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AAIB Field Investigation reports

ACCIDENT

Aircraft Type and Registration:	Bolkow 208C Junior, D-EGFU
No & Type of Engines:	1 Roll-Royce/Continental 0-200-A engine
Year of Manufacture:	1967
Date & Time (UTC):	2 September 2011 at 1314 hrs
Location:	Peterborough Sibson Airfield, Cambridgeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	675 hours (of which 22 were on type) Last 90 days - 6 hours Last 28 days - 0.3 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was on final approach to land at Sibson Airfield when it struck the uppermost cable of a set of power transmission lines situated approximately 0.5 nm from the airfield. The runway in use had a significantly displaced threshold to provide aircraft on approach with adequate clearance from the transmission lines. Evidence suggested that the pilot made an approach to the start of the prepared runway surface, rather than the displaced threshold. The pilot's unfamiliarity with the airfield, distraction due to a departing aircraft in front and inadequacies in the briefing material available may have been contributory factors to the accident. Several safety actions have been taken or proposed as a result of this accident.

History of the flight

The pilot planned to fly from Long Marston Airfield, near Stratford-upon-Avon, to Sibson Airfield, near Peterborough. This was his first flight to Sibson and on the morning of the accident he telephoned the airfield operator to make some general enquiries. He did not confirm he would be definitely coming and indicated that should he decide to fly to the airfield that day he would telephone again to book in. As a result, the pilot was not given the usual briefing on operating to the airfield and the aircraft was not added to the booking-in sheet retained by the radio operator, as would have been normal.

The pilot departed at about 1224 hrs from Long Marston and at about 1408 hrs contacted Sibson control tower for joining instructions. He next reported being on a

left base leg, and again later on finals, for Runway 24. All of these transmissions seemed normal with no indications of the pilot experiencing any difficulties.

At the time D-EGFU was approaching the airfield, the pilot of a Cessna Caravan was preparing to depart from Sibson and transmitted that he was taxiing for takeoff from Runway 24. ATS informed the Caravan pilot that D-EGFU was on finals. The Caravan pilot, who was familiar with operating from the airfield, continued to taxi towards the takeoff point for Runway 24 and reported that he would hold short of the runway. He then reported that he had D-EGFU in sight and was lining up for takeoff. The pilot of D-EGFU transmitted that he was on short finals. The pilot of the Caravan continued to line up and take off and later stated that he estimated D-EGFU to be at a range of 2 to 3 nm as he entered the runway.

Witnesses on the airfield who could see both aircraft considered that D-EGFU was too close to the runway to be able to land safely behind the departing Caravan and expected to see it go around. D-EGFU however appeared to continue its approach and was then seen to hit the uppermost cable of an overhead power transmission line[1] running across the approach path to the runway, about 0.5 nm from the displaced threshold. Witnesses report that D-EGFU appeared to be flying in a normal attitude until it hit the cable. The aircraft was then seen to fall vertically, initially tail-first, before hitting the ground and causing fatal injuries to the pilot.

Weather

An aftercast obtained from the Met Office described the weather conditions affecting Sibson at the time of the accident as fine, with little cloud and good visibility. The surface winds were light and from the west-south-west.

It was not possible to determine whether the sun's position would have affected the pilot's ability to see the power transmission lines or airfield. The relative bearing and elevation of the sun recorded at 1300 hrs of 200° and 44° respectively, and at 1400 hrs of 219° and 40° respectively, placed the sun approximately 35° to 40° to the left of the runway during the approach and above the pilot's line of sight when looking towards the ground.

Accident site

The aircraft came to rest inverted in a field on the south-eastern side of the A1 road. The accident site was a level area located close to the extended centreline of Runway 24 of Peterborough Sibson Airfield, some 0.44 nm east-north-east of the displaced threshold. Above the general area of the final impact site were located a set of high tension electrical power distribution cables, supported by metal pylons routed in an approximately north-south orientation. The uppermost of these cables, the earth cable, was damaged.

The earth cable consisted of a small diameter steel stranded core surrounded by a larger cross-sectional area of stranded aluminium cable. The latter strands appeared to be of soft aluminium possessing only low tensile strength. All cables exhibited considerable sag between pylons.

Footnote

[1] Overhead power transmission lines are supported by lattice steel towers and are commonly referred to as pylon lines.

Wreckage information

Detached items of wreckage were mostly located in close proximity to the main aircraft wreckage. The outboard left wing leading edge was lying adjacent to the main wreckage. The left wingtip was located approximately 40 m away, between the two carriageways of the A1 road. The left inboard section of the wing leading edge was not found. Fragments of canopy transparency and part of a headset were found on the northbound carriageway of the A1 (the side nearest the main wreckage). Evidence of cable impact damage was visible on the leading edge of the right wing.

Examination of the aircraft wreckage and the ground markings at the site indicated that the aircraft had struck the ground in a near vertical orientation with a low forward speed. There was no evidence of propeller rotation at the time of impact.

Detailed aircraft examination

The aircraft was recovered by the AAIB and subjected to a detailed examination in order to establish the pre-impact integrity of the aircraft and to deduce the impact sequence.

Examination of the aircraft structure revealed damage to the right wing leading edge consistent with an initial cable contact on the upper surface of the outboard section of the wing, as well as damage on the underside of the inboard section. The leading edge of the left wing had separated from the front spar in a manner consistent with the cutting action of a cable travelling outboard from the wing root. The composite wingtip had separated from the aluminium alloy wing box by application of a force in an outboard direction, approximately along the axis of the wing spar.

No evidence of any pre-impact failure was found in the aircraft's structure or flying controls. A strip examination of the engine similarly did not reveal any failures, other than those resulting from ground impact. The propeller exhibited no evidence of rotation at impact. Functional testing of the magnetos and sparking plugs revealed no significant problems.

During the wreckage recovery operation, it was observed that there was no fuel in the single fuel tank. A subsequent specialist analysis of soil samples for traces of hydrocarbons in the earth at the final impact point was inconclusive. Examination of the fuel tank identified two small impact-related holes close to either side of the forward face, near the top of the tank.

GPS data

A Garmin GPSMAP196 GPS receiver was recovered from the accident site which contained recorded data from ten flights, including the accident flight.

The unit recorded the aircraft taking off from Long Marston Airfield at 1224 hrs and flying in a direct track to Sibson Airfield at an altitude of about 2,300 ft. South of Sibson, the aircraft descended to about 1,200 ft and then tracked to the east before briefly turning north and then carrying out a climbing turn in a wide orbit over the area of Orton Waterville. Halfway through the orbit, the aircraft started to descend once more and joined the left base for Runway 24. The pilot then flew a gentle descending turn onto the final approach, establishing on the runway centreline at about 1.2 nm from the Runway 24 threshold. The last recorded point was approximately 300 m east of the power lines at 1312:52 hrs. Figure 1 shows the GPS recording in the vicinity of Sibson Airfield.

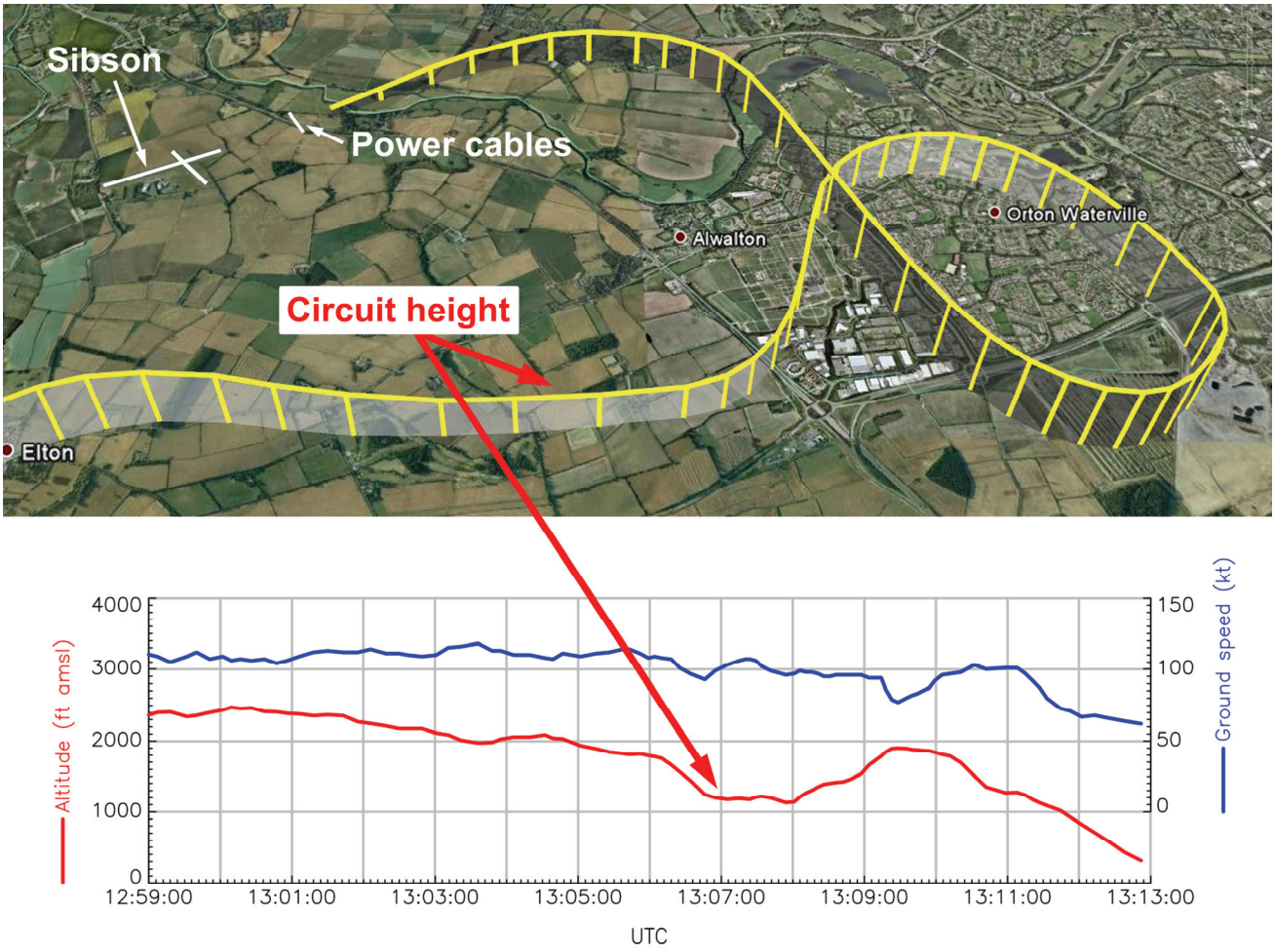


Figure 1

GPS track in the vicinity of Sibson Airfield

Figure 2 compares aircraft GPS height with track distance from the Runway 24 displaced threshold. Superimposed on the chart is the representative position and height of the pylon towers running closest to the runway and the part of Runway 24 between the start of the prepared runway surface and the displaced threshold. The tracks depicted in black were recorded on a number of aircraft flown by pilots familiar with Sibson Airfield. These flights cleared the pylon towers by approximately 150 ft or more. The red track is of the accident aircraft.

Two of the previous landings recorded by the GPS unit recovered from D-EGFU had been to runway thresholds that could be clearly referenced. Figure 3 overlays these approaches, together with the approach from the accident flight, aligning the other runway thresholds with the start of the prepared runway surface (not the displaced threshold) of Runway 24 at Sibson. The comparison, whilst not statistically robust, indicates a possibility that the aiming point for the landing may have been the start of the runway and not the displaced threshold.

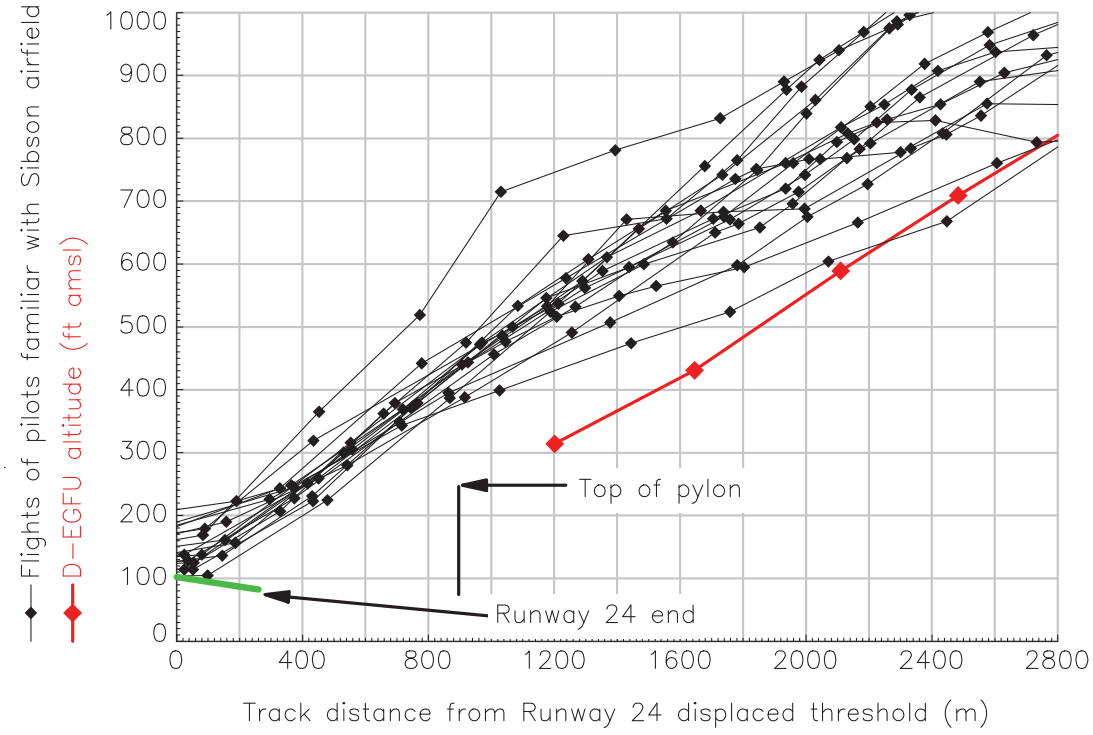


Figure 2

Comparison of the D-EGFU accident approach
with approaches made to the same runway by pilots familiar with the airfield

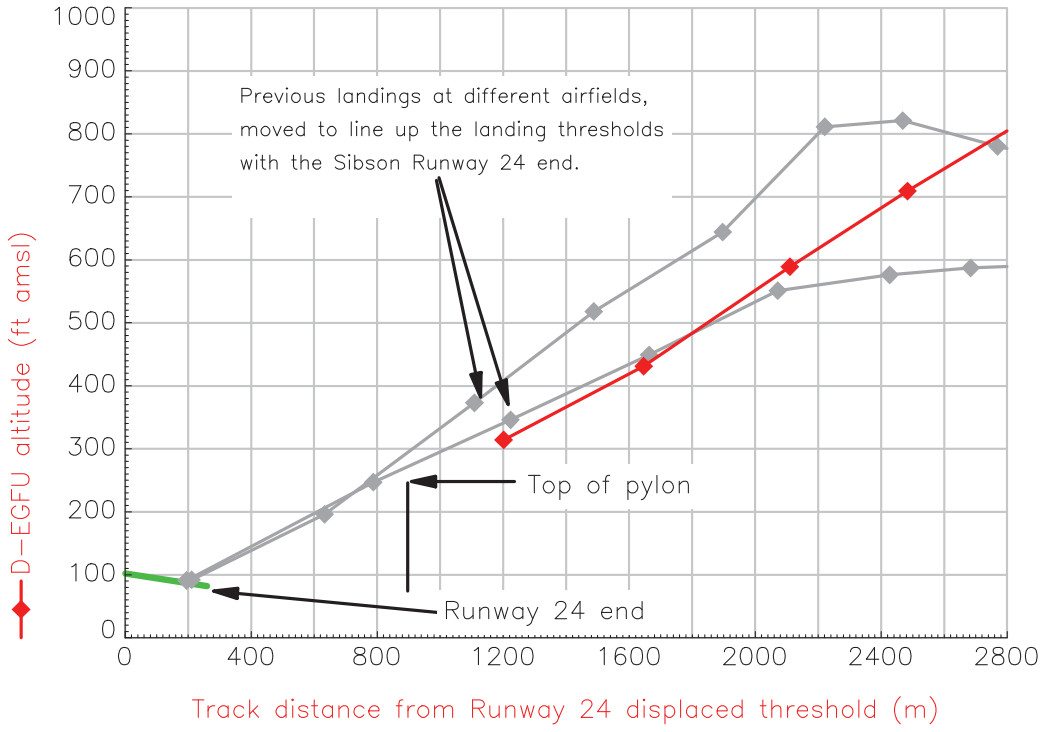


Figure 3

Comparison of the accident approach with approaches
at other airfields disregarding the displaced threshold

Radar data

Radar recordings of the accident flight were reviewed and confirmed the validity of the GPS data recovered from D-EGFU.

The radar recordings did not reveal any other aircraft of significance in the vicinity of the airfield at the time of the accident other than the Caravan aircraft which took off from Sibson whilst D-EGFU was on final approach. This aircraft appeared on the radar recording at 1313:46 hrs, after takeoff when it was approximately 700 m beyond the end of Runway 24. This was 54 seconds after the last GPS recorded position of D-EGFU, indicating the departing aircraft was still on the runway at the time of the accident.

