact with the branches caused a yaw to the left which the instructor was unable to correct.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-28-161 Cherokee Warrior III, G-BZDA	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-320-D3G piston engine	
<b>Year of Manufacture:</b>	2000 (Serial no: 2842087)	
<b>Date &amp; Time (UTC):</b>	27 June 2016 at 1125 hrs	
<b>Location:</b>	White Waltham Airfield, Berkshire	
<b>Type of Flight:</b>	Training	
<b>Persons on Board:</b>	Crew - 2	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Engine, propeller, engine bearer, nose landing gear, lower firewall	
<b>Commander's Licence:</b>	Commercial Pilot's Licence	
<b>Commander's Age:</b>	41 years	
<b>Commander's Flying Experience:</b>	370 hours (of which 154 were on type) Last 90 days - 27 hours Last 28 days - 19 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

Whilst returning from a local training flight, the engine lost power during final approach. The instructor conducted a forced landing in a field short of the runway. Although the aircraft sustained significant damage, neither occupant was injured. The weather was good, with scattered cloud at 3,500 ft, the temperature was 20°C and the dew point 13°C.

After recovery of the aircraft, the engine was tested by the aircraft's maintenance organisation and found to operate normally.

When the temperature and dew point were plotted on the CAA icing conditions chart contained in '*Safety Sense Leaflet 14, Piston Engine Icing*', it indicated that moderate icing could be expected at cruise power and serious icing at descent power. (See Figure 1.)

The instructor candidly commented: "... *the main point to put across to other pilots flying in weather conditions similar to that on the day of my incident is that, even when applying the carb heat for the recommended time as per the POH, icing can still form in the carburettor. It is a lesson I learnt that day and an experience I would not like to repeat!*"

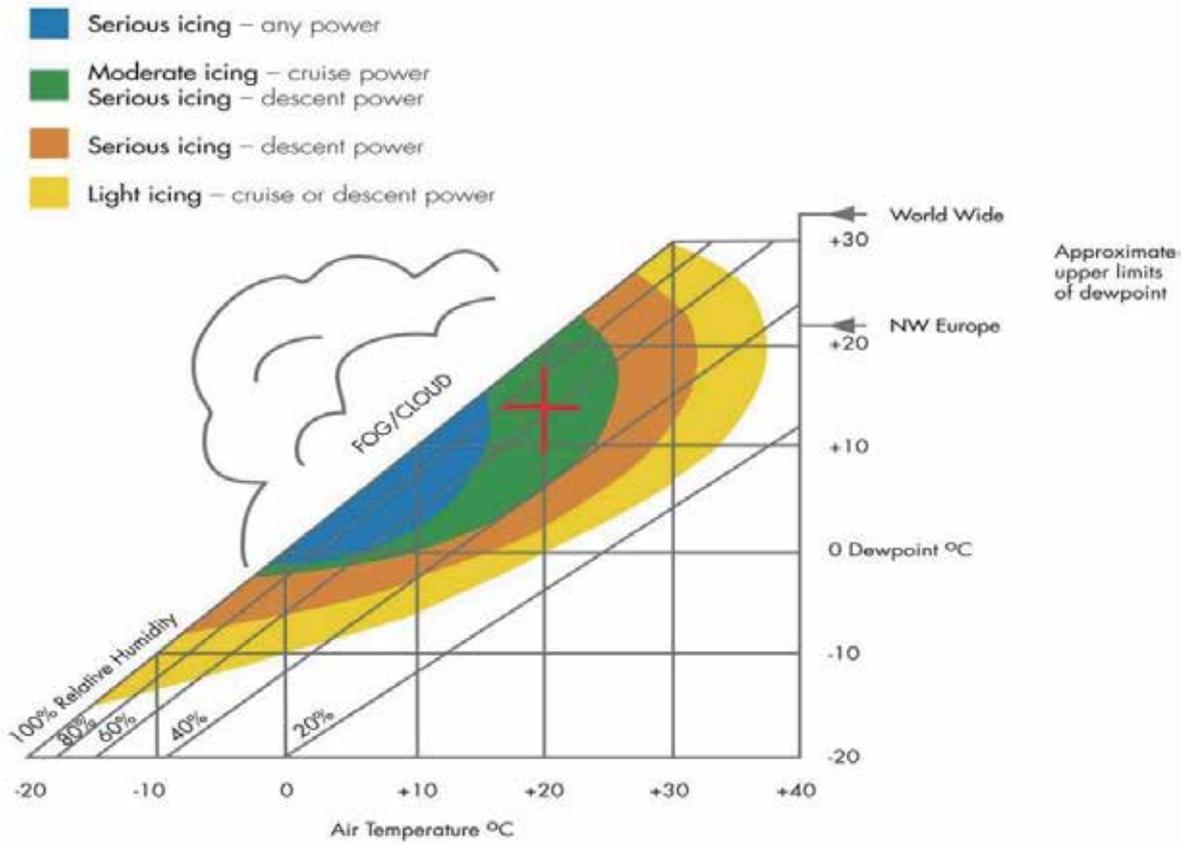


Figure 1

**SERIOUS INCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA-30 Twin Comanche, G-ATXD	
<b>No &amp; Type of Engines:</b>	2 Lycoming IO-320-B1A piston engines	
<b>Year of Manufacture:</b>	1966 (Serial no: 30-1166)	
<b>Date &amp; Time (UTC):</b>	23 April 2016 at 0930 hrs	
<b>Location:</b>	RAF Fairford, Gloucestershire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 2
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	69 years	
<b>Commander's Flying Experience:</b>	8,219 hours (of which 279 were on type) Last 90 days - 44 hours Last 28 days - 19 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The pilot visited Kemble regularly, and knew the aerodrome well. His usual route to Kemble was via Fairford, where he habitually changed frequency from Brize Radar to Kemble Information. On this occasion, he routed via Farringdon and changed frequency there, advising Kemble that he would join right-hand downwind for Runway 08. He saw the runway at Fairford, and mistook it for Kemble; it was on approximately the same bearing, and at the same distance, as Kemble is from Fairford. The pilot stated that this triggered a false hypothesis based on expectation, and he was so sure that the runway was Kemble that he did not check that he was in the correct place. He added that he was also distracted by his passengers, to whom he was explaining the pre-landing checks and procedures.

The pilot realised his mistake immediately on touchdown, completed a safe landing, and informed Kemble of his error.

He considered this "a classic case of confirmation bias", and that joining downwind had deprived him of the opportunity to realise his mistake in the overhead.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Piper PA34, N37US	
<b>No &amp; Type of Engines:</b>	2 Teledyne Continental Motors TSIO-360 engines	
<b>Year of Manufacture:</b>	1980 (Serial no: 34-8070111)	
<b>Date &amp; Time (UTC):</b>	11 April 2016 at 1300 hrs	
<b>Location:</b>	Jersey Airport	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Commercial Pilot's Licence	
<b>Commander's Age:</b>	88 years	
<b>Commander's Flying Experience:</b>	6,000 hours (of which 3,000 were on type) Last 90 days - 3 hours Last 28 days - 1 hour	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The aircraft was to be test-flown following maintenance, and was parked in the aero club parking area, which is connected to the taxiway system by a paved private taxi route which is not designed to meet any particular standards. ATC cleared the pilot to taxi to the runway holding point, and he followed the taxi route centreline. Having reached the holding point, ATC informed the pilot that his aircraft's wing had contacted another aircraft parked beside the taxi route, and the flight was abandoned.

Inspection showed minor damage to the wingtip of a PA-28 which was parked adjacent to the taxi route.

Notwithstanding that the collision occurred while the aircraft followed a taxi route, rather than taxiway, the pilot's own analysis of the collision caused him to realise that following a taxiway centreline does not assure clearance from parked aircraft.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Pitts S-1S Special, G-MAXG	
<b>No &amp; Type of Engines:</b>	1 Lycoming IO-360-B1B piston engine	
<b>Year of Manufacture:</b>	2001 (Serial no: PFA 009-13233)	
<b>Date &amp; Time (UTC):</b>	17 April 2016 at 1222 hrs	
<b>Location:</b>	Brighton Aerodrome, Yorkshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Impact damage to propeller, landing gear, wings, rudder and rear fuselage	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	52 years	
<b>Commander's Flying Experience:</b>	450 hours (of which 159 were on type) Last 90 days - 3 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

## Synopsis

During his approach to land, the pilot had been advised to use the right side of the grass runway in use, Runway 28L, due to a waterlogged area. During his approach he had been side-slipping his aircraft to the left during his hold-off, to allow the aircraft ahead to clear the runway, but he had not realised his aircraft had drifted too far right. On touchdown, and after a small bounce, the right mainwheel ran off the runway into a ploughed surface and the aircraft pitched forward and spun around. Although the aircraft was damaged, the pilot was uninjured.

## History of the flight

The pilot was on approach to landing after completion of his final flight during an aerobatic competition. Due to an area of the grass runway being waterlogged he had been advised to use the right side of the runway of the grass runway in use, Runway 28L, which was marked by cones. During his final approach, behind other landing traffic, he held off until the runway was clear and then set up for a normal three-point landing. The aircraft touched down close to the runway edge and after a small bounce the aircraft violently pitched forward and rotated through approximately 210°, coming to rest off the runway. The landing gear, propeller, wings, rudder and rear fuselage were damaged during the incident. The pilot was uninjured. Figure 1 shows the accident taking place.



**Figure 1**

Picture reproduced by kind permission of Mr Kenneth Wooley

## Discussion

The pilot's analysis of the incident led him to conclude that in holding off he had been side-slipping to the left, normal for the conditions, and had not appreciated that his aeroplane had drifted right. His attention had been taken by the aircraft ahead and he had not realised that his aircraft was now too close the runway edge. On touchdown the right mainwheel ran off the runway into a deeply ploughed surface and the combination of asymmetric drag and forward speed caused the aircraft to pitch forward and rotate before coming to rest.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Pitts S-1S Special, G-PARG	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-360-A4A piston engine	
<b>Year of Manufacture:</b>	1971 (Serial no: 19528-1)	
<b>Date &amp; Time (UTC):</b>	12 August 2016 at 1331 hrs	
<b>Location:</b>	Gloucester Airport	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - 1 (Minor)	Passengers - N/A
<b>Nature of Damage:</b>	Substantial	
<b>Commander's Licence:</b>	Light Aircraft Pilot's Licence	
<b>Commander's Age:</b>	53 years	
<b>Commander's Flying Experience:</b>	150 hours (of which 31 were on type) Last 90 days - 8 hours Last 28 days - 6 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The aircraft was on final approach to Runway 22 where the surface wind was from 240° (varying between 210° and 280°) at 12 kt gusting to 22 kt, the visibility was over 10 km and there were few clouds at 4,000 ft amsl. The pilot reported that the aircraft bounced on touchdown and began to yaw to the left. He applied power to go around but, as the aircraft reached a height of approximately 30 ft (estimated visually by the controller in the ATC tower), it banked to the left and the wing tip struck the ground. The aircraft came to rest "almost inverted" but the pilot was able to exit unaided with only minor injuries.