Airfield description

Sibson Airfield has two grass runways orientated 15/33 and 06/24 (Figure 1). Runway 06/24 is the main runway and is 935 m long but, due to obstacles at either end, the two thresholds are significantly displaced. The Runway 06 threshold is displaced by 467 m due to trees near the airfield boundary. The Runway 24 threshold is displaced by 259 m due to the presence of the pylon line struck by the aircraft. This creates the illusion of a short runway only 209 m long being available between the two displaced threshold markings.

The airfield is licensed. The flying school, resident at the time of the accident, was responsible for operating the airfield in accordance with the licence. A parachuting centre is also based at the airfield and special procedures exist to allow parachuting operations to continue whilst the airfield remains active. These include the prohibition of deadside and overhead joins for arriving aircraft.

The normal circuit height is 1,000 ft QFE.

Published airfield information

The UK Aeronautical Information Publication (AIP) provides details of airfields in the UK and is the definitive source of information used in the preparation of a number of commonly used airfield guides. The relevant AIP entry for Sibson Airfield includes a section entitled '*Aerodrome Obstacles*' which gives specific information on obstacles affecting all four runways. This included the following statement:

> '***Remarks:*** *Line of HT cables 130-160 ft aal 230-261 ft amsl running north-northwest/ south-southeast 0.49 nm.'*

The pilot was using an extract for Sibson Airfield from a commonly used airfield guide. Information on obstacles on the approach to Runways 06 and 24, as well as a local mast, appeared in a section entitled '*Caution*'. The information relating to the pylon line read: '*Power lines on Rwy 24 approach*' without details of their height or distance from the airfield. In addition, the displaced threshold at either end of the runway, whilst marked, was not made obvious by the inclusion of arrows on the airfield diagram.

An examination of the airfield guide, and another established airfield guide produced by a different publisher, revealed a lack of consistency in both regarding the descriptions used when referring to overhead power lines. This made it difficult for users of the guides to differentiate between overhead power distribution lines[2] and the larger overhead transmission lines. In addition, some entries gave specific details on location of the power lines whilst others did not.

Footnote

[2] Overhead power distribution lines refer to the smaller power lines often supported by wooden poles and supplying domestic properties.

The airfield had its own website which contained information on operating to the airfield. This too warned of '*power lines on approach to Runway 24*' but gave no details on their height or distance from the airfield.

Licenced airfield obstacle clearance requirements

CAA document CAP 168 details requirements for the licensing of Aerodromes. Chapter 4 relates to the assessment and treatment of obstacles. It states:

> *'The effective utilisation of an aerodrome may be considerably influenced by natural features and man-made constructions inside and outside its boundary. These may result in limitations on the distance available for take-off and landing and on the range of meteorological conditions in which take-off and landing can be undertaken. For these reasons, certain areas of the local airspace must be regarded as integral parts of the aerodrome environment. The degree of freedom from obstacles in these areas is as important in the granting and retention of an aerodrome licence as the more obvious physical requirements of the runways and their associated runway strips, and is determined by survey in accordance with CAP 232 – Aerodrome Survey Requirements.*
>
> *The method of assessing the significance of any existing or proposed object within the aerodrome boundary or in the vicinity of the aerodrome is to establish defined obstacle limitation surfaces particular to a runway and its intended use.'*

Figure 4 illustrates the obstacle limitation surface as defined in CAP 168 for the category of runway appropriate to Runway 24 at Sibson.

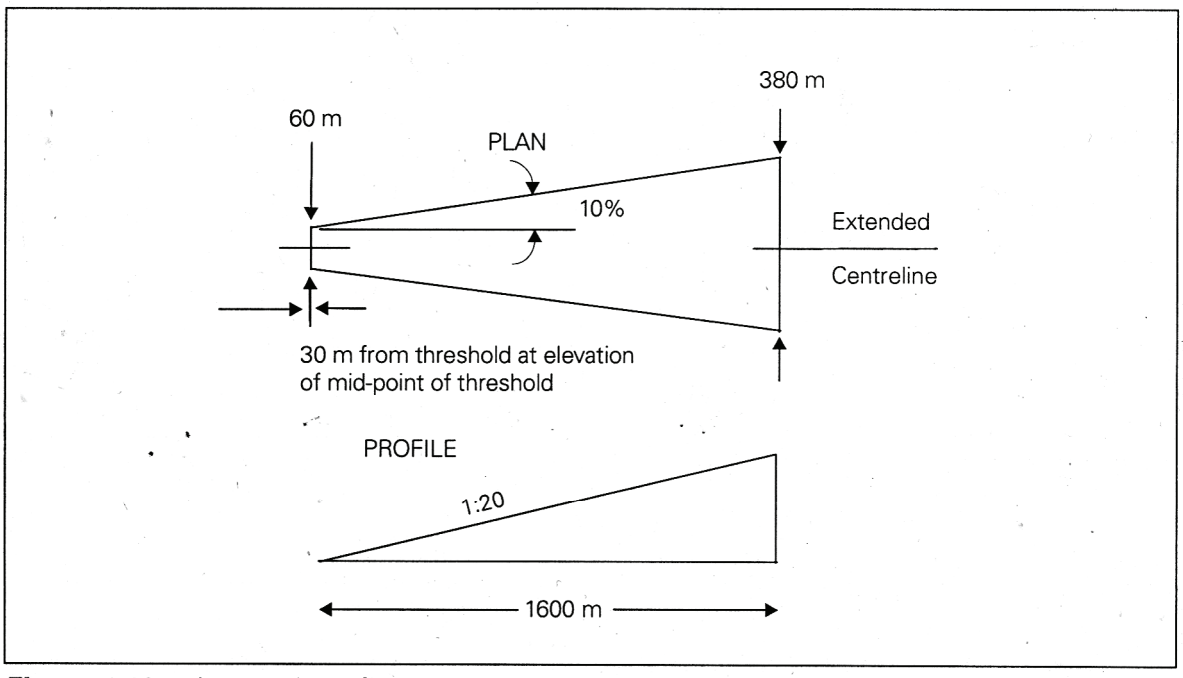


Figure 4.10 Approach surface associated with a non-instrument runway where the code number is 1

Figure 4

Obstacle limitation surface as defined in CAP 168 for the category of runway appropriate to Runway 24 at Sibson

Fuel

No records exist that would allow an accurate determination to be made of the amount of fuel on board the aircraft at the time it departed Long Marston for the flight to Sibson.

However, the aircraft was known to have been refuelled with 25.26 litres of fuel on 24 July 2011 and a further 46.88 litres on 25 July 2011. The pilot's logbook indicates that the aircraft had flown 1 hour 5 minutes between these two refuels and an additional 2 hours 20 minutes after refuelling on 25 July, prior to its departure for Sibson.

The aircraft had a 100 litre capacity fuel tank and a consumption rate of about 23 litres/hr. The aircraft must therefore have had additional fuel on board to that uploaded on 24 and 25 July 2011. Had the aircraft been refuelled on 25 July 2011 so that it was full, there would have been adequate fuel on board for the flight to Sibson and a reserve of about 1 hour 10 minutes. However, without the means of determining exactly how much fuel was on the aircraft after refuelling, it remains possible that the aircraft had little, or no remaining fuel at the time of the impact with the pylon line.

Previous incidents

The AAIB has no records of any other serious incidents or accidents at Sibson Airfield involving the power transmission line hit by the pilot of D-EGFU.

The CAA MOR database records two cases of wire strikes at the airfield. An incident on 14 June 1982 involved a helicopter striking power lines whilst crop spraying. The other incident, on 12 October 1985, involved an aircraft which landed after striking wires. The pilot was subsequently successfully prosecuted for low and reckless flying. Both incidents appear to have involved power distribution lines, not the transmission line struck by D-EGFU.

Pathology

The pilot's medical certificate was valid at the time of the accident and he was not required to wear spectacles whilst flying. The autopsy revealed no apparent medical conditions which may have contributed to the accident.

Analysis

Impact sequence

Given that the aircraft was positioned close to, or on the extended centreline of the runway at the time of the first impact, it is reasonable to assume the aircraft axis was approximately aligned with that centreline and the aircraft was approximately wings level. Allowing for the slight forward sweep of the wing, and taking into account the angle at which the power cables crossed the extended runway centreline, the outboard section of the right wing would have contacted the cable first. The site of the impact being close to the north eastern pylon, the considerable cable sag and very slight wing dihedral would account for the higher position of the initial contact on the upper wing surface. The subsequent contact on the lower wing surface indicates that the cable contact had moved inboard.

The extent to which the wing contact caused the aircraft to yaw to the right, and consequently roll, as well as decelerate and possibly descend, as the wing came into progressive contact with the cable, is not known. It is clear, however, that damage was then inflicted to part of the canopy adjacent to the wing root allowing fragments of transparency to fall onto the carriageway together with cockpit contents (headset). The geometry of the damage and the known orientation of the cable indicate that some time after the initial strike the cable contacted the left wing root with the aircraft banked steeply to the right. It was then deflected relative to the aircraft such that it translated along the front face of the left wing

spar, cutting off the leading edge skin and finally causing the outboard leading edge section to push the attached wingtip outboard, failing its fastenings to the aluminium alloy skin in a lateral direction between the spars.

The inboard section of the left wing leading edge could not be accounted for but the possibility that it fell onto the back of a freight vehicle travelling on the A1 road could not be dismissed. The final orientation of the cutting action of the cable through the left wing, relative to the aircraft axes, indicates that the aircraft orientation was grossly altered from the attitude for straight and level flight.

The location of the aircraft wreckage almost directly below the cable impact damage confirms the almost total loss of forward speed following the strike. After striking the cable the aircraft then fell, adopting a nose-down attitude during its descent.

Progressive re-orientation through the total impact/descent sequence would have almost certainly interrupted the fuel flow and/or inhibited correct carburettor operation, so a loss of engine power would probably have resulted. This, coupled with the almost complete loss of airspeed would lead to the propeller ceasing to rotate and would account for the lack of evidence of rotation at final ground impact.

Engineering analysis

The small holes identified in the fuel tank were orientated such that, with the aircraft inverted and resting with its tail fin in contact with the ground, they were at, or very close to, the lowest point of the tank. This would explain the complete absence of fuel in the tank.

The aircraft and engine examinations did not reveal any evidence of technical defects prior to the impact with the cable.

Operational analysis

The lack of evidence of any technical failure suggests the pilot would have been able to avoid flying into the power transmission line. That he did not indicates he was either not aware of its existence or, if he was, he did not appreciate his position relative to it.

Whilst the AIP entry for Sibson Airfield would have been available to the pilot to review, it is common for pilots to refer to a flight guide, such as the one found with the pilot at the time of the accident, rather than the AIP entry itself. If that was the case in this instance then, with the exception of perhaps his chart, the sources of information available to the pilot to plan and undertake his flight did not provide precise information on either the nature, or the location, of the power transmission line. It is possible, therefore that he was unaware of its presence when he commenced his approach.

From the limited evidence available, it appears the pilot flew a normal approach path angle, but towards the start of the prepared runway surface rather than the displaced threshold. The pilot's unfamiliarity with the airfield and the unusual appearance of the runway created by significantly displaced thresholds at both ends might have contributed to him choosing this approach path. The pilot might have also have been drawn to the start of the runway by the presence of the Cessna Caravan taxiing towards the runway for takeoff.

Sibson Airfield provides various challenges to pilots, not least the inability to join overhead. This denies pilots the opportunity to survey the runway properly prior to landing, which is of particular importance if unfamiliar with the airfield. It is possible that the recorded flight path showing the aircraft descending to circuit height, then climbing again prior to carrying out an orbit, was due to the pilot losing sight of the airfield and trying to re-orientate himself with the runway.

By carrying out the approach to the start of the runway surface, the pylon line represented an obstacle in the aircraft's path. Even if the pilot had been aware of the presence of the power transmission line, the cables would have been difficult to see. This was made all the more difficult by the fact that the lattice steel towers (pylons), which are easier to see, were positioned either side of the approach path, leaving only the power cables across the flight path. In addition, it is considered the pilot might have been distracted by the Cessna Caravan taking off whilst he was on finals. Radar and GPS data, and the statements of witnesses on the ground, suggest D-EGFU was considerably closer than the range of 2 to 3 nm estimated by the pilot of the Cessna Caravan at the time he lined up. The final approach path to Runway 24 is less than 1.5 nm in order to avoid a built-up area. It is not clear at which point in D-EGFU's approach the estimated range was made by the pilot of the Cessna Caravan. The reported nature of the radio transmission by the pilot of D-EGFU in response to the takeoff transmission from the Caravan also indicates that the two aircraft were in relatively close proximity. It is possible that this situation distracted the pilot of D-EGFU at a critical time as he approached the power line.

Safety actions

Consideration has been given to measures which could be implemented to try and prevent a recurrence of such an accident. These include the installation of approach path lighting at the displaced thresholds to indicate the appropriate approach path and aiming point. They also include ways to increase the conspicuity of the transmission lines. Such measures must however be proportionate to the perceived risk and in themselves not introduce additional problems. The owners of the power transmission line have entered discussions with the airfield operator and the CAA to explore the options available.

The airfield operator has stated it will seek to enhance the information provided about the power lines on its website. The publisher of the guide used by the pilot has now revised the entry for Sibson Airfield to incorporate specific details of the power transmission line and to highlight, on the airfield diagram, the existence of displaced thresholds on Runway 06/24. The publisher will also attempt to introduce a more consistent method to record the presence of power lines in their publication, as will the publisher of the other flight guide reviewed during this investigation.

ACCIDENT

Aircraft Type and Registration:	Cessna T210N, XB-LLD
No & Type of Engines:	One Teledyne Continental TSIO-520-R piston engine
Year of Manufacture:	1981 (Serial no: 210-64265)
Date & Time (UTC):	14 November 2011 at about 04:00 hrs
Location:	9 miles north-east of Gerrard Smith International Airport, Cayman Brac, Cayman Islands
Type of Flight:	Unknown
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 2 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	N/K
Commander's Flying Experience:	N/K
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was destroyed when it struck poles and trees while landing at night on an unlit road on the island of Cayman Brac. Both occupants were fatally injured. There was a large spill of Avgas from tanks carried in the cabin as part of a modified fuel system, but no fire.

Times in this report are UTC; local time was UTC –5 hrs.

History of the flight

At about 0345 hrs residents on the southern coast of Cayman Brac heard a light aircraft piston engine. They later considered that the aircraft appeared to be crossing the coast from south to north. At about 0400 hrs the owner of a nearby property heard an aircraft engine and, as this was unusual, walked out onto his driveway, where he saw a single engine aircraft pass from west to east overhead. The aircraft was displaying no lights and was difficult to see. Another witness heard the engine noise decrease to nothing, then sharply increase before suddenly stopping. Believing that a crash may have occurred, this witness called the emergency services. Wreckage was located and the crash site secured at 0500 hrs. Two crewmembers were discovered by rescue personnel; both had received fatal injuries.

No international flight plan relating to this flight could be found. At the time of the accident the three airports on the Cayman Islands group were closed and Cayman Brac's airport was unlit. Although ATC was closed, radio recording equipment at the airport was operational

and no radio calls were recorded. There had been no reports of aircraft noise from the north coast or western areas of the island.

Meteorological information

At the time of the accident all local airfields were closed, as were their respective met offices. The Police Air Support Unit (ASU) which responded to the accident reported excellent visibility, no low cloud and that there was a bright, almost full moon. The wind was easterly at about 12 kt. The road at the accident site stood out clearly from the surrounding terrain.

Personnel information

Pilot A: A Commercial Pilot's Licence issued to Pilot A by the state of Mexico was recovered from the wreckage. The Mexican authorities reported that the pilot's licence was renewed by practical examination in February 2006 and this revalidation expired in February 2008. He held multi-engine and instrument ratings as well as a Lear Jet series 20 type rating. Other details of his experience were not available. A flight plan recovered from the aircraft, for a flight to XFQC, named him as the Pilot in Command.

Pilot B: Pilot B held a Commercial Pilot's Licence issued by the state of Columbia in 1976. No other details of his qualifications or experience were available.

Pathological information

Post-mortem examinations conducted on behalf of the Cayman Island's Coroner revealed that both pilots had received injuries during the accident that would have been immediately fatal. Toxicology results for Pilot A were positive for the presence of Cocaine Metabolites with associated compounds and Chlorphenamine, a substance commonly used in anti-histamines. Pilot B's results were negative.

Aircraft details

The recent history of the aircraft could not be established in any detail, although some documentation was found in the wreckage. This included a Certificate of Airworthiness, issued on 17 October 2010, valid to 18 October 2012 and newly issued engine and airframe log books. The latter contained a 'Revalidation' Inspection stamp dated 19 October 2011, with total airframe hours of 2,404. An earlier stamp, dated 22 May 2010, indicated that the aircraft had been repaired following an accident. The engine log book also contained Inspection stamps dated 22 May 2010 indicating that both the engine and propeller had been overhauled. There were 'Revalidation' Inspection stamps for these components, dated 19 October 2011, indicating that both engine and propeller had achieved 22 operating hours since overhaul. There was no documentation relating to operation of the aircraft after this date, or any entries detailing actual flights.

The aircraft serial number was found on the left door frame. Reference to the aircraft manufacturer revealed that the aircraft was constructed in 1981 and registered in the USA. It was deregistered in the USA in September 2003 and was registered in Mexico in September 2009. No records of the period 2003-2009 were located.