## SERIOUS INCIDENT

<b>Aircraft Type and Registration:</b>	Robinson R44 Astro, G-BZGO
<b>No &amp; Type of Engines:</b>	1 Lycoming O-540-F1B5 piston engine
<b>Year of Manufacture:</b>	2000 (Serial no: 757)
<b>Date &amp; Time (UTC):</b>	13 June 2016 at 1547 hrs
<b>Location:</b>	Approx 8 miles north of Manchester Barton Airport
<b>Type of Flight:</b>	Training
<b>Persons on Board:</b>	Crew - 2                      Passengers - None
<b>Injuries:</b>	Crew - None                      Passengers - N/A
<b>Nature of Damage:</b>	Left windscreen broken
<b>Commander's Licence:</b>	Commercial Pilot's Licence
<b>Commander's Age:</b>	57 years
<b>Commander's Flying Experience:</b>	4,000 hours (of which 1,900 were on type) Last 90 days - 110 hours Last 28 days - 39 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and additional inquiries by the AAIB

### Synopsis

While flying at approximately 1,500 ft and 90 kt the helicopter struck a bird, which broke the left windscreen and entered the cockpit. The crew declared a MAYDAY, but were uninjured and made a successful landing.

The Robinson R44 windscreen is not designed to withstand birdstrikes and the design requirements do not require it to do so. The United States (US) Federal Aviation Administration (FAA) is reviewing birdstrike protection requirements for Normal category rotorcraft.

### History of the flight

The helicopter had departed from Manchester Barton Airport and was flying at approximately 1,500 ft and 90 kt. There were two people on board; the commander in the left seat and a qualified helicopter pilot undergoing refresher training in the right seat.

The commander had just taken control of the helicopter when a bird struck and broke through the left windscreen. The bird was killed on impact and entered the cockpit with its wings unfolded. The pilot in the right seat took control and the helicopter lost approximately 700 ft in altitude whilst the crew dealt with the incident. They declared a MAYDAY and returned to Barton for an uneventful landing (Figure 1). Neither crew were injured.



**Figure 1**

Damage to left windscreen of G-BZGO

The bird was not sent for analysis, but photographs showed that it was most likely a Herring Gull. The pilot reported that the bird weighed approximately 0.6 kg.

### **Birdstrike requirements**

The Robinson R44 was certified to FAA Regulation (FAR) Part 27. FAR 27 applies to Normal category rotorcraft with maximum weights of 7,000 lb (3,175 kg) or less and up to nine passenger seats. There are no requirements in FAR 27 relating to birdstrike resistance but there is a requirement that *'windshields and windows must be made of material that will not break into dangerous fragments'*.

The equivalent European Aviation Safety Agency (EASA) Certification Specification, CS-27, contains the same requirements as FAR 27.

### **Previous incidents**

The AAIB has issued two previous reports after similar events on helicopters certified to the requirements of FAR 27: N109TK (AAIB Bulletin 3/2012) and G-ODAZ (AAIB Bulletin 6/2014).

### **Safety Actions**

In November 2010, the NTSB wrote to the FAA with Safety Recommendations following an investigation of a Sikorsky S-76C birdstrike accident that resulted in eight fatalities. The S-76C is certified to FAA Part 29, which specifies the requirements for Transport

category rotorcraft. FAR 29 includes birdstrike requirements and one recommendation addressed the fact that similar requirements are not defined in Part 27:

*'Revise 14 Code of Federal Regulations Part 27 to specify a bird weight and velocity of impact that the helicopter must withstand and still be able to land safely and that the windshield must withstand without penetration. Consider current military and civilian bird-strike database information and trends in bird populations in drafting the revision (A-10-147)'*

In response to this recommendation, the FAA have convened an Aviation Rulemaking Advisory Committee (ARAC) Rotorcraft Birdstrike Working Group. The working group has been tasked with providing recommendations for enhancing birdstrike protection for Normal category rotorcraft and the helicopter manufacturer has confirmed that they are participating in this initiative.

EASA commissioned a study in 2008/2009 to investigate the adequacy of current aircraft certification requirements and the final report included a recommendation that CS-27 be enhanced, preferably to include a 2 lb/1 kg windshield birdstrike capability. EASA are participants in the FAA Rotorcraft Birdstrike Working Group and any decision to consider amending CS-27 is dependent on the outcome.

The NTSB advise that the helicopter manufacturer is investigating tougher windscreen materials to improve occupant protection in the event of a birdstrike.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Robinson R44 Raven, G-EVEE	
<b>No &amp; Type of Engines:</b>	1 Lycoming O-540-F1B5 piston engine	
<b>Year of Manufacture:</b>	2005 (Serial no: 1517)	
<b>Date &amp; Time (UTC):</b>	29 May 2016 at 1200 hrs	
<b>Location:</b>	Near Chiltern Park, Oxfordshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 3
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Damage to skids	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	19 years	
<b>Commander's Flying Experience:</b>	148 hours (of which 31 were on type) Last 90 days - 8 hours Last 28 days - 7 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

## Synopsis

The pilot was performing a cross-country flight when the low fuel warning activated. While manoeuvring to land, the engine was temporarily starved of fuel and ran down. The pilot conducted an autorotation to land in a field during which the helicopter sustained damage to its skid assembly.

## History of the flight

The pilot reported that he was routing from Perranporth, in Cornwall, to a private site in Oxfordshire near the Stokenchurch mast, via Dunkeswell Airfield. The first leg of approximately 80 nm had been without incident, though it had taken 20 minutes longer than he had planned. He calculated the next leg as being 100 nm long and estimated that it would take one hour.