The aircraft fuel system had been the subject of a significant, amateur modification that added approximately 600 litres (158 US gals), which is described in the 'Detailed examination of wreckage' section of this report. In addition, the wing tips had been extended to include additional fuel capacity. No obvious manufacturer's details were observed on the components, although the installation appeared similar to a modification kit that is commercially available as an FAA Supplemental Type Certificate (STC); this adds

approximately 16 gals (US) per side. The total fuel capacity of the aircraft would probably have given it a range considerably in excess of 2,500 nm.

Documents recovered from the aircraft

Relevant documents recovered from the aircraft included:

- A receipt from Guadalajara Airport, Mexico dated on the day of the accident.
- An arrival report at Chetumal Airport, Mexico, dated the day of the accident at 2035 hrs, stating that the aircraft had arrived from *'FQC'*.
- A handwritten ATC flight plan from Chetumal Airport, Mexico to *'XFQC'*. The flight was estimated to take 50 minutes and the aircraft was reported to have four hours endurance. XFQC is not a recognised ICAO code and the letter X is not issued by ICAO. The flight plan included the route *'CTM DCT FQC*[1]*'*. FQC is not a recognised navigation aid.

The Mexican authorities suggested that FQC could have been mistakenly entered instead of FCQ a staffed airfield in south-east Mexico. However, their enquiries found no record of the accident aircraft having visited that airfield in November 2011. Further enquiries with four other staffed airfields in this area found no records of any visit by the accident aircraft.

Recorded data

No radar or RT recordings were available.

Two Garmin 495 GPS units were recovered from the aircraft wreckage. Both had sustained significant damage during the accident and would not power up normally. When recovered, one GPS (GPS A) had a battery pack attached, and other (GPS B) did not. No other battery pack was located in the wreckage. However, a Garmin cigarette lighter adaptor cable was recovered which could have enabled GPS B to be plugged directly into the aircraft's electrical power supply.

Following recovery to the AAIB's facilities at Farnborough both GPS units were downloaded. GPS A had an Active Route selected to a location in Venezuela near its border with Columbia. GPS B had an Active "GO TO" selected to a point mid way between Jamaica and the northernmost point of Columbia. It also contained a track log. The relevant sections of the track log commenced at Chetumal Airport, Mexico, crossed the border to Belize where the aircraft appeared to land, though not at the location of any known airfield, before departing to the east across the southern Caribbean Sea. This track log terminated at 0202 hrs, at a point 196 nm south of Cayman Brac when either power to the GPS or a satellite signal was lost. Figure 1 is a screen dump taken from GPS B of the map page which would have been available at the time of the power/signal loss. This page also shows the track. The recorded altitude at this point was 8,450 feet amsl. The end of the track log was 300 nm short of the Active "GO TO" point which is just visible on the lower right edge of Figure 1.

Footnote

[1] This indicates an intended route from Chetumal direct to *'FQC,'* a position that was not identified by the investigation.

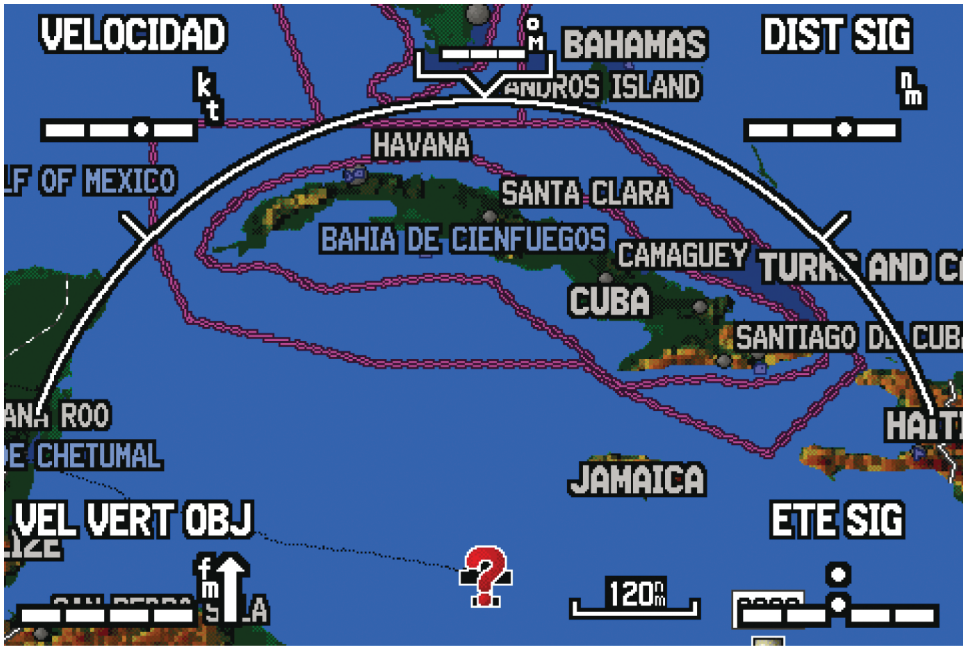


Figure 1

GPS map display showing track (thin black line at bottom left) to the point where power/signal was lost (indicated by question mark). (Note Cayman Islands are not displayed)

Accident site details

The accident site was immediately adjacent to an isolated straight road approximately 28-30 ft (8.5-10 m) wide that had been built in preparation for proposed residential development. (The wingspan of a standard Cessna 210 is 36 ft 9 in.) A line of substantial wooden telephone/power cable poles had been installed at approximately 70–80 m intervals along the southern edge of the road, which was orientated approximately east to west. Evidence suggested that the aircraft had attempted to land westbound along the road. The ground each side of the road was covered with dense vegetation consisting of bushes, cacti and small trees growing out of a rough, frangible limestone base. The nature of the terrain was such that smaller pieces of wreckage were not found.

Accident site

The first evidence of aircraft contact with a ground-based obstacle was a light scuff on one of the wooden poles, approximately 8 m above the base. A small fragment of fibreglass from the left wingtip was found on the road nearby. It was apparent that the left wing had subsequently struck a number of trees to the left of the road, resulting in pieces of wing structure breaking away. Approximately 140 m from the initial contact there had been a major impact with another pole, most probably on the nose of the aircraft. This had caused major disruption to the airframe, and was probably responsible for the severity of the injuries sustained by the crew. The impact had resulted in the top half of the pole snapping off, coming to rest approximately 10 m further down track. The disposition of the wreckage, together with the damage to the vegetation, indicated a steepening left bank angle that resulted in the aircraft performing a cartwheel before coming to rest in an upright attitude, pointing approximately 90º to the right of its impact track.

The aircraft had been carrying ten 60-litre detergent containers that held varying amounts of Avgas fuel; these were found in the aircraft cabin and in the immediate vicinity. In addition, lengths of flexible hose and quick-release couplings, originating from the wing roots, protruded from the cabin roof.

The major impact with the pole had resulted in the engine becoming detached and the propeller hub sustaining extensive damage. Only one of the three propeller blades had remained attached to the hub. Another was found earlier in the wreckage trail close to the telegraph pole and the third was not recovered. The furthest flung piece of wreckage was the right wing tip, with its integral fuel tank, which was found some 20-30 m beyond the main wreckage site. The vegetation nearby displayed the staining/withering effects of exposure to gasoline, indicating that the tank contained fuel at the time of the accident.

In general, the extent of the wreckage trail combined with the severity of the damage to the aircraft indicated a moderate speed (ie above stall speed) with the engine developing power.

The wreckage was gathered up during 16-17 November 2011 and taken to a secure part of a local dockyard, where it was examined further by the investigating team.

Detailed wreckage examination

The row of seats behind the pilots had been removed in order to accommodate the 10 plastic containers of fuel in the cabin. Three containers were ruptured and were empty; another was damaged but still contained approximately 12 litres. One was nearly full, containing an estimated 50 litres, with the remainder containing smaller amounts. The total fuel recovered was around 126 litres. The containers were fitted with screw caps, with pieces of polythene sheeting inserted into them, perhaps in an attempt to improve sealing or to minimise the escape of fuel vapour. A photograph of the fuel containers, taken after they had been removed from the wreckage, is shown in Figure 2.

The lengths of hose were attached to an electric fuel pump mounted within the structure of each wing root; the pump outlets were connected to the wing tanks. The two motors were identical, with the data plates indicating

Figure2

Fuel containers carried in the aircraft cabin

that they were 24 volt DC units. The associated wiring was traced to the rear of the instrument panel, where the left and right pumps were connected to the 'FLOOD LITES' and 'PITOT HEAT' rocker switches respectively. After removal from the aircraft the pumps were connected to a 24 volt supply and appeared to operate. The other ends of the hoses terminated in the cabin area, where another, unattached length of hose was found. This may have served as an extension to enable it to reach the furthermost container. The investigation concluded that the modified fuel system enabled the fuel carried in the cabin to be pumped into the wing tanks during flight by operating the 'FLOOD LITES' and 'PITOT HEAT' switches on the instrument panel, the labelled functions of these switches having been disabled. Once the plastic containers had been disposed of, the hoses could be concealed behind the headlining of the cabin roof, giving the appearance of a standard aircraft.

An electrically operated screwjack-type flap actuator was located in the underside of the left wing. The position of the nut on the threaded jack-screw indicated that the flaps were in the retracted position at impact; this was verified with the aid of advice received from the aircraft manufacturer. The flap operating lever, however, was found in the flaps fully down position. The adjacent position indicating needle indicated '10º', although this was not considered reliable because its associated linkage had been disrupted during the impact and could be moved freely.

The front left cylinder head on the engine had broken off during the impact. The remaining part of the cylinder was removed and the piston and bore were noted to be in good condition. There was a large quantity of oil around the engine generally, including within the filter, and it was concluded that the engine was in good condition. This accorded with the limited documentation, which indicated a recent overhaul, with the Hobbs meter indicating 18 hours of operation. The manifold valve was removed and the internal fuel screen was noted to be clear of debris. The propeller control unit, located on the forward left side of the engine, had broken off and was not recovered. The turbocharger had broken open, with significant damage being observed on the impeller blades and the associated shroud; this was considered to be an indication of the engine developing power at the time of impact.

The landing gear was found to be down when the wreckage was lifted. After being placed on the ground, the main landing gear legs appeared to engage with their uplocks and did not subsequently hang down again when the fuselage was next lifted. This suggested that the gear had been extended at the time of the accident. The cabin area was too badly disrupted to determine whether the emergency landing gear handle had been used.

The aircraft battery had been thrown clear of the main wreckage and was substantially damaged. What appeared to be a date, 20/05/2010, was written in permanent ink on top of the battery; this was around the time of the log book Inspection stamps and may be an indication of a capacity check conducted at that time. The alternator, located at the front of the engine, had broken up on impact; its drive belt was not recovered or identified. The aircraft had a solid state alternator regulator; this was damaged and was removed for subsequent testing.

Inside the cockpit, rocker switches that had not been damaged were found in the OFF position. Photographs provided by the police, taken on the night of the accident, showed the battery master/alternator switches at their OFF positions, and the magneto switch selected to BOTH. The panel lighting rheostats were in the DIM positions.

Many of the circuit breakers, particularly those from the right side of the instrument panel, were missing,

including the 60 amp Alternator Breaker. None of the remaining circuit breakers, which included the 5 amp Alternator Regulator circuit breaker, were found to have tripped.

The left and right cabin doors were of slightly different designs. Both doors had sustained damage to their leading edges, resulting in the hinges breaking off. The latches, at the rear of the doors, were noted to be in relatively good condition and the doors were probably closed at impact.

Subsequent testing

When the alternator regulator was tested in an avionics workshop, a short circuit occurred immediately after power was applied. A detailed examination of the unit was not possible because, as is typical for this type of component, the circuitry had been encased in potting resin at manufacture. The resin, intended after setting to protect the components against moisture and vibration, renders them subsequently inaccessible. However, it was noted that a component, possibly a resistor or capacitor, partially protruded from the resin and had been severely distorted as a result of having been crushed by the metal casing, which had been damaged in the accident sequence. It was not possible to assess the pre-impact condition of the component, which may have been responsible for the failure of the regulator to function.

Analysis

There was insufficient evidence to determine the purpose of the flight, but there were indications that it was intended to be clandestine, including the modified fuel system, the intended route and the unidentified flight plan destination.

The recovered documents and GPS data indicated that the aircraft had previously departed Guadalajara for a flight to Chetumal, Mexico; a great circle distance of approximately 858 nm. This was within the theoretical range of a standard Cessna 210 and appears to have occurred without incident, arriving at 2035 hrs. The crew filed a flight plan for an unidentified destination then departed, initially to the north before turning south and crossing the border into Belize. The aircraft landed briefly at an improvised airstrip, then departed and flew east for some 490 nm, at which point the GPS track ended. If GPS B was powered solely by the aircraft electrical supply then a failure of the electrical system could result in the recorded track ending in the manner found. Equally, the GPS could have been deliberately or inadvertently unplugged.

The reason for the deviation from the original track was not determined. However, there was evidence of failure of the electrical system, which would have affected navigation instruments and prevented use of additional fuel carried in the cabin. The crew may not then have been confident either of maintaining their original course or of having sufficient fuel to complete their intended journey. They may have decided instead to follow a northerly route towards the large landmass of Cuba. Thus, the aircraft's arrival at Cayman Brac may have been a coincidence. It is possible that the straight road, which according to the ASU would have been clearly visible in the moonlight, appeared to present an opportunity for a forced landing and an alternative to continuing the flight. The unsuitability of the road as a landing site suggests it was not the planned destination and it is more likely that the landing was attempted following problems with the aircraft or crew.

It was not possible to establish the cause of any electrical failure due to the general disruption to the aircraft and some components not being recovered, but there was evidence that one might have occurred.

The electrically operated flaps were found in the retracted position, whilst the flap selector was found in the fully down position, as would be normal practice for landing. The landing gear, which also required electrical power for extension, could have been extended using the emergency, manually operated, system.

Other items of electrical equipment, such as the anti-collision beacon and lights, had been switched off. The battery master/alternator switches might have been turned off in preparation for a forced landing, but there would be no need to turn switches off separately for these other services. Their positions as found, and the absence of radio calls, might indicate attempts earlier in the flight to shed electrical load, or an intention to remain unobserved.

Witness evidence indicates that the aircraft crossed the coast of Cayman Brac to the west of the accident site, heading north. The fact that no-one reported hearing an aircraft further north or east suggests that the aircraft did not continue far beyond that point before turning downwind, and commencing its approach to land. One ear witness report of engine noise was consistent with the aircraft making an approach to the road; the subsequent increasing engine note indicated an attempted go-around. Either before or during the go-around the aircraft struck the first pole, resulting in loss of control and the subsequent impact.

Despite the large quantity of fuel on board, there was no post-impact fire. Common ignition sources in aircraft accidents are fuel splashing onto hot engine exhausts, and sparks arising from disruption of the electrical system. In this case, the aircraft's impact with the pole resulted in the engine and exhaust detaching and coming to rest away from the main wreckage. A serviceable battery might have generated sparks during the impact; an exhausted battery would have had little or no capacity to do so.

Conclusion

The aircraft probably suffered an electrical failure which prevented use of the modified fuel system intended to provide additional range. The aircraft then deviated from its original flight path, possibly because the crew intended to divert to Cuba, and its track passed over Cayman Brac. Evidence indicates that the pilot attempted to land on a road. The aircraft was destroyed when it encountered obstacles, including poles, beside the road.

The manner of operation of this aircraft, including extended flights over water and the modified fuel system, introduced risks to the flight of which the crew must have been aware. No Safety Recommendations were made.

ACCIDENT

Aircraft Type and Registration:	YAK-52, RA-3585K
No & Type of Engines:	1 Ivchenko M14P piston engine
Year of Manufacture:	1990
Date & Time (UTC):	28 April 2011 at 1150 hrs
Location:	Langford, near Maldon, Essex
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 2 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	Private Pilot's Licence
Commander's Age:	43 years
Commander's Flying Experience:	673 hours (of which 66 were on type) Last 90 days - 20 hours Last 28 days - 10 hours
Information Source:	AAIB Field Investigation

Synopsis

During a tailchase, the aircraft entered an inverted spin at approximately 1,800 ft agl, probably because of unintentional pro-spin positioning of the flying controls. Although the spin ceased after three turns, the aircraft impacted the surface of a lake during the ensuing dive. The investigation identified several factors relevant to the accident, including operation of the aircraft, the type of flight instruments fitted to it and the manner in which the activity was conducted.

History of the flight

The flight took place on the third day of a three-day formation flying school. Weather conditions in the morning were not conducive to the planned flying, and the participants delayed briefing until there was some improvement.

A briefing was given before flight by the instructor who was flying in RA-3585K, and all six pilots in the formation attended it. The content of the flight was to be manoeuvring with the aircraft positioned in vic[1], echelon, and line astern formations, followed by a demonstration of a formation loop and then tailchase by the instructors. The minimum height to be used in the tailchase was 1,000 ft agl. The exercise was to be flown three times, to provide each student with experience in each position in the formation. Other information suggested that because the tailchase had been demonstrated by the instructors during a flight the day before, it was possible that the students would fly the tailchase under the instructors' supervision.

Footnote

[1] A vic formation makes a 'V' shape, flying point-first.

The first part of the flight consisted of manoeuvring, a tailchase and a loop, all in either vic, line astern, or echelon formation. During line astern manoeuvres, RA-3585K was seen to enter mild pilot-induced oscillations around its correct position in the formation, and then to resume a stable and accurate position. An instructor in another aircraft in the formation suggested that the oscillations were consistent with the student handling the controls of RA-3585K, and the correction was an indication that the instructor had taken control. He commented that such oscillations, at that stage of the course, would indicate a relatively slow rate of learning by the student. During this first exercise, RA-3585K was the third aircraft in the formation.

At some later stage during the manoeuvring, perhaps during a formation position change, RA-3585K broke off from the other two aircraft. An instructor in another aircraft recalled that RA-3585K entered cloud and the crew lost sight of the formation. The instructor in RA-3585K called 'out blind'[2], and the three aircraft carried out the applicable pre-briefed procedure. However, in endeavouring to re-join the formation, the crew of RA-3585K found themselves attempting to join up with another formation nearby. Having recognised their error, they reported to the other members of their formation, by radio, that they would not re-join the formation but would instead return to land at North Weald. Following further exchanges by radio, they decided not to return to North Weald but to re-join the formation, and this was then accomplished.

The members of the formation then discussed their fuel states, and decided to conclude the exercises with a short tailchase, before returning to North Weald. RA-3585K was now second in the tailchase of three aircraft.

The lead aircraft was being flown by its student, who had attended the formation school a number of times and was an experienced ex-military pilot. He was manoeuvring his aircraft according to instructions from his instructor.

The tailchase began with a timed break from an echelon-right formation. After the break, the lead aircraft executed wingovers, first to the right, then the left, then to the right, and then again to the left. Just after the apex of the final wingover, the student flying the lead aircraft executed an aileron roll.

The student in the third aircraft was wearing a helmet fitted with a video camera, the recording from which was provided to the AAIB. It showed RA-3585K following the lead aircraft into the final wing-over, pulling up, rolling left towards an inverted position and decelerating, at an altitude of approximately 1,800 ft. The instructor in the aircraft behind commented later that the aircraft:

> *'seemed to pull up a bit steep... and get slow at the top.'*

At the apex of its manoeuvre RA-3585K was seen to reach a low speed and apparently *'very high'* angle of attack. It then progressively rolled and yawed into an inverted spin to the left, which continued for three turns until the aircraft flew out of view of the camera.

Eyewitnesses described the aircraft recovering from the inverted spin into an erect dive at a low height. The aircraft impacted a lake and sank in the water. Another aircraft in the formation transmitted a MAYDAY

Footnote

[2] The 'out blind' call is given by a formation member who breaks away from the formation without maintaining visual contact with the formation.

call to the Distress and Diversion cell at the London Area Control Centre. Emergency services attended, including rescue divers in a search and rescue helicopter who entered the water and located the wreckage. Both occupants had been fatally injured.

Recollections of instructors in the other aircraft

The instructor in the third aircraft interpreted the pull-up into the final wingover as the beginning of a loop, because of the duration of the descent which preceded it and the aggressive pull-up into the manoeuvre. The instructor in the lead aircraft recalled later that the pull-up had been neither particularly aggressive nor weak.

The instructor in the third aircraft commented that during the tailchase, the positioning, anticipation and spacing of RA-3585K in the formation were all good. At no stage did he feel concerned about the manner in which RA-3585K was being flown. He was not able to deduce whether the student or instructor was flying RA-3585K. He offered the opinion that because this tailchase was the second one in the flight during which RA-3585K had flown other than in the lead position, the instructor may have used it as a teaching exercise, not a demonstration exercise, and so either occupant may have been flying RA-3585K. The instructor in the lead aircraft was of the opinion that the tailchase could have been either.

Recorded information

Radar data for the accident flight provided no height information and could not be used to distinguish between the three aircraft with any certainty. GPS data from the third aircraft and footage from the video camera fitted to helmet of the student in this aircraft, which followed RA-3585K during its final wing-over manoeuvre, was analysed.

The video recording was not of sufficiently high quality to enable the attitude or control positions of RA-3585K to be determined. Interpretation of the images was difficult for several reasons, including the presence in shot of the canopy surround, the manoeuvring of the aircraft from which it was taken, the head movements of the student on whose helmet the camera was mounted, and the lack of a constantly-visible local horizon. The combination of the GPS and images did, however, indicate that the manoeuvre was being flown at a GPS altitude of approximately 1,800 ft agl.

Meteorological information

An aftercast provided by the Met Office indicated that around the accident site the visibility was approximately 15 km, the wind at 2,000 ft amsl was north-easterly at 25 to 30 kt, and the cloud base was between three and seven oktas with a base between 1,500 ft and 1,800 ft agl. The Met Office report stated that forecast information which had been available on the day of the accident had been *'broadly consistent'* with the observed phenomena.

Video evidence suggested that the cloudbase may have been slightly higher than this and also showed that there were some sizeable gaps in the cloud.

The formation school

The formation school had taken place twice-yearly for many years at North Weald Aerodrome. The chief flying instructor had a background as a military pilot and flying instructor and examiner.

Training at the school involved first demonstrating new skills to students, then teaching them actively, and then allowing them to practise the skills with assistance from their instructors. As their skills developed, the students would exercise their new skills with reducing

intervention and coaching to the point at which they flew unaided but supervised.

Students and instructors generally attended the school for three consecutive days of flying. Each day students and instructors were organised into pairs and then into formations, typically of three aircraft, for the flying exercises. The student and instructor in RA-3585K had been paired together for all three days of the school, although the student flew once with another instructor.

On the first day of the school, the participants gathered and each one introduced himself, giving a brief description of his flying experience. The chief flying instructor then gave a 'phase brief' which described the purpose of the school and the standard operating procedures. Formations then briefed their activities together before flight and, after flight, debriefs were conducted both as a formation and privately between each instructor and student.

The students were briefed that they were at all times in command of their aircraft, and therefore bore ultimate responsibility for safety. The chief flying instructor described a "contract" between the students and instructors, stating that students should follow the instructions of their instructors, and that their instructors should be given control immediately at any time they requested it, though the student retained responsibility for the safe conduct of the flight.

The school did not have a formal risk management or safety system.

Other organisations ran similar formation flying training events both at North Weald and elsewhere. There was no requirement for such organisations to be approved by the EASA or the CAA and no special regulation of such activities took place.

Standard operating procedures

The organisers of the school had produced a set of standard operating procedures, largely based upon British military formation training procedures, which were circulated to all participants before they attended.

The section on tailchase exercises was as follows:

> *'Tailchasing is defined as a 'follow the leader' exercise. At no time is a tailchase to be allowed to develop into a 'dog fight'. The leader is to nominate a base height below which none of the formation is to descend: this height may be briefed on the ground or in the air, dependent upon the prevailing weather conditions. Members of the formation are not to allow their spacing to reduce to such an extent that the safety of any aircraft in the formation is prejudiced.*
>
> *The following limits are to be applied to tailchasing:*
>
> *a The leader is to maintain VMC at all times*
>
> *b Minimum height 1000 ft agl for experienced pilots, higher limits for ab initios*
>
> *c Minimum vertical clearance from cloud – 500 ft*
>
> *d Minimum spacing – 100 metres*
>
> *e Minimum speed – 150 kph*
>
> *f Leader is to pre-brief min/max G to be used in the tailchase (normally 0-4g)'.*

The power to be set for the tailchase was stated as 80% propeller rpm and 80 cmHg manifold pressure. Pilots were briefed to maintain position in formation without altering the power setting, by using 'lead' and

'lag' techniques. During manoeuvring, the pilot of an aircraft which moved closer to the preceding one would 'lag' by turning or pitching slightly out of the manoeuvre until the correct spacing was once again achieved, and vice versa.

The minimum height employed by the UK military for tailchase training in modern single-engine piston aircraft is 3,000 ft agl. The chief flying instructor commented that the distinction made (in point b, above) between 'experienced' and 'ab initio' pilots was subjective, and could not be measured in terms of flying hours and numbers of flights. He stated that it depended upon an individual student's performance, and how comfortable an instructor felt with that individual.

The procedures included instructions to be followed by pilots flying in formation when visual contact was lost between following and preceding aircraft, intended to ensure safe separation was maintained between aircraft and to enable aircraft to rejoin a formation.

Chief flying instructor's comments

The chief flying instructor stated that for a demonstration tailchase, flown by the instructors, he would expect the minimum height to be 1,000 ft agl, and 1,500 ft agl for a demonstration which was planned to become a teaching and/or practising exercise, with the students handling the controls. He said that tailchases flown early in the school were "very structured" with the objective of teaching students how to maintain position in formation using lead and lag techniques, and would normally consist of two 360° turns at 2g, followed by two wingovers, two barrel rolls and two loops. He stated that for demonstrations the lead aircraft would almost always be flown by the instructor, because a student might not fly sufficiently sensitively to the followers' training needs, but that the lead aircraft student in this case had attended a number of formation schools and could be expected, with assistance from his instructor, to lead the tailchase competently.

The chief flying instructor reviewed the briefing material used for the flight and the previous de-brief records for the pilot, and considered that these were "highly suggestive" that the instructor would be handling the aircraft at the time of the accident. He was shown the video recording of the accident flight and commented that it showed a:

> *'really simple, gentle, tailchase – there didn't seem to be any aggressive manoeuvring at all.'*

The chief flying instructor stated that during a wingover in a tailchase, it was important to keep to one side of the preceding aircraft's flight path, to avoid its wake, and when rolling it was necessary to keep the aircraft's nose pitched so as to keep the preceding aircraft in sight.

With regard to an aileron roll flown by the preceding aircraft, he stated that the following aircraft's pilot need not, and would not be expected to, follow the preceding aircraft's roll. The objective for the following pilot was to follow the preceding aircraft's flight path, not its every manoeuvre.

The chief flying instructor said that he had experienced incipient inverted spin entry "many times" in the Yak-52 during aggressive tailchase manoeuvres. These almost always occured when flying through a preceding aircraft's slipstream at a relatively low speed. He added that the aircraft was immediately responsive to corrective control inputs made by reducing the power to idle and centralising the controls, which prevented the development of a spin entry. He described an inverted spin as "horribly disorientating" and stated that he had

never carried out an inverted spin in a Yak-52, and did not intend to do so, because he would always recover at the incipient stage.

He commented that the aircraft was a "very honest, basic aeroplane" and that the flight regime in which it was operated during the formation school was at the "heart of the envelope". Neither the chief flying instructor, nor other instructors and students interviewed in the course of the investigation, had regarded unintentional spinning as a likely hazard during the formation school exercises. TIt was generally agreed that it was extremely improbable that a student or instructor would execute an intentional inverted spin during a tailchase.

Pilots

Pilots with access to Yak-52 aircraft were able to attend the school as students. They were expected to bring two headsets or helmets and two parachutes with them. The students covered their own costs and the subsistence costs for the instructors, who were not paid for their involvement.

There was no minimum standard of training, competence, experience or recency in aerobatics or recovery from unusual attitudes for the students participating in the 'school' and although each student described his previous experience during a meeting on the first day of the activity, no assessment of ability was made prior to commencement of the activity.

The students were required to be qualified to fly their aircraft as pilot in command. The students flying the aircraft in formation with RA-3585K were in command of their aircraft during the school flights.

The student in RA-3585K

The student had obtained a PPL in 1999. According to his log book and other records, his first exposure to an aerobatic aircraft was in 2008 when he undertook some training on an Extra 200 and then a Slingsby T67 aircraft. This training was planned as the beginning of an aerobatic course and comprised 3 hrs 5 minutes of basic aerobatics including unusual attitudes, an introduction to spinning, and training in loops, aileron rolls and barrel rolls. He did not complete the aerobatic course.

He purchased RA-3585K (then on the British register) in October 2009 and undertook conversion training on the type with an experienced instructor and examiner whose experience on Yak-52 aircraft amounted to 4,300 hours over 30 years, including display flying, and who specialised in training pilots to fly the Yak-52 aircraft.

The instructor agreed to provide a type conversion and safety training. The student had only flown his aircraft twice, with another instructor, to deliver it to its base in the Netherlands. Over four days in April 2010, the two flew slightly less than ten hours, the "vast majority" of which was circuit flying. The instructor commented that it took "rather a long time – about 80 touch-and-gos" before he was sent solo in the circuit. The instructor stated that the student was not in a hurry to be sent solo, but was concerned to achieve a good performance. The two also flew some high angle of attack exercises, stalling, and incipient and one-turn conventional (erect) spins.

The instructor described the student as a slow learner but with a "correct attitude", who made slightly more mistakes than others. His handling skills were "below average". However, he was willing to work very hard to achieve a suitable standard and did not perform unpredictably.

In July 2010, the two flew four further times, concentrating on high angle of attack, stalls, and one-turn conventional spins. On the final flight, accelerated stalls and departures from controlled flight were carried out, but only as "familiarisation". The instructor stated that the student was not proficient in handling departures from controlled flight at the end of the exercises. The two did not fly together again.

Later entries in the student's log book included occasional reference to aerobatic manoeuvres and mention of "spins", against a total of five hours flying which he logged as pilot in command. The investigation found no evidence that he had received training in inverted spins and recovery.

Instructors

Instructors at the school were either military or civilian pilots with extensive formation flying experience; several were current or former military flying instructors with experience in teaching formation flying. A few were experienced Yak-52 pilots, but some only had experience of flying the Yak-52 as rear seat occupants during previous formation schools. Some of them held civilian licences, and some had civil or military instructor qualifications (or both), but some were not qualified to fly or instruct in civilian aircraft. The chief flying instructor stated that the instructors were "safety pilots to help and advise".

Instructors were briefed about technical aspects of the Yak-52 aircraft, including the importance of maintaining balance because of the considerable torque of the engine and propeller combination. They were not provided with any formal flying training in handling the Yak-52 aircraft.

There were no recency requirements for the instructors, either in aerobatic or non-aerobatic flying, or in recovery from unusual attitudes or spins.

The RA-3585K instructor

The rear seat occupant in RA-3585K was a transport aircraft commander in the RAF with experience teaching formation flying, tailchasing, and aerobatics in light aircraft in military service. He held a UK PPL in addition to his military flying qualifications. The investigation found no evidence that he had received training in manoeuvring the Yak-52 close to the limits of its envelope, in spin recovery in the type, or in inverted spinning in any aircraft type.

Although his military flying log books were available to the investigation, no log book of civilian flying was found. Investigators established that he had flown light aircraft, including aerobatic types, in recent years, but it was not possible to quantify this activity or establish its scope. There was no evidence that he had practised inverted spinning. The instructor had participated in the school regularly over the previous five to seven years of its operation, and had also taught at another similar school using a different aircraft type.

One of the other pilots in the formation stated that during the briefing for the flight, another instructor had briefed the instructor that "he needed to pull more g and maintain speed" at the top of a loop, to avoid 'falling out' at the top of the manoeuvre; a loop led by the instructor had reportedly been "a little slow" at the top.

Other participants in the school reported that the instructor and student had been getting on well together, with no signs of tension or disagreement between them, or between them and other participants.

The student and instructor had flown on both preceding days, and the instructor had written notes on the pilot's

sortie report form. The first day's report contained no notes against the heading *'tailchase'*. The second day's report contained a comment against the heading *'tailchase'* which stated that a demonstration of a tailchase had been given, in the lead aircraft position, during which wingovers and barrel rolls had been carried out.

Parachutes

Both occupants wore parachutes. There was no evidence that either occupant had attempted to release his seat harness or abandon the aircraft.

A variety of makes of parachute, with different characteristics, were used by pilots attending the school. Some pilots were not aware of the characteristics of their parachutes. Some owners who had parachutes made in the former Soviet Union had disposed of these because of their weight and replaced them with parachutes of Western design.

Discussions with other participants in the school revealed that the use of these parachutes in this activity was not well understood. Group briefings had not included use of parachutes, minimum abandoning heights, or the relevant procedures. Some pilots had briefed their passengers on parachute use, but there was no evidence of such a briefing between the pilot and rear seat occupant of RA-3585K. One may have taken place unobserved.

Several participants were asked about the minimum heights at which an attempt to evacuate the aircraft would be successful. Some had not given consideration to the question, and various opinions were offered ranging between 1,000 ft and above 3,000 ft agl.

Some pilots involved in the school were concerned that if they abandoned their aircraft, it might then cause harm to persons or property when it crashed.

The AAIB report of an unconnected occurrence[3] during which a pilot successfully abandoned an aircraft at low height, stated:

> *'The pilot had frequently rehearsed the sequence of actions needed to be completed when abandoning the aircraft and was able to exit the aircraft very quickly; a factor which was significant in the successful outcome. Other pilots who wear parachutes may benefit from regular practice and rehearsal of aircraft abandonment drills.'*

Post-mortem examination

A specialist aviation pathologist who carried out post-mortem examination of both pilots found that the crash forces were outside the range of human tolerance and that both had suffered severe multiple injuries on impact. Whilst neither exhibited classical control-type injuries to their hands, the instructor had suffered ankle fractures which might indicate his feet were on the rudder pedals at impact. Toxicology results were negative other than for caffeine.

Aircraft instruments

RA-3585K had original instrumentation in both cockpits, including AGI-1K gyro horizon and DA-30 combined VSI and turn/bank indicator (Figure 1)

The gyro horizon differs from typical western instruments in two principal areas. The horizon ball within the instrument, the face of which is visible to the pilot, is light grey on its lower half and black on the upper; western instruments generally feature a blue upper half, which is relatively lighter, and a brown lower

Footnote

[3] D-FBBD and F-AZDP, reference EW/C2011/07/02, AAIB Bulletin 2/2012.

Figure 1

Instrument panel similar to that fitted to RA-3585K showing gyro horizon (top centre) and combined VSI and turn/bank indicator (top right)

half, which is darker. With the aircraft in inverted flight, and assuming that the gyro horizon had not toppled, the presentation may have looked similar to a western horizon in erect flight. Roll is depicted by motion of the miniature aircraft symbol, not the ball.