The R44 Pilot's Operating Handbook does not provide, and is not required to provide, fuel consumption figures. The pilot planned on a fuel consumption of 16 USG per hour and experienced instructors have advised AAIB that this was an appropriate figure for planning.

The pilot's weight and balance calculation showed that, with his passengers, he could carry a maximum of 25 USG of fuel. He had dipped the fuel tanks on arrival at Dunkeswell and, as 7 USG remained on board, he requested an uplift of 18 USG, which airfield

records show as being provided. The pilot estimated that 25 USG would be sufficient fuel for his route, plus about 40 minutes of reserves.

During the flight the pilot noticed that his groundspeed was slower than planned and he recalled seeing 90 kt on his GPS. He had estimated that this would increase his flight time by about six minutes.

As he passed south abeam RAF Benson the pilot considered diverting to Chiltern Park airfield for fuel but considered that he would still achieve his original planned landing site. However, shortly after this the LOW FUEL warning light came on. This red warning is set to activate when slightly over 3 USG of fuel remained and therefore allows, at most, 10 minutes of flight time, to include landing.

The pilot decided to land at a farm he had just passed and, selecting a field to land in, made a right turn with about 25° angle of bank. During the turn, the engine ran down to about 50% power, the rotor rpm drooped and the rotor rpm warning horn sounded.

The pilot entered autorotation and conducted a forced landing, during which the helicopter touched down heavily in a field of standing crop, damaging the skid assembly. The helicopter's four occupants were uninjured.

### Operating advice

The Pilot's Operating Handbook section titled '*Safety Tips*' contains Robinson Helicopter Safety Notice SN-15, titled: '*Fuel Exhaustion Can Be Fatal*' that cautions pilots on the hazards associated with running out of fuel and suggests precautions that should be taken to avoid doing so. The following precautions are recommended while the helicopter is in flight:

*'Continually check both hour meter and fuel gauges. If either indicates low fuel, LAND.'*

*Always land to refuel before the main tank fuel gauge reads less than 1/4 full.*

*NEVER allow the fuel quantity to become so low in flight that the low fuel warning light comes on.'*

CAA General Aviation Safety Sense Leaflet 17 titled '*Helicopter Airmanship*' (published on the CAA website) provides general guidance to helicopter pilots. Section 3.9 '*Fuel planning*' includes the following recommendations:

*'Always plan to land by the time the tank(s) are down to the greater of 1/4 tank or 45 minutes, but don't rely solely on the gauge(s) or low fuel warning.'*

*'Remember, a headwind may be stronger than forecast, which particularly affects slower-flying helicopters. Frequent use of carb heat/hot air will also increase fuel consumption.'*

*'Know the hourly fuel consumption of your helicopter. In flight, check that the gauge(s) agree with your calculations.'*

**Survivability**

The damage to the skids was consistent with that intended to improve crashworthiness in a heavy landing and minimise occupant injury.

**Conclusion**

The pilot considered that he may have misjudged the amount of fuel on board and underestimated the effects of the headwind. When the low fuel warning illuminated, manoeuvring towards the landing site momentarily starved the engine of fuel.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Zenair CH 601UL Zodiac, G-CCZK
<b>No &amp; Type of Engines:</b>	1 Rotax 912-UL piston engine
<b>Year of Manufacture:</b>	2004 (Serial no: PFA 162A-14270)
<b>Date &amp; Time (UTC):</b>	15 July 2016 at 1115 hrs
<b>Location:</b>	Popham Airfield, Hampshire
<b>Type of Flight:</b>	Private
<b>Persons on Board:</b>	Crew - 1                      Passengers - 1
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	Left landing gear, left wing and propeller
<b>Commander's Licence:</b>	Private Pilot's Licence
<b>Commander's Age:</b>	62 years
<b>Commander's Flying Experience:</b>	918 hours (of which 384 were on type) Last 90 days - 2 hours Last 28 days - 0 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot

During the pre-flight inspection, the pilot checked that the engine's oil and coolant levels were normal and sampled the aircraft's fuel for any obvious contamination. After a normal engine start, he then conducted engine run-up checks prior to takeoff, during which the engine performed normally.

However, on initial climb out from Popham, passing 350 ft and clear of the airfield's boundary, the pilot felt a loss in engine power accompanied by the sudden onset of engine vibrations. Unable to maintain altitude, he lowered the nose of the aircraft to maintain flying speed and adjusted the throttle, but still the engine continued to run roughly. He made a radio call to Popham, informing them that due to engine failure he was going to make a forced landing in a field west of the airfield. During the landing, the aircraft decelerated rapidly upon encountering a crop of wheat in the field, during which the left wing and left undercarriage suffered damage. The pilot and passenger, who were wearing lap and diagonal harnesses, were able to vacate the aircraft without injury or assistance. The cause for the engine's power loss has not been established.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Zenair CH 601XL Zodiac, G-EXXL	
<b>No &amp; Type of Engines:</b>	1 Rotax 912ULS piston engine	
<b>Year of Manufacture:</b>	2012 (Serial no: LAA 162B-14868)	
<b>Date &amp; Time (UTC):</b>	19 June 2016 at 1110 hrs	
<b>Location:</b>	Pilling Sands, Morecambe, Heysham, Lancashire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 2	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Landing light lens and left wing skin	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	56 years	
<b>Commander's Flying Experience:</b>	9,672 hours (of which 27 were on type) Last 90 days - 5 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

**Synopsis**

The aircraft was on a local flight from a private airstrip when it collided with a recreational kite at a height of 720 ft, causing minor damage to the left wing. The pilot reported that the kite flight activity had not been 'NOTAMed', and the kite did not have any streamers attached to aid conspicuity. The kite flying activity had not been notified to the CAA as required by the Air Navigation Order.