The combined VSI and turn/bank indicator has two needles. A solid white needle is read against the white scale inside the rim of the instrument to determine rate of climb or descent. The yellow and black needle is read against the yellow arc above it to determine turn direction and rate.

Spinning the Yak-52

Depending upon the direction of rotation of the engine and propeller combination, aircraft have a tendency to roll in one direction or other under the influence of the engine's torque. The direction of rotation of the Yak 52's engine and propeller induce a roll to the right.

A very experienced Yak-52 pilot and instructor was consulted about the accident spin.

Having viewed the video recording a number of times, he commented that the spin appeared to be a conventional inverted spin, and that from the aircraft's performance he was able to deduce that the controls were in a pro-spin position, as though the spin was executed intentionally. He added that in an inverted spin, even with the control column held fully forward, the spin stops when full opposite rudder is applied. He stated that to maintain an inverted spin, the controls must be held in pro-spin positions. Because of the engine torque, spinning to the left is more difficult to achieve than spinning to the right. He concluded that, assuming there was no malfunction or restriction to the flying controls, the spin entry was definitely either deliberate or the result of mishandling of the controls. This would have been consistent with an attempt to enter a roll from the near-inverted position

visible in the video recording. Had the throttle been closed and the controls centralised or released, the aircraft would not have entered the developed spin. He stated that height loss in a three turn inverted spin with an accurate recovery would be of the order of 2,500 ft.

He later commented:

'I have tried to replicate the entry into inverted spin that was captured on the video.

In the process of the half roll I was gently and progressively applying the left rudder and advancing the stick forward. By the time the aircraft was inverted the rudder was about 80% of the full travel to the left and the stick 80-90% fully forward. During all attempts there was no tendency for the aircraft to enter an inverted spin with this somewhat partial deflection of controls. In each and every case I had to "force" it into the manoeuvre by closing the throttle and applying full left rudder and moving the stick fully forward. The ailerons remained neutral. The timing between reaching the inverted attitude and beginning of the inverted spin was about 3-5 seconds. The development of the spin was normal and very similar to the one shown on the video.

Overall, in all cases the aircraft behaviour was completely usual and as I expected. Of course it is possible to have variations of the entry with different control inputs, for example, ailerons to both sides and different power settings. However, through all of my flying with the Yak-52, I never witnessed unexpected strong tendency of the aircraft to develop an inverted spin from inverted flight. The controls should be in a pro-spin position in order to induce the entry. A mishandled stall turn may lead to unexpected inverted spin; I've seen this a number of times. But there again, the rudder is normally fully to the right and the stick is fully forward and to the left. This is a different scenario.'

Regarding parachutes, he stated that the original Russian manual for the aircraft suggested 3,300 ft agl as a minimum abandon height, but that particular types and brands of parachute had their own, lower, limits. He reported that according to training he had received, the lowest minimum height for parachute exit was 180 ft agl[4] assuming a speed of 220 kph and immediate parachute deployment by hand; at 120 kph the height was 210 ft agl; using an automatic opening device set to 2 secs delay, the minimum height was 360 ft agl. He stated that he viewed the probability of successful parachute descent as being very high, but that in the Soviet Union, where he had learnt to fly the Yak-52, all pilots were required to make a parachute jump every year, which built confidence and minimised delay in action should parachute use be necessary while flying.

Engineering investigation

Accident site and initial examination

The aircraft had come to rest submerged in a small lake, approximately 30 metres from the shore. Examination of the wreckage by divers confirmed that the aircraft was lying inverted on the lake bed. The right wing had separated from the fuselage and the left wing had failed approximately eight feet from the wing root.

An initial examination of the aircraft was carried out after recovery from the lake. The engine mounting

Footnote

[4] All heights mentioned in this paragraph are approximate conversions from metric values.

structure had failed and the engine had been pushed back into the engine bay firewall and displaced to the left. The right wing structure had failed at the wing root and the adjacent fuselage structure was severely damaged. The damage to the fuselage structure had resulted in failure of the forward cockpit shoulder harness attachment structure.

The remains of the right wing exhibited significant leading edge damage and the right main landing gear was in the UP position. The right wing flap had been torn from its mounting structure. The left wing had failed immediately outboard of the flaps and the leading edge of the wing had been compressed and pushed upwards. The left wing flap and the left main landing gear were in the UP position. The continuity of the rudder and elevator control circuits was confirmed.

Sections of the aircraft's propeller had been recovered from the surface of the lake, one of which exhibited leading edge damage, consistent with the propeller blade striking a tree branch whilst rotating. Examination of the trees surrounding the lake failed to identify any areas of damage to their branches.

The aircraft fuel tanks had ruptured, and no fuel samples were recovered, but significant fuel contamination of the lake surface was apparent. The continuity of the engine throttle and propeller pitch control system was confirmed from both crew positions to the engine. Both throttle levers were in the fully forward (full power) position and the propeller pitch control selectors were in the FINE pitch position. No witness marks were found within ether system to confirm the position of these controls at impact.

Both occupants had been wearing parachutes and their harnesses, including the crotch strap, and the rudder pedal foot straps were securely fastened. The damage to the fuselage had resulted in failure of the forward cockpit shoulder harness mounting structure. One section of the mounting bracket for the rear cockpit shoulder harness had failed, releasing the right shoulder harness strap. The left shoulder harness strap had failed approximately 30 cm from its attachment point.

Detailed examination

Reconstruction of the aileron control circuits showed no evidence of a pre-impact restriction or defect. Damage to the aileron bell-cranks, located in the outer wings, was consistent with the application of a left wing down aileron input at impact. Examination of the flap selection and extension system confirmed that both flaps had been in the UP position.

Measurement of the propeller blade pitch angle indicated that the propeller blades had been close to the fine pitch position (14.5°) at the time of the impact. There was no evidence of a major malfunction within the engine; examination of the spark plugs showed no evidence of abnormal operation.

The impact forces and the failure of the engine mounting structure during the impact had resulted in significant damage to the engine accessories which prevented testing of the engine ignition systems, the propeller governor and the carburettor. Examination of these components did not identify any evidence of pre-impact defects.

Examination of the failed shoulder harness strap from the rear cockpit confirmed that it had failed in overload. No defects were identified with the material of the harness. Metallurgical examination of the rear cockpit shoulder harness attachment bracket did not identify any abnormalities in the bracket and confirmed that it had failed in overload. The seat harnesses and

attachments fitted to RA-3585K were designed to withstand loads up to 16 g. Post-mortem examination of the two occupants of the aircraft indicated that the impact forces were significantly in excess of this value.

Registration history of the aircraft

Shortly after purchasing the aircraft the owner moved it from the UK, and based it in the Netherlands. The aircraft was removed from the UK register and placed on the register of the Federation of Amateur Aviators of Russia as RA-3585K. This organisation issued a Certificate of Airworthiness for the aircraft on 30 January 2011.

Prior to bringing RA-3585K into the UK to undertake the training course, the owner applied to the UK CAA for approval to operate the aircraft within UK airspace. This application was approved based, in part, on the aircraft holding a current Certificate of Airworthiness.

Enquiries made to the Russian Federation by the AAIB during the course of this investigation have identified that the Federation of Amateur Aviators of Russia is not authorised by the Russian CAA to issue Certificates of Airworthiness for general aviation aircraft.

The issues relating to the registration of this aircraft will be dealt with in a separate AAIB study.

Analysis

Engineering

The damage to the aircraft was consistent with it striking the surface of the lake upright with a nose-down attitude of approximately 45° and the right wing low. Witness marks on the aileron control circuit indicated that attempts were being made to roll the aircraft into a "wings level" position at impact.

The impact forces resulted in the right wing and the outboard section of the left wing separating from the airframe. The damage to the fuselage caused by the separation of the right wing resulted in the failure of the forward cockpit shoulder harness attachment structure. The force of the impact exceeded the ultimate load of the rear cockpit shoulder harness and its attachment bracket and resulted in their failure.

There was no evidence of any pre-impact defect or restriction within the flight control systems, although the presence of a restriction could not be entirely ruled out.

Whilst the position of the engine and propeller controls at the time of impact could not be verified, there was no evidence of a failure or abnormal operation of the aircraft's engine, carburettor or the propeller governor. The video recording showed that the propeller was rotating as the aircraft entered the inverted spin. Although no estimation of the propeller's rotational speed at impact could be made, the fact that the propeller blades were close to the FINE pitch position indicated that the propeller rpm at impact was high.

Operation

The flight progressed uneventfully until, some time before the accident manoeuvre, the crew of RA-3585K lost visual contact with the preceding aircraft and broke away from the formation. The school had specified procedures which were to be followed by the pilots of the three aircraft. The crew of RA-3585K apparently mistook another formation of two aircraft for their own, and attempted to join it, before declaring a decision to return to North Weald without completing the planned exercises.

RA-3585K subsequently re-joined the correct

formation, and a decision was taken collectively to conclude the flight with a tailchase. The school's usual tailchase sequence was not followed, and the tailchase began with a series of four wingovers. Although it was not usual for the lead aircraft to be flown by the student, the student in this case was relatively experienced and executed the manoeuvres according to his instructor's commands.

The instructor in the lead aircraft recalled that the pull-up into the final wingover was not remarkable; the instructor in the third aircraft perceived it to have been sufficiently aggressive to have come to the conclusion that a loop was to be performed. If the pull-up was more aggressive than usual, it may have led to RA-3585K's speed being lower than usual, and rate of deceleration being greater, at the apex of the wingover.

The entry into the inverted spin was gradual and progressive, and not consistent with a flick manoeuvre resulting from a wake encounter, although participants in the formation school had experienced incipient spins in those circumstances.

Evidence from the experienced Yak-52 pilot and instructor suggested that pro-spin control inputs, at least of rudder and elevator, were necessary to achieve an inverted spin. While the engineering investigation did not rule out some form of control restriction, it is unlikely that one restriction would affect both controls at the precise moment that pro-spin inputs were being applied. The direction of roll into the spin was contrary to the direction in which a torque-induced roll would develop, so it is likely that the spin was entered because the controls were positioned to cause it.

The roll executed immediately after the apex of the wingover by the lead aircraft was not in keeping with the usual tailchase format, and may not have been expected by the crew of RA-3585K. As RA-3585K reached the apex of its wingover, in or close to an inverted position, with the speed low and reducing, the rolling manoeuvre flown by the lead aircraft may have caused momentary confusion. It is possible that control inputs were made by the pilot flying RA-3585K to roll the aircraft prematurely, or to pitch and roll the aircraft to maintain visual contact with the lead aircraft as it executed its roll.

It was not possible to determine whether the student or instructor in RA-3585K was handling the controls during the wingover.

If the student was flying the aircraft, it is possible that his limited experience in aerobatics and recovery from unusual attitudes contributed to a loss of control. This limited experience, and the presence of the more experienced instructor, may have prevented the student from ensuring that the flight remained comfortably within his abilities, or from taking control to prevent or recover from the departure from controlled flight. In that case, the outcome may have been different if an appropriate minimum standard of competence, especially in aerobatic manoeuvres or recovery from unusual attitudes, had been set for participant students.

If the instructor was flying the aircraft, it is possible that his limited experience in aerobatic flying in the Yak-52 and recovery from unusual attitudes in the type may have caused him to reach too low a speed at the apex of the wingover. Another instructor had discussed speed at the top of a loop with him in the briefing prior to the flight, highlighting that he had not pulled hard enough in that manoeuvre. This limited experience may also have delayed or prevented his recognition of the impending departure from controlled flight.

No training in handling the aircraft, in particular in recovery from unusual attitudes or spins, was provided to instructors. Training and experienced in handling the Yak-52 aircraft, particularly in recovery from unusual attitudes and spins, might have been beneficial in this regard.

The aircraft impacted the water in a dive following recovery from the inverted spin. Had the same recovery begun at sufficient height, the aircraft would not have impacted the water. The minimum height for tailchases chosen by the formation school provided a smaller margin for recovery than that used by the UK military.

If the students were intended to be in command throughout the exercises, and thus responsible for maintaining safe control of the aircraft throughout, it would be reasonable for steps to be taken to ensure that the aircraft were only manoeuvred within the students' own experience, ability, and confidence. The investigation did not identify any mechanism by which this was achieved.

Although the participating students were told that they remained in command throughout, they were expected to cede control to their instructors when the instructors requested it, and were aware that their instructors were generally much more experienced in aerobatic and formation manoeuvres than the students. Ambiguity as to who would control the aircraft may have delayed action to recover from the inverted spin.

Inverted spinning is known to be a disorientating experience, and the spin in this case continued for at least three turns. The student and instructor's lack of experience in inverted spinning may have delayed effective recovery action.

The gyro horizon and combined VSI and turn/bank indicator presented information in a different style to the instruments typically found in the aircraft with which the instructor was familiar. Had he consulted these instruments around the time at which the spin entry occurred, or endeavoured to determine the direction of spin from the turn co-ordinator, the presentations may have confused him or delayed his action.

It is unlikely that the spin entry was intentional because this was not consistent with the briefed exercise, would not have enabled continuation of the tailchase and given the entry height, would have been hazardous.

Although both occupants wore parachutes, there was no evidence of an attempt to abandon the aircraft and witnesses indicated that little attention had been paid by participants in the formation school to the use of parachutes. Had the occupants of RA-3585K attempted to abandon the aircraft when control was lost or shortly thereafter, fatalities may have been prevented. The AAIB has reported previously that pilots who wear parachutes may benefit from regular practice and rehearsal of aircraft abandonment drills.

The school advised the AAIB that it had introduced a number of measures in light of the accident, including:

- Compulsory aircraft abandonment practice drills for all participants, with a full briefing from the student to the instructor on the operation and operating envelope of the particular parachute used in the aircraft.
- A more formal and recorded method for establishing student previous experience.
- The minimum tail chase height has been increased to 3000 ft regardless of experience.

- Instructor training (in the form of lecture and discussion) on the spin (all modes) and low speed characteristics has taken place and refresher training will be conducted at each school.

- The main phase briefing on day one has been expanded to include a fuller discussion on the roles of the aircraft commander and the instructor.

Conclusions

The aircraft impacted a lake during the recovery from an inverted spin. No technical malfunction or defect was identified to account for the accident and it was not possible to determine which occupant was handling the controls during the spin entry or recovery. It is likely the spin entry was not intentional but began when the flying controls were placed into pro-spin positions with the aircraft inverted, at low speed and high angle of attack. Recovery may have been adversely affected by the occupants' unfamiliarity with the manoeuvre, ambiguity as to who had control, and flight instrument presentations. The aircraft impacted the lake before the recovery could be completed.

AAIB correspondence reports

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

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

The accuracy of the information provided cannot be assured.

ACCIDENT

Aircraft Type and Registration:	Airbus Industries A321-211, OE-LBF
No & Type of Engines:	2 CFM56-5B3/P turbofan engines
Year of Manufacture:	2001
Date & Time (UTC):	23 December 2011 at 1748 hrs
Location:	Manchester Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 6 Passengers - 182
Injuries:	Crew - None Passengers - None
Nature of Damage:	Skin damage to aft lower fuselage
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	13,182 hours (of which 5,534 were on type) Last 90 days - 123 hours Last 28 days - 52 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot, Occurance Reports and recorded flight data

Synopsis

The tail of the aircraft struck the runway during an approach and go-around in gusty conditions.

History of the flight

The accident occurred during a scheduled flight from Innsbruck in Austria to Manchester. The 1707 hrs ATIS report for Manchester gave a surface wind from 320° at 16 to 27 kt with scattered cloud and light rain showers. Reported visibility was 10 km and the temperature was 6°C. As neither of the flight crew had operated to Manchester before, they checked their company's briefing information regarding the airport. The only significant point gleaned concerned the runway profile.

The co-pilot was pilot flying. The aircraft was vectored for an approach to Runway 23R, with speed being reduced early in the approach for separation from preceding traffic. As the aircraft intercepted the localiser, the crew noticed a crosswind of about 40 kt, although the ATC reported surface wind was given as 320° at 12 kt. Initially, the approach was in smooth conditions, but the aircraft encountered turbulence as it descended through approximately 1,500 ft aal.

The co-pilot disengaged the autothrust system as briefed and, with turbulence increasing as the aircraft descended, the commander increased the approach speed target by 5 kt. Slightly below 1,000 ft, the

co-pilot disengaged the autopilot. Below 400 ft, he experienced increasing difficulty controlling the aircraft, having to apply full sidestick control on occasions. By about 100 ft the situation had become worse and shortly afterwards he initiated a go-around. TOGA[1] thrust was set and the co-pilot rotated the aircraft to an initial pitch attitude of 10° nose-up. Almost simultaneously, the crew sensed a severe downdraft which caused the aircraft to sink and the main gear to make contact with the runway.

A standard missed approach was flown and preparation made for a further approach, the co-pilot remaining as pilot flying. A 10 kt increment was applied to the target approach speed. The crew encountered similar conditions to those on the first attempt and noted a sudden negative windshear late in the final approach, giving a 10 to 15 kt speed loss. However, the aircraft continued to a normal landing.

During the Commander's external inspection after arriving on stand, he discovered damage to the lower rear fuselage skin and suspected that the aircraft had suffered a tail strike during the go-around manoeuvre. An engineering inspection confirmed that the aircraft would be unable to operate the return sector pending further maintenance action.