**History of the flight**

The aircraft was on a local flight from a private airstrip when it collided with a recreational kite being flown at a height of approximately 720 ft (219 m), from the beach at Pilling Sands, near Morecambe. The pilot returned to the airstrip where it became apparent that the string of the kite had cut through the landing light lens skin on the left wing, and a portion of string remained lodged in the wing.

The pilot reported that the kite flight activity had not been 'NOTAMed' or advised to local flying clubs, and the kite did not have any streamers attached to aid conspicuity.

The pilot and her passenger subsequently drove to the beach to speak with the individuals involved in the activity and reported that they appeared unaware of the implications of flying their kites at such heights. The pilot described her concern that the kite had not been visually identifiable in accordance with the relevant kite-flying regulations.

## Regulations pertaining to kite flying

### *Historic regulations*

At the time of this incident, the Air Navigation Order (ANO) 2009 was extant. Article 164 'Gliders, kites and parachutes' stated:

*'... (2) Except with the permission of the CAA: ..... (b) a kite must not be flown at a height of more than 30 metres above ground level within the aerodrome traffic zone of a notified aerodrome during the notified operating hours of that aerodrome;*

*(c) a kite must not be flown at a height of more than 60 metres above ground level; .....*'

Historically, Rule 53 of 'The Rules of the Air Regulation 2007', 'Captive balloons and kites by day,' (hereafter referred to as Rule 53) had also stated the following requirements regarding the required marking of kites operating above 60 m (197 ft):

*'53. (1) A captive balloon flying by day at a height exceeding 60 metres above the surface shall have attached to its mooring cable tubular streamers which are (a) not less than 40 centimetres in diameter and 2 metres in length; and (b) marked with alternate bands of red and white 50 centimetres wide at intervals of not more than 200 metres measured from the basket or, if there is no basket, from the lowest part of the balloon.*

*(2) A kite flying by day at a height exceeding 60 metres above the surface shall have attached to its mooring cable either: (a) tubular streamers as specified in paragraph (1); or (b) at intervals of not more than 100 metres measured from the lowest part of the kite, streamers not less than 80 centimetres long and 30 centimetres wide at their widest point, marked with alternate bands of red and white 10 centimetres wide.'*

Additional requirements for kites operating at night to be illuminated, were also described in Rule 52 of 'The Rules of the Air Regulation 2007', 'Captive balloons and kites by night' (hereafter referred to as Rule 52).

Following the introduction of the Standardised European Rules of the Air (SERA<sup>1</sup>), 'The Rules of the Air Regulation 2015' came into force in the UK on 30 April 2015 and Rules 52 and 53 were removed from the Rules of the Air. There are no equivalent provisions for kite conspicuity in SERA.

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### Footnote

<sup>1</sup> SERA, which applies to every aircraft operating in EU airspace regardless of type or state of registration, replaced most but not all of the UK Rules of the Air Regulations. As the SERA rules do not cover all aspects of the Rules of the Air, the UK has retained a small number of supplementary rules currently described in 'The Rules of the Air Regulations 2015'.

### *Current regulations and kite flying Permissions*

The Air Navigation Order 2016 came into force on 25 August 2016. Article 92 includes the requirements relevant to kite flying, previously described in Article 164 of the ANO 2009.

In accordance with the requirements of Article 92, a kite operator who wishes to operate above 60 m must seek Permission from the Civil Aviation Authority (CAA) Airspace Regulation Section. In issuing a Permission the CAA will assess the location of the proposed kite operation, coordinate with adjacent aerodromes or airspace operating agencies and may impose a limit on the altitude at which the kite may be operated. A NOTAM will then be issued to notify all airspace users.

Prior to April 2015, any kite flying permission granted by the CAA would also have included the conspicuity requirements previously described in Rules 52 and 53; however, these requirements were removed from CAA Permissions with the introduction of SERA.

### **Safety Action**

In response to this incident and in light of the changes made under the introduction of SERA, the CAA has reviewed its current policy pertaining to the issuance of Permissions for kite flying activities. While the CAA can no longer mandate the conspicuity requirements previously described in Rules 52 and 53, it has advised the AAIB that all future Permissions for kites (and captive balloons) will include a statement that operators:

*'Should have attached to its mooring cable either:*

*(a) tubular streamers as specified in paragraph (1) (this relates to the identical marking of captive balloons);or*

*(b) at intervals of not more than 100 metres measured from the lowest part of the kite, streamers not less than 80 centimetres long and 30 centimetres wide at their widest point, marked with alternate bands of red and white 10 centimetres wide'.*

For conspicuity at night, all Permissions for night operations will state (and detail) that the kite should be lit in the manner previously required by Rule 52.

### **Discussion**

In April 2015, the CAA removed the conspicuity requirements for kites from its Permissions. However, the kite flying activity described in this incident was not notified to the CAA and therefore was not the subject of a CAA Permission. This suggests that the kite operator was not aware of, or chose not to comply with, the Article 92 requirement to obtain a Permission; nor did they seem to be aware of any former conspicuity requirements for kites.

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### **Bulletin Correction**

On 11 November 2016 the word '*and*' was removed from after kite in the final paragraph under the heading 'Safety Action' on page 93 above.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Zlin Z.526F Trener Master, G-EHZT	
<b>No &amp; Type of Engines:</b>	1 LOM M137A piston engine	
<b>Year of Manufacture:</b>	1974 (Serial no: 1317)	
<b>Date &amp; Time (UTC):</b>	7 May 2016 at 1530 hrs	
<b>Location:</b>	Seething Airfield, Norfolk	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Cowlings, propeller, central fuselage and flaps	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	62 years	
<b>Commander's Flying Experience:</b>	1,254 hours (of which 22 were on type) Last 90 days - 16 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

During the approach the landing gear warning bell sounded when the pilot reduced engine power in order to slow down and lower the flaps and landing gear. He believed he then lowered the landing gear and selected *FLAP ONE*. After increasing the power to maintain speed the bell stopped. He continued the approach, lowering the remaining stages of flap. Once over the runway the pilot selected idle power and flared the aircraft; as he did so the bell sounded again. The aircraft then landed with the landing gear up and slid to a halt on the runway. There were no injuries.

The pilot commented that he thought the green light, indicating the landing gear was down, was on but difficult to see due to glare. He did not check the wing-mounted 'barber's pole' indicators that protrude from the wings when the landing gear is down. The stall warning and landing gear warning horn were identical in another aircraft type he had been flying recently. Consequently, he thought that the bell that sounded just before touchdown was the stall warning, which he often heard when landing the other aircraft type.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Fournier RF5B, G-BPWK	
<b>No &amp; Type of Engines:</b>	1 Sportavia-Limbach SL 1700-E piston engine	
<b>Year of Manufacture:</b>	1973 (Serial no: 51036)	
<b>Date &amp; Time (UTC):</b>	3 June 2016 at 1910 hrs	
<b>Location:</b>	Usk Airfield, Monmouthshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Propeller blades, lower cowling, fuselage, left wing, and engine shock-loaded	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	55 years	
<b>Commander's Flying Experience:</b>	53 hours (of which 13 were on type) Last 90 days - 13 hours Last 28 days - 13 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The pilot reported that, following a local flight, he approached Usk Airfield to land on the shorter grass landing area on a heading of approximately 060°.

During the landing flare he realised that there may be insufficient distance for the ground run. As the aircraft touched down, he reached for the landing gear brake lever but inadvertently released the flight spoilers which retracted, as designed<sup>1</sup>. The aircraft then bounced and floated for some distance before touching down again. There was insufficient distance remaining to stop and the aircraft overran the airfield and toppled down a 12 ft drop into a stream. The pilot was uninjured.

CAA Safety Sense Leaflet 1, titled '*Good Airmanship Guide*', advises that, when landing, pilots: '*Go-around if not solidly 'on' in the first third of the runway...*'

**Footnote**

<sup>1</sup> The flight spoilers are sprung-loaded to the retracted position.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Ikarus C42 FB80, G-CDRO	
<b>No &amp; Type of Engines:</b>	1 Rotax 912-UL piston engine	
<b>Year of Manufacture:</b>	2005 (Serial no: 0507-6750)	
<b>Date &amp; Time (UTC):</b>	30 June 2016 at 1620 hrs	
<b>Location:</b>	Popham Airfield, Hampshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Nose landing gear leg collapsed	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	61 years	
<b>Commander's Flying Experience:</b>	145 hours (of which 145 were on type) Last 90 days - 2 hours Last 28 days - 2 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The pilot had not flown for 10 months and had carried out a check flight with an instructor before conducting a session of solo circuits later that afternoon. The first three solo circuits were without incident. During the fourth circuit, shortly before the landing flare, the pilot was distracted by a radio message from the air/ground radio operator requesting his position. He then realised that the aircraft was high and slow and initiated a go-around. However, the aircraft bounced before climbing away.

During the subsequent landing the nose landing gear collapsed, having probably been damaged during the previous ground contact.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Ikarus C42 FB80 Bravo, G-GIAS	
<b>No &amp; Type of Engines:</b>	1 Rotax 912UL piston engine	
<b>Year of Manufacture:</b>	2014 (Serial no: 1410-7350)	
<b>Date &amp; Time (UTC):</b>	24 June 2016 at 1000 hrs	
<b>Location:</b>	Alnwick, Northumberland	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Landing gear and fuselage	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	21 years	
<b>Commander's Flying Experience:</b>	506 hours (of which 266 were on type) Last 90 days - 117 hours Last 28 days - 46 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

**Synopsis**

The aircraft was carrying out a local flight around Northumberland and was at 1,500 ft when the engine began to run roughly and stopped. The pilot made a stable approach into a field for a forced landing. Whilst braking, the wheels hit a rut which caused the landing gear to collapse. The pilot and passenger vacated the aircraft without injury. At the time of writing the cause of the engine problem is not known.

**History of the flight**

The aircraft had taken off from Eshott Airfield for a local flight around Northumberland and climbed to 1,500 ft without incident. As the aircraft was overhead the northern edge of Alnwick, without warning, the engine began to run roughly and then stopped. The pilot configured the aircraft for a best glide speed, turned away from the town and selected a suitable field for a forced landing. After a stable approach the aircraft touched down safely and the pilot applied the brakes to stop the aircraft. During braking the wheels hit a rut in the field which caused the landing gear to collapse, bringing the aircraft to an immediate stop. The pilot made the aircraft safe and he and his passenger vacated uninjured. At the time of writing the cause of the rough running and stoppage of the engine is not known.