Occurrence reports

Reports were received from Manchester ATC and the Airport Authority. Manchester ATC reported that the incident occurred on a dark and windy night. At 1450 hrs that afternoon a 'weather standby' had been initiated due to the crosswind. This was a procedure for use when the weather conditions deteriorated to such an extent as to render the landing of aircraft more difficult. Under the weather standby procedure, the airport's Rescue and Fire Fighting service deployed to designated standby areas on the aerodrome. After the aircraft damage had been discovered, runway operations were suspended pending an inspection. This revealed ground marks typical of a tail strike in the area of runway abeam taxiway JA.

Recorded information

The Flight Data Recorder (FDR) showed that the autothrottle system was disengaged at about 2,000 ft radio altitude, and the co-pilot's sidestick commands began at 920 ft, which is consistent with the commander's recollection of when the autopilot was disengaged. From that point until established in the go-around, almost continual roll inputs were made, the largest of which were distributed equally about the zero input position. Below 170 ft the amplitude of 'roll right' inputs increased, with full roll command, both right and left, occurring shortly before the aircraft touched down.

At about the 70 ft the thrust levers were moved rearwards towards the idle position and both engine rpm reduced towards idle, followed by a large nose-down pitch demand. Very shortly afterwards, the thrust levers were advanced fully but the lag in engine acceleration meant that the engines were still accelerating towards full power when the aircraft touched the runway. Rate of reduction of radio altitude in the last 200 ft of the approach remained nearly constant. On touchdown the aircraft's pitch attitude was 9.8° (very close to that commanded by side stick input), with 0.7° roll to the right.

Data showed that the aircraft had been subject to an average 4 kt tailwind component during most of the approach, but that this became a 8 kt headwind component at approximately 100 ft.

Footnote

[1] Takeoff/Go-Around thrust.

Manufacturer's comments

The aircraft manufacturer confirmed that damage to the aircraft was consistent with the tail striking the ground. The damage occurred in an area which would be expected to be affected for an A321 at a high pitch attitude with the main landing gear struts compressed. The recorded pitch and acceleration values were consistent with this scenario. The manufacturer noted that, at the time an upwards trajectory was recorded, the aircraft pitch was about 9°, below the tail contact attitude of 11.2° with landing gear struts fully extended. Thus, it was concluded that the tail strike occurred at touchdown.

The manufacturer carried out a wind reconstruction. It was determined that most of the approach was conducted with an average tailwind of 4 kt, but that this changed at about 200 ft to an 8 kt headwind component. The wind changed again to a tailwind of about 8 kt, just as the go-around manoeuvre was initiated. The manufacturer considered that the combination of loss of energy due to the changing environmental conditions and slow acceleration of the engines from their near idle condition made runway contact unavoidable.

Discussion

The final sequence of events which lead to the tail strike appears to have been started with the change of relative wind experienced just before landing. This enhanced the aircraft's performance and was probably the reason the co-pilot reduced thrust and applied a nose-down pitch input, at the same time as applying up to full lateral control inputs. The aircraft's engines had quickly reduced to near idle rpm so the aircraft continued to sink despite the subsequently increasing pitch attitude, which may have accounted for the pilots' impression that the aircraft had been subject to a sudden downdraft.

ACCIDENT

Aircraft Type and Registration:	Agusta AW-109, M-EMLI
No & Type of Engines:	2 Pratt & Whitney Canada PW206C turboshaft engines
Year of Manufacture:	2001
Date & Time (UTC):	2 May 2012 at 1625 hrs
Location:	West London Shooting School, Northolt, Middlesex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Impact damage to rotor tips
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	37 years
Commander's Flying Experience:	2,099 hours (of which 162 were on type) Last 90 days - 22 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

On arrival at the landing site, the passenger, who was a helicopter pilot, requested that the aircraft be landed on a path to avoid damaging a lawn, which was "boggy". He said that he had established on a previous visit that there was sufficient clearance from a line of trees to the north-west. The pilot agreed to the request and also judged that there would be sufficient clearance. However, the rotor blades clipped a small branch of one of the trees while the helicopter was manoeuvring

The pilot believed he had allowed himself to be persuaded to take an inappropriate course of action. He would not normally have landed so close to obstacles and, although he saw the trees, he did not see the overhanging branch, which was not in leaf.

ACCIDENT

Aircraft Type and Registration:	Agusta A109S Grand, G-STGR
No & Type of Engines:	2 Pratt & Whitney Canada PW207C turboshaft engines
Year of Manufacture:	2006 (Serial no: 22027)
Date & Time (UTC):	4 May 2012 at 1842 hrs
Location:	Helsby, Cheshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Impact damage to tail rotor blades and damage to a fence
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	1,900 hours (of which 1,000 were on type) Last 90 days - 82 hours Last 28 days - 35 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Whilst manoeuvring for landing at a private helipad, the helicopter's tail rotor blades struck an adjacent fence. The pilot received no unusual cockpit indications and was unaware of the tail rotor strike until after shutdown.

History of the flight

After refuelling at Hawarden Airport, the helicopter departed for a flight to a private landing site at Helsby in Cheshire, with two crew members on board. The weather at the landing site was fine, with the surface wind estimated to be from 030° at 14 kt. The landing site was at an elevation of about 250 ft amsl and was a helipad on the roof of a private house, part of the construction of which was below ground level.

The helicopter approached from the south-west; the helipad was identified only late on the approach and trees immediately before it were noted. In the latter stages of the approach, the second pilot requested that the pilot break off the approach to reposition for an approach from the opposite direction, as this was the approach path which was to be used for a subsequent night landing. The pilot, therefore, flew a downwind approach from the north-east and established the helicopter in a 10 to 15 ft hover over the centre of the landing area. Keeping the edge of the building in sight as a reference, the pilot manoeuvred the helicopter over the helipad and turned it into wind for the landing.

After engine shutdown, it was discovered that the tail rotor blades had struck a fence, which ran adjacent to the western side of the helipad and would have been behind the helicopter after it had turned into wind. The pilot had experienced no unusual vibrations or cockpit indications. He recalled seeing the fence but reported that his attention was focussed on keeping the edge of the building roof in sight, whilst positioning over the helipad. He was not aware that the helicopter had struck the fence.

SERIOUS INCIDENT

Aircraft Type and Registration:	P84 Jet Provost T3, G-BKOU
No & Type of Engines:	1 Rolls-Royce Viper 10201 turbojet engine
Year of Manufacture:	1961 (Serial no: PAC/W/13901)
Date & Time (UTC):	28 March 2012 at 1145 hrs
Location:	RAF Wyton, Cambridgeshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - N/A
Injuries:	Crew - None Passengers - None
Nature of Damage:	Fire and heat damage to areas of the fuselage and jet pipe
Commander's Licence:	Private Pilot's Licence
Commander's Age:	69 years
Commander's Flying Experience:	11,970 hours (of which 450 were on type) Last 90 days - 8 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft engine did not relight following a planned in-flight shutdown, conducted during a post-maintenance flight test. A fire warning occurred and the appropriate emergency actions were carried out, after which the fire warning extinguished. The aircraft made a successful forced landing at RAF Wyton. Evidence was found of a fire in the region of the aircraft where the engine exhaust cone is joined to the jet pipe.

History of the flight

The aircraft was being flown to complete a flight test following minor control adjustments. Takeoff from North Weald was at 1100 hrs, with two experienced Jet Provost pilots onboard. Weather conditions were fine, with light westerly winds, good visibility and no low cloud.

The aircraft was climbed to FL200, initially, before being descended to FL100 to continue the test items. During this period, the crew were receiving a Lower Airspace Radar Service from RAF Cottesmore. The pilot in the left seat carried out a 'hot' relight at about 160 kt airspeed, with no adverse indications. The captain, flying in the right seat, then took control and prepared to carry out an engine shut-down and cold relight. With the engine shut down and the airspeed at 120 to 130 kt, the jet pipe temperature (JPT) indicated 20 to 30°C and the engine rpm was about 12%. The

relight was initiated by pressing the relight button and opening the HP fuel cock, but the JPT and rpm remained unchanged.

The right-seat pilot closed the HP fuel cock and both pilots confirmed the correct setting of the relevant controls and switches. A further relight was attempted, this time using the emergency relight switch, with non-essential electrics switched off. After 15 to 20 seconds, and still with no rise in the JPT or rpm, light smoke was seen rising in the cockpit in the vicinity of the left seat. The relight attempt was aborted and both pilots selected 100% oxygen to their masks.

While the crew attempted to determine the source of the smoke, the fire warning light illuminated. No smoke was visible trailing behind the aircraft but they decided to treat the warning as genuine, given the preceding events. Flight Reference Cards actions were carried out and, after the fire extinguisher had been discharged, the fire warning light extinguished. The left-seat pilot made a MAYDAY call before transferring to RAF Wyton ATC, in preparation for a forced landing at the air station.

The crew flew a standard forced landing pattern to Runway 26 at RAF Wyton, with the aircraft touching down about one third distance along the approximately 2,500 m runway. The aircraft was brought to a halt and the crew vacated the cockpit normally. The airport fire service attended but, with no indications of an ongoing fire, did not employ any extinguishing equipment. Subsequent inspection of the aircraft revealed 'sooting' inside the fuselage and jet pipe, with an area of paint scorching and blistering evident on the upper fuselage in the area of the engine cone / jet pipe join.

The aircraft captain noted that the relight attempts were continued for about 20 seconds, and that the JPT and rpm would normally begin to increase within 5 to 10 seconds of opening the HP fuel cock. The cockpit smoke was never thick enough to be a significant issue and eventually dispersed.

The aircraft's maintenance organisation advised that there appeared to be no pre-existing defect. It was considered likely that fuel had pooled in the area of the engine cone/jet pipe union during the relight attempts and had subsequently ignited. Although there is a fuel drain in that area, fuel may not drain effectively if the aircraft is in other than a level attitude.

ACCIDENT

Aircraft Type and Registration:	Cessna 177RG Cardinal RG, G-BBHI
No & Type of Engines:	1 Lycoming IO-360-A1B6 piston engine
Year of Manufacture:	1972 (Serial no: 177-0225)
Date & Time (UTC):	28 May 2012 at 1655 hrs
Location:	Newtonards Airport, Co Down
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to propeller tips, fuselage underside, radio navigational aid antenna and engine shock-loaded
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	56 years
Commander's Flying Experience:	1,798 hours (of which 26 were on type) Last 90 days - 83 hours Last 28 days - 16 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The owner pilot was flying with an instructor in order to regain his Certificate of Revalidation. Returning to the airfield, neither pilot noticed that the landing gear had not been selected down and the aircraft landed with it retracted.

History of the flight

The pilot, who had not flown since June 2011, was receiving instruction in order to regain his Certificate of Revalidation and IMC rating. On 28 May he flew as Pilot-under-Training (Pu/t) for 1 hour and 10 minutes with an instructor, covering general handling, stalls, practice forced landings and glide approaches to Runway 22 at Newtonards. In the afternoon he again flew as Pu/t but with a different instructor, performing similar exercises and concluding with an overhead join and standard circuit to a touch-and-go landing, again on Runway 22.

The pilot was not happy with his execution of the landing because of a crosswind and he asked to try another. However, rather than simply perform another circuit, he told the instructor that he would like to leave the circuit to perform some checks on the autopilot, which had been worked on recently. Accordingly, they left the circuit and tried the various autopilot modes, which appeared to show that there were still some problems with it. After spending some time trying

to resolve them, the instructor expressed his concern that they needed to get back to Newtonards before the airfield closed at 18.00 hrs.

As there was no other traffic, they joined the circuit on left base leg for Runway 22. Both the instructor and Pu/t stated that their attention was primarily focussed on the forthcoming crosswind landing, which appeared to be satisfactory, if a little low, up until the point of touchdown. As they rounded out, a loud scraping noise was the first indication that the landing gear was not extended – the aircraft slid on its belly for about 150 m before coming to a halt. There was no fire and both occupants exited the aircraft normally, the airfield fire service attending quickly.

Both pilots admitted that they had forgotten to extend the landing gear and believe that the major contributory factor was their concentration on handling the upcoming crosswind landing, particularly the fact that the approach was a little low. The instructor also said he may have been a little too relaxed due to his confidence in the abilities and experience of the Pu/t. A further factor was almost certainly the fact that G-BBHI was not fitted with an audio or visual configuration warning - later serial numbers of this model have such a device.

ACCIDENT

Aircraft Type and Registration:	Cessna F172M Skyhawk, G-BCOL
No & Type of Engines:	1 Lycoming O-320-E2D piston engine
Year of Manufacture:	1974 (Serial no: 1233)
Date & Time (UTC):	5 July 2012 at 1035 hrs
Location:	Netherthorpe Airfield, South Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Extensive
Commander's Licence:	Private Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	101 hours (of which 35 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot reported fine, calm conditions for takeoff, with a temperature of 20°C. Runway 24 was in use, a grass runway 553 m long with a takeoff run available of 490 m. The runway has an upward slope with an overall gradient of 1.9%. The grass was reported to be damp.

The aircraft had just undergone routine annual maintenance. The pilot carried out a thorough pre-flight check, including fuel tests, and determined that the fuel tanks were approximately three-quarters full. Pre-takeoff power checks were satisfactory and the pilot prepared for a short field takeoff, using 10° flaps.

The pilot felt that the aircraft was not accelerating as he was used to, but attributed this to the grass surface. He attempted to rotate the aircraft but it did not become airborne. It overran the runway and passed through a hedge before turning over and coming to rest inverted. The pilot secured the aircraft and followed his passenger out of the aircraft through the right entry door.

The pilot thought that the aircraft had failed to gain sufficient speed for takeoff. He attributed this to a combination of the damp grass, uphill runway slope and the possibility of a light tailwind component.

ACCIDENT

Aircraft Type and Registration:	Cessna T206H Turbo Stationair, G-KIKX
No & Type of Engines:	1 Lycoming TIO-540-AJ1A piston engine
Year of Manufacture:	2001 (Serial no T20608267)
Date & Time (UTC):	12 March 2012 at 1838 hrs
Location:	Challock, near Ashford, Kent
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Extensive damage to front fuselage and engine
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	903 hours (of which 1 was on type) Last 90 days - 43 hours Last 28 days - 26 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by AAIB

Synopsis

The pilot descended his aircraft below the safety altitude in failing light conditions and poor visibility. He was relying upon navigation data from a GPS unit, but had inadvertently programmed an erroneous destination into it. The GPS steering commands took the aircraft over higher terrain and, as the pilot applied power to arrest the descent, the aircraft struck the ground at an elevation of about 580 ft amsl, without the pilot gaining external references. Although the aircraft was substantially damaged, the pilot survived with minor injuries.

History of the flight

The pilot had been ask to go from his home airfield at Lashenden (Headcorn) in Kent to Tilstock Airfield in Shropshire, in order to collect G-KIKX and fly it back to Headcorn. Although he was involved in the decision about which day the flight should be made and had agreed to it, it was to be the pilot's seventh working day and was originally intended to be a day off.

The pilot caught a train to Shropshire at 0735 hrs and arrived at around 1320 hrs. He was not familiar with the aircraft and, when he examined its documents on arrival he found them incomplete. A delay was, therefore, incurred whilst the matter was resolved to the pilot's satisfaction.

The pilot completed his preliminary checks on the aircraft and noted that the fuel load of about 30 US gallons was less than he would require. He was

told he would be unable to obtain fuel at Tilstock but that he could refuel at Sleap Airfield (about 7.5 nm away). The pilot also noted that the GPS navigation unit had a defective screen in the area of the waypoint data entry field, which effectively obscured the first character, a defect which had been drawn to his attention during earlier type training. The pilot observed that great care had to be taken when entering waypoint data and that it was not possible to guarantee the accuracy of the entry by reference to the data field alone.

The pilot departed Tilstock some time before 1700 hrs for the short flight to Sleap. There, the aircraft was fuelled to full and the pilot took the opportunity to telephone his manager at Headcorn to check the weather. He was told that the weather was workable but that there was a bank of cloud to the east. The manager was not on the airfield at the time and advised the pilot to call the control tower at Headcorn for an accurate report. It was reported that no such call was received. Staff recalled that the airfield was under low overcast cloud that afternoon, although some circuit flying did take place up until 1657 hrs. From METAR and TAF reports, the pilot did not expect to encounter significant cloud as far as Gatwick Airport.

The pilot reported departing from Sleap for the VFR flight to Headcorn at 1710 hrs (although reports from Sleap put the time closer to 1720 hrs). The route described by the pilot was a minimum of 172 nm long. With sunset occurring at 1757 hrs, the landing was thus to be expected in twilight or at night, although the runway at Headcorn was not lit.

The flight for the majority of the route was uneventful and the pilot spoke to London ATC to obtain latest weather reports. The actual en-route weather was better than expected until reaching North Kent, by which time daylight was fading. The pilot had earlier confirmed his position over the Lamborne VOR/DME by joint use of the GPS and his VOR equipment. He then set the GPS to give direct navigation to Headcorn (entering, he thought, ICAO code 'EGKH') and noted that the resulting track and distance appeared correct.

The aircraft encountered increasing cloud until it was flying above an overcast layer. With an indicated 7 nm to run to the GPS destination, the pilot commenced a descent through cloud, aiming to fly not lower than 600 ft altitude (Headcorn Airfield is at an elevation of 72 ft amsl). In fact, he allowed the descent to continue slightly below 600 ft and, as he applied power, the aircraft struck terrain. The engine stopped abruptly and the aircraft pitched nose-down, sliding on its main wheels and forward fuselage for a short distance, before coming to rest.

The pilot, who was only slightly injured, vacated the aircraft quickly and telephoned the police, giving his position as north-west of Headcorn. He then returned to the aircraft to make it safe and await the police. When help had not arrived after about an hour, he re-powered the GPS and entered EGKH as the destination. This gave his position as about 8 nm north-east of Headcorn Airfield, not north-west as he reported to police.

The aircraft had crashed on a relatively flat piece of terrain, at an elevation of about 580 ft amsl. Its position was just a few hundred metres from Challock gliding site, elevation 600 ft amsl, with the ICAO identification EGKE. (The safety altitude in the area was 2,400 ft, based on a mast up to 1310 ft elevation, 16.5 nm north-west of Headcorn).

Pilot's assessment of the cause of the accident

In his report, the pilot identified a number of significant events and situations leading up to the accident. It had occurred at the end of a relatively stressful day

which itself came at the end of a long working week. He therefore considered that fatigue had played a part. Although the pilot was aware that the weather and late departure presented a potential problem, he had not identified a suitable alternate airfield in case landing at the unlit Headcorn Airfield was not possible. As the aircraft neared Headcorn and encountered deteriorating weather and rapidly failing light conditions, pressure to complete the flight increased and resulted in poor decision making.

Finally, the pilot had relied on the GPS for position information for his let-down through cloud. When he subsequently reviewed the events of the day, he thought it likely that he had made a GPS input error, through a combination of equipment deficiency, fatigue and time pressure, and that he had erroneously selected Challock gliding site as the desired GPS destination waypoint instead of Headcorn.

Search and Rescue activity

At 1838 hrs the Distress and Diversion Cell at London Air Traffic Control Centre (Military) received signals from the aircraft's emergency locator beacon through a receiver near Ashford in Kent. The appropriate search and rescue authorities were notified, although the origin of the signals was unknown at that stage. It was subsequently established that the pilot had been in contact with Kent police, but as he was unsure of his position, the police requested assistance to trace the aircraft. A replay of recorded radar identified the aircraft, which was tracked to a position about 7.5 nm north-east of Headcorn, heading south-east towards Ashford. At 2120 hrs, Kent police advised that the aircraft and pilot had been located.

Further enquiries

Further information, provided to the AAIB by other personnel connected with the aircraft, indicated that it had been made clear during a demonstration flight and required differences training, prior to the ferry flight, that the GPS unit, in which the navigation database had expired, was not useable and, if required, pilots should use a portable GPS unit.

Publications

In its Introduction, the CAA's General Aviation Safety Sense Leaflet 25, entitled *Use of GPS*, states:

> *'Unless specifically approved for particular purposes, such [GPS] equipment is only to be used as an aid to other forms of navigation.'*

Elsewhere, it also states:

> *'The GPS system has generally shown exceptional reliability, but it has been known to suffer technical and human failure. Consequently,* ***GPS must not be relied upon as a sole navigation reference in flight-critical applications****. Common sense dictates that pilots should not only familiarise themselves with the techniques required to use the system properly, but understand how it could go wrong and prepare for the unexpected.'*

AAIB comment

The pilot's report identified a number of links in this accident 'chain', any one of which could have been 'broken' to avert the accident or make it less likely. These included the initial planning of the flight, the lack of preparedness of the aircraft for flight, the acceptance of the aircraft, inadequate flight planning and the late departure.

The pilot could have delayed the flight to the following day. In the event, he embarked on the flight in an unfamiliar aircraft, in weather that was less than ideal, with an ETA after dark at an unlit airfield, without a planned alternate destination and in a fatigued state.

The pilot thus placed himself under mounting pressure as the flight progressed, culminating in a descent significantly below the safety altitude, without visual references, using the GPS as the prime means of navigation. It is likely that the pilot inadvertently selected EGKE (Challock) as the destination, instead of EGKH (Headcorn), resulting in a track which took the aircraft over much higher terrain than the pilot realised. Because the two airfields were so close, the track and distance generated by the GPS were not grossly in error and were therefore less likely, without thorough pre-flight preparation and good positional awareness, to have been noticed. Nevertheless, the decision to descend was the primary cause of the accident.

ACCIDENT

Aircraft Type and Registration:	DH82A Tiger Moth, G-AOHY
No & Type of Engines:	1 De Havilland Gipsy Major MK 10-1 piston engine
Year of Manufacture:	1939 (Serial no: 3850)
Date & Time (UTC):	24 May 2012 at 1345 hrs
Location:	Wickenby Airfield, Lincolnshire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Damage to propeller, wings and tail section, engine shock-loaded
Commander's Licence:	Private Pilot's Licence
Commander's Age:	68 years
Commander's Flying Experience:	15,093 hours (of which 23 were on type) Last 90 days - 44 hours Last 28 days - 20 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft was approaching a grass landing area of restricted length with an inoperative airspeed indicator. It became low on final approach and struck standing crops immediately before the landing area, pitching forward and coming to rest inverted. Although experienced, the pilot had limited recent training or experience on type.

History of the flight

The purpose of the flight was to provide a trial lesson. Apart from a little haze, the weather conditions were fine, with a surface wind from 050° at 10 kt. Wickenby had two paved runways, orientated 03/21 and 16/34. G-AOHY was to operate from a triangular shaped area of grass formed in the northern angle between the runways, which provided a landing distance of about 200 m.

During the pilot's pre-flight preparation, he was somewhat distracted by the discovery that the aircraft's compass ring was missing, which left the aircraft without a useable compass. During takeoff, the pilot's attention was entirely outside the cockpit and he did not realise that the needle of the airspeed indicator had detached and was lying loose inside the instrument, leaving only the needle stub with which to estimate airspeed.

With no other nearby airfields suitable for a grass landing, the pilot prepared for an approach to the grass area at Wickenby. The approach was made at an estimated 54 kt, the pilot being aware that he could not afford to be too fast with only a restricted landing area and in an aircraft without wheel brakes. The aircraft became low on the approach in the latter stages and, despite the pilot applying full power, the landing gear struck standing crops at the edge of a field immediately before the landing area.

The aircraft pitched nose-down and came to rest inverted, just clear of the crops. The propeller was destroyed and damage was sustained to the wings and tail section. There was no damage to the open cockpit area and the two occupants were able to escape the aircraft. The airfield fire and rescue crew responded immediately, joined later by the civil emergency services.

Although very experienced, the pilot observed that he had limited experienced on the Tiger Moth. He had originally flown it in 1964 and had only a brief conversion back to type in 2010. Since that time he had flown only 12 hours on type at irregular intervals, and had carried out only one landing on type in the eight months prior to the accident. The pilot considered that his lack of currency on type and limited recent training were contributory factors in the accident.

ACCIDENT

Aircraft Type and Registration:	Enstrom 280FX Shark, G-OJMF
No & Type of Engines:	1 Lycoming HIO-360-F1AD piston engine
Year of Manufacture:	1999 (Serial no: 2086)
Date & Time (UTC):	8 February 2012 at 1425 hrs
Location:	Manchester Barton Airport
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Tail rotor; rear fuselage and left landing gear skid
Commander's Licence:	Private Pilot's Licence
Commander's Age:	38 years
Commander's Flying Experience:	3,905 hours (of which 3,890 were on type) Last 90 days - 33 hours Last 28 days - 23 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB examination of tail rotor bearing

Summary

The pilot experienced a lack of tail rotor authority and elected to do a run-on landing at Manchester Barton. The helicopter veered after landing and the tail rotor struck the ground. The lack of tail rotor control was due to the separation of the flange on the tail rotor pitch change bearing.

History of the flight

The pilot was conducting a navigation exercise when, at the first turning point, he experienced a "feeling of lack of full tail rotor authority". More specifically, there was no response to left pedal inputs. He conducted a gentle turn to the right and elected to return to the airfield, which was approximately 20 nm distant, and transmitted a PAN call on arrival. He decided to conduct a run-on landing on grass Runway 14. Although the initial touchdown was straight, the helicopter veered to the right and encountered rough, frozen ground at the side of the runway. This caused the helicopter to bounce on its skids such that the tail rotor struck the ground prior to coming to a halt. As a result the tail rotor assembly, together with the rear of the tail boom, were damaged (see Figure 1). The pilot was uninjured.

The investigation

Before the aircraft was moved, it was noted that the yaw control cable on the left side of the tail boom had been

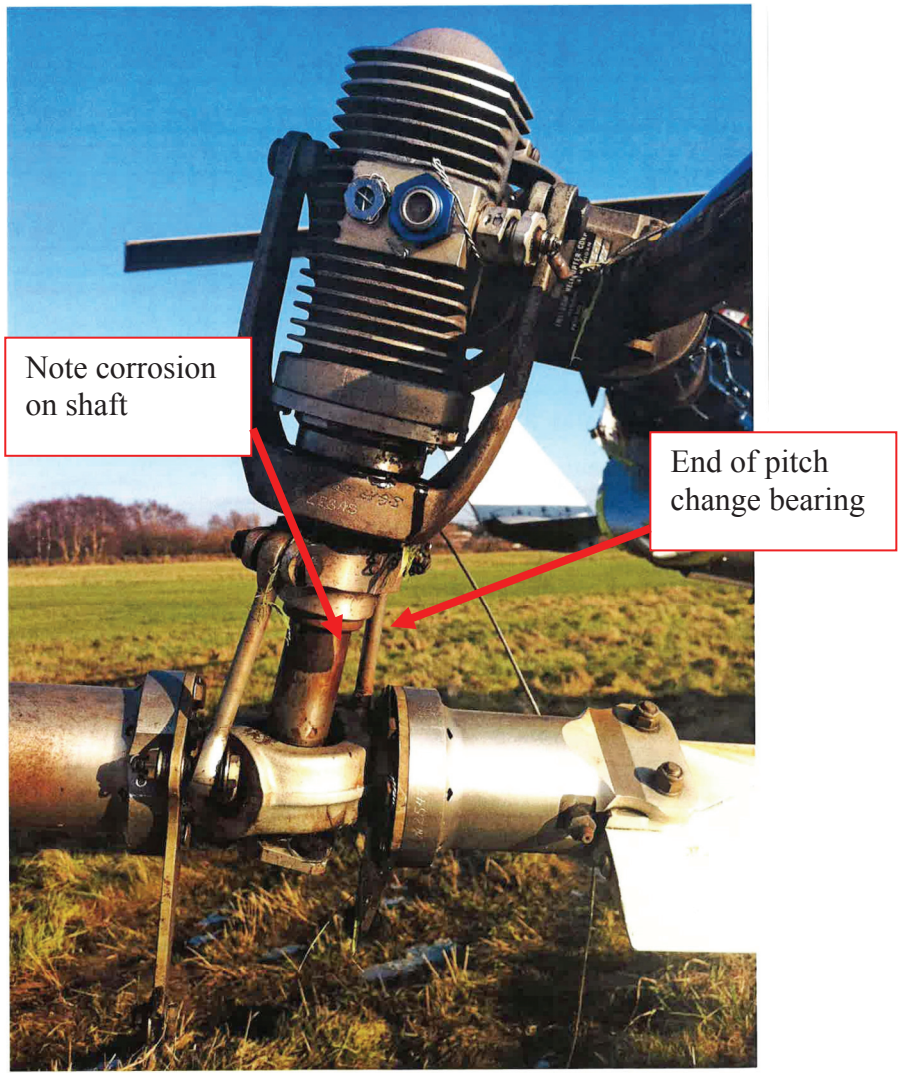


Figure 1

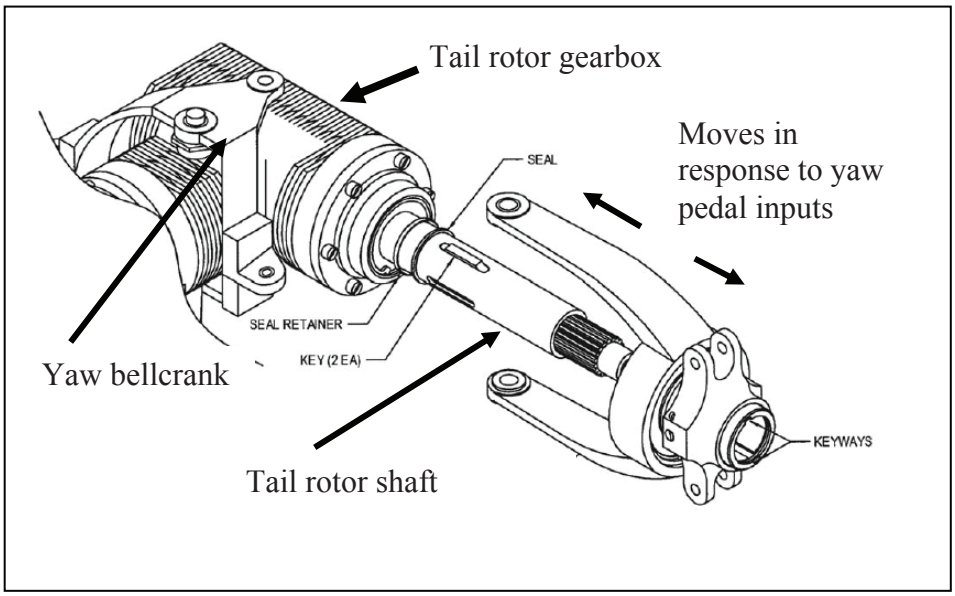
Tail rotor assembly after the accident

severed. The helicopter manufacturer commented that they were aware of rare occurrences of cables being severed in flight, but only during violent manoeuvres. In this case it was concluded that the cable was cut as a result of the damage sustained during the landing.

After disassembly of the tail rotor it was observed that that the flange on the inboard end of the bronze pitch change bearing had broken off and was missing. Figure 2 shows the salient details of the tail rotor drive and pitch control components.

The pitch change bearing is keyed to the tail rotor shaft. It is also pinned to the pitch link retainer such that both components rotate with the tail rotor shaft whilst contained within the bearing housing assembly. The pitch link retainer is connected to the yaw controls and moves axially along the shaft in response to yaw pedal movements.

It was immediately apparent that the flange on the inboard end of the pitch change bearing had broken away and was missing. The separated portion would have to have broken into several pieces in order *not*



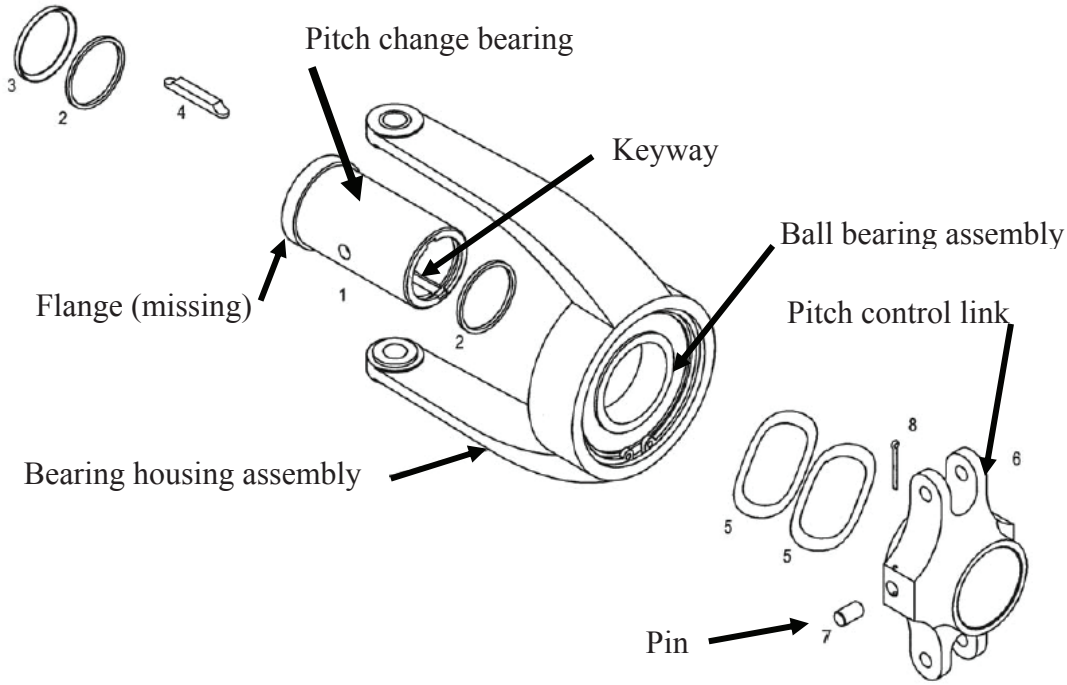


Figure 2

Tail rotor pitch control details (adapted from illustrated parts catalogue)

to have been retained on the shaft. The helicopter manufacturer stated that they were unaware of any previous bearing failures of this nature.

The remaining part of the bearing was sent to the AAIB where it was subjected to a metallurgical examination.