## ACCIDENT

<b>Aircraft Type and Registration:</b>	Maverick 430, G-MZJJ
<b>No &amp; Type of Engines:</b>	1 Jabiru 2200A piston engine
<b>Year of Manufacture:</b>	1998 (Serial no: PFA 259-13016)
<b>Date &amp; Time (UTC):</b>	22 May 2016 at 1745 hrs
<b>Location:</b>	Shop Farm, Clopton, Suffolk
<b>Type of Flight:</b>	Private
<b>Persons on Board:</b>	Crew - 1                      Passengers - 1
<b>Injuries:</b>	Crew - None                      Passengers - None
<b>Nature of Damage:</b>	Fuselage and landing gear badly damaged
<b>Commander's Licence:</b>	National Private Pilot's Licence
<b>Commander's Age:</b>	69 years
<b>Commander's Flying Experience:</b>	568 hours (of which 217 were on type) Last 90 days - 11 hours Last 28 days - 11 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot

## Synopsis

The aircraft ran out of fuel and was severely damaged while attempting an engine-off landing in a field.

## History of the flight

The pilot had flown from Monewden Airfield in Suffolk to Shoreham Airport. The flight had taken 1 hour 40 minutes and had used 25 litres of fuel, leaving 35 litres (indicated) in the 60 litre fuel tank for the return flight. In planning the return flight the pilot used a fuel consumption of 11 litres per hour, which gave an endurance of just over three hours. The surface wind at Shoreham was from 220° at 12 kt and the pilot calculated that the return flight would also take 1 hour 40 minutes and require approximately 19 litres of fuel. This would leave a reserve of 16 litres of fuel, which on the planned fuel consumption would be sufficient for approximately 1 hour 25 minutes of flight.

The pilot stated that while he planned on a tail wind, the actual wind at 2,000 ft was from 120° at 15 kt and "he was blown off course to the west". Consequently, he had to back track in order to verify his position. He was then refused permission to fly through the ATZ at Southend Airport, which required him to extend his flight further.

As the aircraft approached Ipswich, which is approximately 10 miles south of Monewden, there was 5 litres (indicated) of fuel remaining in the tank. The engine ran normally until

approximately 2 to 3 miles from Monewden, when during the descent to circuit height the engine suddenly cut out. The pilot did not attempt to start the engine, but instead positioned the aircraft for a field landing during which the main landing gear struck the top of a ditch on the boundary of the field. While the pilot and passenger were uninjured, the lower fuselage and landing gear were severely damaged. The accident flight had lasted about 2 hours 45 minutes.

### Comments by the pilot

The pilot reported that following the accident there was approximately 2 to 3 litres of fuel remaining in the tank. He was of the opinion that as the fuel outlet pipe is situated at the rear of the tank, it is probable that the pipe became uncovered during the descent resulting in fuel starvation and the engine cutting out. The pilot stated that as soon as he realised that he was getting low on fuel, he should have diverted to one of the airfields en-route.

### AAIB Comment

While the pilot estimated the fuel consumption as 11 litres per hour, the consumption on the outbound flight was 15 litres per hour, assuming the fuel gauge was correct. The accident flight lasted for about 2 hour 45 minutes before the engine cut out, which at 11 litres per hour would have required 30 litres of fuel with 5 litres remaining in the tank. Therefore, the fuel consumption on the accident flight was probably greater than 11 litres per hour.

The pilot continued the flight beyond Ipswich with 5 litres (indicated) of fuel remaining, without being aware of how much was unusable. With regard to fuel planning, CAA Safety Sense Leaflet 1e advises:

#### *'13 FUEL PLANNING*

*a) Always plan to land by the time the tanks are down to the greater of ¼ tank or 45 minutes' cruise flight, but don't rely solely on gauge(s) which may be unreliable. Remember, head-winds may be stronger than forecast and frequent use of carb heat will reduce range.*

*b) Understand the operation and limitations of the fuel system, gauges, pumps, mixture control, unusable fuel etc. and remember to lean the mixture if it is permitted.'*

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Rans S6 Coyote II, G-BSMU	
<b>No &amp; Type of Engines:</b>	1 Rotax 582 piston engine	
<b>Year of Manufacture:</b>	1990 (Serial no: PFA 204-11732)	
<b>Date &amp; Time (UTC):</b>	18 June 2016 at 1310 hrs	
<b>Location:</b>	Benston Farm, Cumnock, Ayrshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Nosewheel detached, top and bottom engine cowlings damaged	
<b>Commander's Licence:</b>	National Private Pilot's Licence	
<b>Commander's Age:</b>	61 years	
<b>Commander's Flying Experience:</b>	130 hours (of which 26 were on type) Last 90 days - 4 hours Last 28 days - 2 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The pilot took off to the north from Benston Farm airstrip for a planned 20-minute local flight with a friend as passenger. The air during the flight was "very bumpy" so the pilot decided to head back to the farm after 15 minutes. The approach was uneventful until, at about 50 ft, as the aircraft crossed a line of trees, the pilot experienced a high sink rate and the aircraft became "difficult to control". The subsequent landing was hard as the aircraft got "dumped" onto the runway before bouncing, then falling back onto the runway, nosewheel first. The pilot and passenger, both wearing lap and shoulder harnesses, were uninjured.

On reflection, the pilot realised he should have gone round; however, he thought that his lack of currency and the high sink rate (the highest he'd ever encountered) were the reasons he was unable to control the aircraft, given that other "more experienced" pilots were able to land.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	SD-1 Minisport, G-CIZA	
<b>No &amp; Type of Engines:</b>	1 Hirth F23 piston engine	
<b>Year of Manufacture:</b>	2015 (Serial no: 129)	
<b>Date &amp; Time (UTC):</b>	16 July 2016 at 0840 hrs	
<b>Location:</b>	Private Airstrip, Meldreth, Hertfordshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	Left landing gear detached, broken propeller and damage to stabilator	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	73 years	
<b>Commander's Flying Experience:</b>	2,237 hours (of which 24 were on type) Last 90 days - 6 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot	

The SD-1 Minisport is an ultralight single-seat aircraft of tailwheel layout and falls into the single-seat de-regulated (SSDR) category when operated in the UK.

After an uneventful takeoff and circuit, the aircraft was configured for landing and on final approach. The pilot reported that the IAS was steady at 60 mph and the groundspeed on his GPS showed a headwind of approximately 15 kt.

As the aircraft passed over the runway threshold it dropped unexpectedly, resulting in a heavy landing and associated damage. The pilot was uninjured. He reported that there was no surface wind when he exited the aircraft and he believed that windshear may have been a contributory factor in the accident.

**ACCIDENT**

<b>Aircraft Type and Registration:</b>	Skyranger 582(1), G-CGMK
<b>No &amp; Type of Engines:</b>	1 Rotax 582/48-2V piston engine
<b>Year of Manufacture:</b>	2009 (Serial no: BMAA/HB/491)
<b>Date &amp; Time (UTC):</b>	19 July 2016 at 1915 hrs
<b>Location:</b>	Over Farm Microlight Strip, Gloucestershire
<b>Type of Flight:</b>	Private
<b>Persons on Board:</b>	Crew - 1                      Passengers - 1
<b>Injuries:</b>	Crew - 1 (Minor)          Passengers - 1 (Minor)
<b>Nature of Damage:</b>	Nosewheel and airframe damage
<b>Commander's Licence:</b>	Private Pilot's Licence
<b>Commander's Age:</b>	60 years
<b>Commander's Flying Experience:</b>	568 hours (of which 16 were on type) Last 90 days - 14 hours Last 28 days - 4 hours
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot

The pilot was conducting a local flight in his microlight aircraft following a period with limited flying. The weather was reportedly hot and humid and there was little or no wind. During his initial approach to the grass strip the pilot elected to go around as he felt he was too high to land safely. During his second approach, the aircraft floated further down the runway than he anticipated. As he attempted to initiate a touch-and-go the aircraft made contact with the ground heavily, causing the nosewheel to collapse. The propeller then dug into the ground, resulting in the aircraft rotating 180° over its nose. It came to rest inverted and pointing back down the runway. The pilot noted, as he evacuated the aircraft, that the windsock was indicating a slight tailwind. He acknowledged that he had left the decision about whether to go around too late to avoid a heavy landing.

## **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](http://www.aaib.gov.uk)).



**BULLETIN CORRECTION**

<b>Aircraft Type and Registration:</b>	Saab-Scania SF340B, G-LGNL
<b>Date &amp; Time (UTC):</b>	2 January 2015 at 0833 hrs
<b>Location:</b>	Stornoway Airport, Isle of Lewis
<b>Information Source:</b>	AAIB Field Investigation

**AAIB Bulletin No 10/2015 page 31 refers**

The AAIB has been informed by a passenger on the flight that he received an injury to his back during the accident. The report must therefore be amended to reflect that there was one serious injury to a passenger. The amendments are detailed below:

**Flight details**

**Injuries:** Crew - None Passengers - **1 (Serious)**

**Synopsis**

The final sentence has been amended to read:

**One** passenger received a serious injury.

**History of the flight**

The final sentence has been amended to read:

**One** passenger received a serious injury.

The online version of this report was corrected on 13 October 2016.

**BULLETIN CORRECTION**

<b>Aircraft Type and Registration:</b>	De Havilland DH82A Tiger Moth, G-AMCK
<b>Date &amp; Time (UTC):</b>	13 May 2016 at 0955 hrs
<b>Location:</b>	Field near Sidmouth, Devon
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot

**AAIB Bulletin No 10/2016 , page 52 refers**

The departure location was incorrectly stated as 'Farway Common Airfield' whereas the aircraft had actually taken off from 'Branscome Airfield'

The first line of the first paragraph was amended on 13 October 2016 and now reads:

The aircraft had taken off from Branscome Airfield for a short (5-10 minute) flight to Dunkeswell.

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

- |  |   |
|--|---|
| 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.<br>Published September 2011.           | 1/2015 Airbus A319-131, G-EUOE London Heathrow Airport on 24 May 2013.<br>Published July 2015.                                  |
| 2/2011 Aerospatiale (Eurocopter) AS332 L2 Super Puma, G-REDL 11 nm NE of Peterhead, Scotland on 1 April 2009.<br>Published November 2011.  | 2/2015 Boeing B787-8, ET-AOP London Heathrow Airport on 12 July 2013.<br>Published August 2015.                                 |
| 1/2014 Airbus A330-343, G-VSXY at London Gatwick Airport on 16 April 2012.<br>Published February 2014.   | 3/2015 Eurocopter (Deutschland) EC135 T2+, G-SPAO Glasgow City Centre, Scotland on 29 November 2013.<br>Published October 2015. |
| 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.<br>Published June 2014. | 1/2016 AS332 L2 Super Puma, G-WNSB on approach to Sumburgh Airport on 23 August 2013.<br>Published March 2016.                  |
| 3/2014 Agusta A109E, G-CRST Near Vauxhall Bridge, Central London on 16 January 2013.<br>Published September 2014.  | 2/2016 Saab 2000, G-LGNO approximately 7 nm east of Sumburgh Airport, Shetland on 15 December 2014<br>Published September 2016. |

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>



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## GLOSSARY OF ABBREVIATIONS

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

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