Bearing investigation

The bearing, which was manufactured from sintered bronze, was examined under a microscope and the fracture face was found to be covered with grease-like deposits, with the staining more prominent over

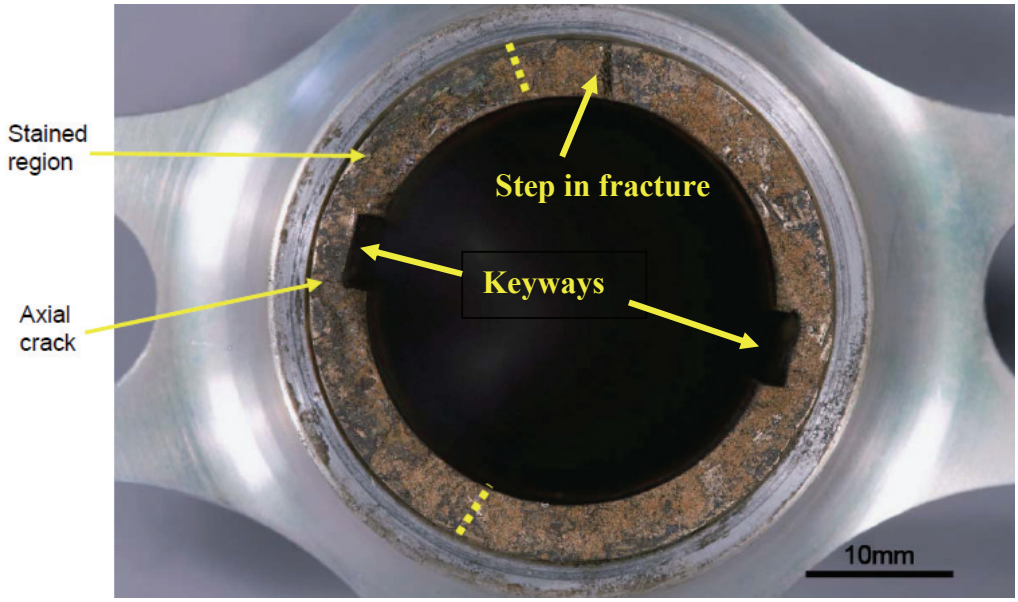


Figure 3

View of bearing fracture face

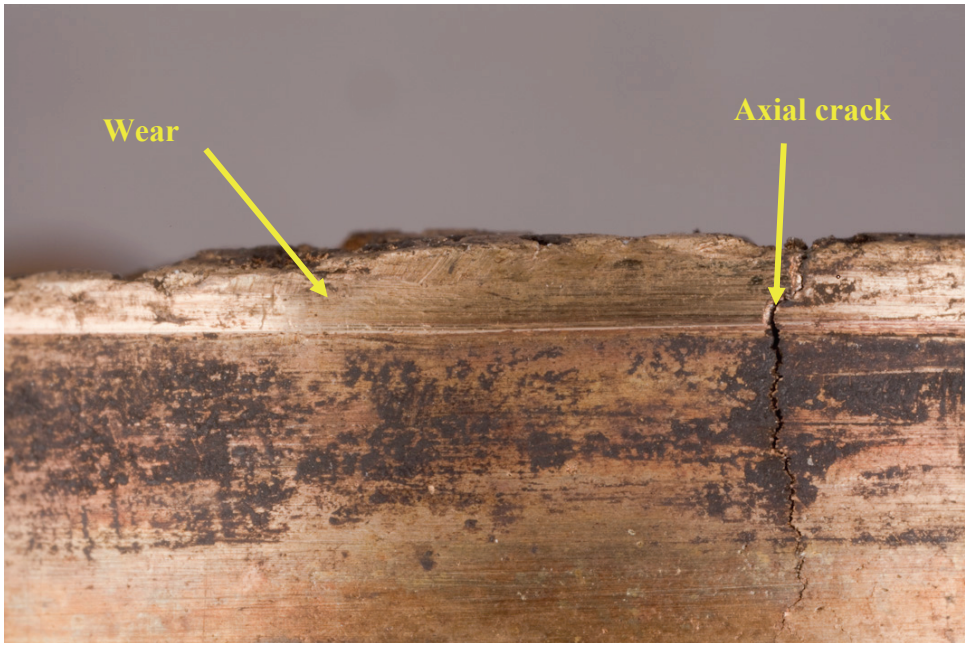


Figure 4

View of bearing outer surface, showing crack and wear mark

approximately one-third of the circumference; this was still evident after being cleaned. A detailed visual inspection revealed the presence of a crack in a corner of one of the keyways within the stained region of the fracture. This had propagated through the wall thickness of the bearing and extended axially for approximately 5 mm. The crack is just visible in Figure 3, with a further view of it on the outer wall of the bearing in Figure 4. There was also a step in the fracture, close to one end of the clean region, as shown in Figure 3.

The crack progression ran from top to bottom (Figure 4), so the crack origin was likely to be in the missing flange portion of the bearing. The wear band extended around approximately one third of the bearing circumference and was coincident with the stained region on the fracture surface. (Note: The outer surface of the bearing is in contact with the inner surface of the bearing housing, within which it rotates, during operation.)

Scanning Electron Microscope (SEM) examination of the fracture surface

Sintered bronze is manufactured via a powder metallurgy process using an elemental mixture of primarily copper and tin. This involves heating to a temperature below the melting point of copper but above that of tin, resulting in a bonded alloy. However the individual particles remain identifiable within the microstructure, such that sintered material has a high porosity, typically 20-25%. For bearing applications the pores are filled with lubricant, usually under a vacuum. The helicopter manufacturer stated that the bearing material specification was oil-impregnated AMS 4805.

The SEM examination revealed different features between the fracture surfaces of the stained and clean regions. Whilst the fracture was intergranular (ie following the surface of the powder particles) in both cases, ductile dimples, consistent with overload failure, were visible in patches in the clean areas, where adjacent particles had bonded. In contrast, the fracture surface within the stained region was masked by corrosion products, with an absence of ductile dimpling. There was insufficient evidence in this area to determine the mode of crack growth. Photographs of the fracture surfaces of the two regions are shown in Figures 5a and 5b.

Energy dispersive X-ray (EDX) analysis was carried out within the stained region of the fracture to determine the elemental composition of the corrosion deposit. This revealed the presence of chlorine, which is corrosive to bronze. A comparative analysis conducted on the clean area revealed that the main elements present were copper, tin and iron, which is consistent with AMS 4805. It was concluded that the chlorine was likely to have come from atmospheric moisture.

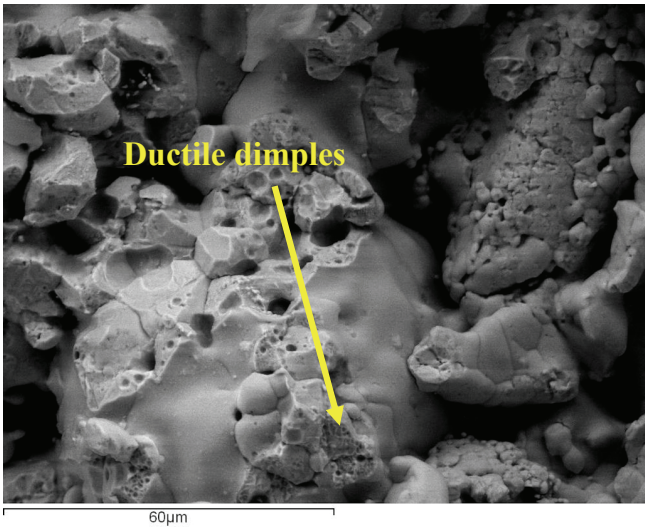


Figure 5a

Fracture surface in clean area

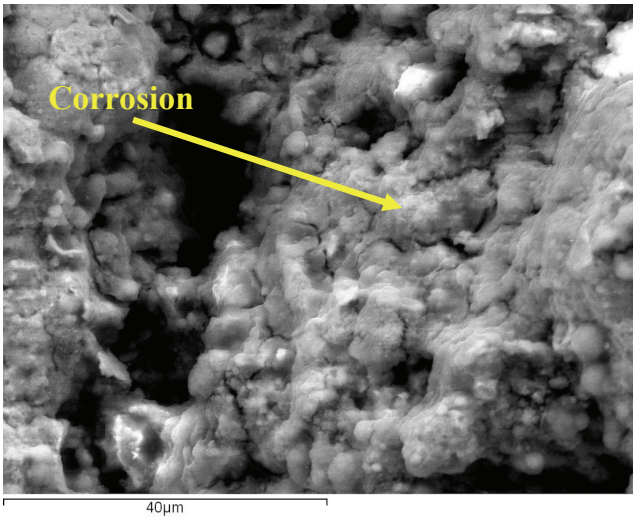


Figure 5b

Fracture surface in stained area

Finally, an assessment was made of the density and porosity of the bearing material. The dimensions of a small piece of the material was accurately measured and weighed. A further check was conducted by means of the measurement of displaced water which led to figures of 6.21 and 6.25 gm/cm^3 respectively. The porosity was assessed by measuring the areas of void on a polished cross section and this was determined to be 31%.

Other information

According to the helicopter's maintenance organisation, G-OJMF had achieved 570 operating hours since new (in 1999) and was parked outside at its operating base. No significant corrosion problems were reported, although an area of corrosion had developed on the tail rotor drive shaft, as can be seen in Figure 1.

The maintenance organisation confirmed that the tail rotor blades were the original components, as fitted at build. There was no record of any disturbances to the tail rotor assembly, other than normal servicing.

Discussion

The available evidence indicated that the tail rotor pitch change bearing had suffered an in-flight failure, in which an integral flange at the inboard end had detached. The flange normally abuts the inboard shoulder of the ball bearing assembly and is thus pulled along the tail rotor drive shaft in an inboard direction in response to a left yaw pedal demand. The absence of the flange would result in the remaining part of the bearing (which is pinned to the pitch control link) being left at a location on the shaft defined by the aerodynamic/dynamic neutral position of the tail rotor. However, a right yaw pedal input would cause the outboard shoulder of the ball bearing assembly to push directly on the pitch control link, thereby changing the pitch of the blades. This scenario accords with the pilot's report of being able to yaw the aircraft only to the right.

The bearing failure is likely to have had its origin in a crack that initiated somewhere on the flange. This progressed in an outboard direction, along the line of a key slot, before branching in a circumferential direction. It was not possible, in the absence of the flange fragments, to determine why the crack occurred. Sintered bronze is specified for its suitability for use in bearings and, in this application, is unlikely to be subjected to significant axial loads. An event such as a tail rotor strike could have resulted in bearing damage but since the rotor blades had not been changed since new, this was discounted. Additional possible explanations could include a material flaw, or an excessive load resulting from a violent yaw pedal input. The latter seems improbable unless there was a resistance arising, for example, from the inner race of the ball bearing assembly becoming temporarily seized to the pitch change bearing due to corrosion following a period of inactivity.

The aircraft had averaged around 50 flight hours per year and was hangared outside so corrosion related problems might be expected. Regardless of the causes of the crack initiation, corrosion featured in the crack progression. The metallurgical examination suggests that approximately one-third of the bearing circumference was cracked prior to the incident flight. The other two-thirds of the fracture was consistent with ductile overload and exhibited little evidence of corrosion, suggesting that this fracture had been a more recent event, probably occurring during the incident flight. The step observed within the overload region of the fracture is most likely the result of two crack fronts, propagating on different planes, coming together. Overload cracks are likely to have propagated from

either end of the stained region, travelling in opposite directions around the bearing until meeting and causing the step.

The wear band that was visible over part of the external wall of the bearing, adjacent to the fracture, was also difficult to explain, although is possible that it occurred following the flange detachment, which resulted in some rotational eccentricity.

ACCIDENT

Aircraft Type and Registration:	Europa, G-EOFS
No & Type of Engines:	1 Rotax 914-UL piston engine
Year of Manufacture:	1999 (Serial no: PFA 247-13033)
Date & Time (UTC):	7 June 2012 at 0930 hrs
Location:	Nayland Airfield, Suffolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Serious)
Nature of Damage:	The aircraft was extensively damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	309 hours (of which 255 were on type) Last 90 days - 9 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft landed further into the runway than planned, with excess speed and in tailwind conditions. The pilot initiated a go-around but the aircraft failed to climb, struck a hedgerow and crashed. The aircraft was extensively damaged and both occupants were injured, one seriously. There was no fire.

History of the flight

The aircraft had taken off from Beccles Airfield for a flight to Nayland, about 39 nm away. On board were the pilot and a passenger. The pilot had not landed at Nayland before and was aware that the 600 m grass runway must be landed on in an uphill direction (Runway 32), owing to its steep slope. Because of this, the pilot had prepared for the flight by visiting the airstrip and talking to a locally based pilot.

The weather was dry and generally fine, with good visibility and scattered cloud. The surface wind at Nayland was from 160° at about 12 kt, giving an estimated tailwind on final approach to Runway 32 of between 10 and 15 kt. Final approach was flown with full flap set and the airspeed at about 60 kt. As the aircraft neared the runway, it experienced sink and the pilot applied power, arresting the descent. The flight path was regained but the aircraft also gained about 10 kt of airspeed. Touchdown occurred further along the runway than was intended and at a faster speed. As the aircraft crested the top of the slope, the pilot decided that there was insufficient distance remaining in which to stop safely, so he decided to abort the landing.

The pilot applied full power and the aircraft became airborne. However, it only reached a height of about 15 to 20 ft before starting to sink slowly. Concentrating on the area ahead, the pilot felt unable to look inside the cockpit to move the flap control to the go-around setting of 15°, so the flaps remained at full. The aircraft continued at a very low height towards a hedgerow and the pilot attempted to clear it by applying a large amount of rearward control column. The tail or landing gear struck the hedgerow and the aircraft continued towards a concrete retaining wall running along the far side of a private driveway.

The pilot realised that he did not have the performance to clear the wall and, manoeuvring the aircraft to avoid hitting it, the right wingtip struck the ground. The aircraft yawed, crashed onto the driveway and came to rest facing back towards the airstrip. The pilot turned off the fuel and vacated the aircraft by the door, before helping his passenger to escape. The pilot pulled his passenger, who was more seriously injured, to a safe distance and returned to secure the aircraft. There was no fire.

All the emergency services attended the scene and the passenger was taken to Colchester Hospital, where he was found to have suffered broken bones and multiple lacerations. The pilot attended hospital later with smaller lacerations, grazing and a neck injury.

The pilot considered that the aircraft may have been affected by an increasing tailwind as it became airborne at the crest of the hill. He felt that a combination of the tailwind, low airspeed and relatively high aircraft weight had contributed to the accident. He reflected that it would have been prudent to have discontinued the landing attempt in the prevailing tailwind conditions.

ACCIDENT

Aircraft Type and Registration:	Jabiru J430, G-HJZN
No & Type of Engines:	1 Jabiru Aircraft PTY 3300A piston engine
Year of Manufacture:	2012 (Serial no: LAA 336-15049)
Date & Time (UTC):	30 June 2012 at 1551 hrs
Location:	Kenyon Hall Airstrip, Cheshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to wings, engine mounts and nose landing gear
Commander's Licence:	Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	2,566 hours (of which 50 were on type) Last 90 days - 30 hours Last 28 days - 12 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Summary

The aircraft drifted to its left after takeoff and the left wing struck trees adjacent to the airstrip. The aircraft yawed rapidly left into the tree line. Neither occupant was injured.

History of the flight

The pilot had flown to the airstrip at Kenyon Hall from Barton airfield (City Airport Manchester) on the morning of the accident with two passengers on board. Over the next few hours he flew G-HJZN three times from the strip with various other members of his flying club as passengers. The grass airstrip is 580 m long by 30 m wide and orientated 05/23. The weather on the day was showery, with a light surface wind, generally from the south-west.

The wind was calm for his final departure and the pilot opted for takeoff in the north-easterly direction. The pilot and one passenger were on board. The aircraft became airborne before the halfway point but, soon after liftoff, drifted to the left towards a line of trees. The pilot banked to the right to correct, but the left wing struck the trees, causing the aircraft to yaw rapidly left into the tree line. The aircraft came to rest approximately 45° nose-down in a ditch, resting on crushed tree branches. The cockpit area sustained damage when a tree branch broke the windscreen, but the two occupants, who were uninjured, were able to vacate the aircraft through their respective doors. The emergency services subsequently attended, and each occupant was examined by ambulance staff.

The pilot thought the aircraft may have been subject to an unexpected wind variation which had led to the flight path deviation soon after liftoff.

ACCIDENT

Aircraft Type and Registration:	Jabiru J430, G-RDCO
No & Type of Engines:	1 Jabiru Aircraft PTY 3300A piston engine
Year of Manufacture:	2004 (Serial no: PFA 325-14052)
Date & Time (UTC):	23 May 2012 at 1530 hrs
Location:	Binstead Airstrip, Isle of Wight
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to the landing gear
Commander's Licence:	Private Pilot's Licence
Commander's Age:	64 years
Commander's Flying Experience:	358 hours (of which 205 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft departed from Sleap Airfield in Shropshire for a flight to an airstrip at Binstead, on the Isle of Wight, with just the pilot on board. Fuel tanks were full on departure, to cater for a round trip without refuelling. The grass strip at Binstead was 400 m long and orientated north-south. The pilot had flown to the strip on three previous occasions, each time landing in a southerly direction. On this occasion, having obtained permission to land from the strip owner, the pilot was advised, before takeoff, that the northerly direction was preferable for landing, and that there was only a light surface wind of less than 5 kt.

On arrival at the airstrip, the pilot confirmed that the surface wind was light but was unable to confirm the wind direction as there was no wind sock or other means of assessing it. The approach to the airstrip was straightforward but the aircraft landed longer than the pilot intended and he was unable to stop it overrunning the end of the strip by about 10 m. The aircraft continued into a field of crop stubble, causing damage to its landing gear.

ACCIDENT

Aircraft Type and Registration:	Jodel D18, G-JRKD
No & Type of Engines:	1 Aeropower VW 2074cc piston engine
Year of Manufacture:	1995 (Serial no: W177)
Date & Time (UTC):	23 May 2012 at 1321 hrs
Location:	Old Sarum Airfield, Wiltshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Minor)
Nature of Damage:	Extensive damage to forward fuselage and wings, propeller broken
Commander's Licence:	Private Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	243 hours (of which 40 were on type) Last 90 days - 2 hours Last 28 days - None
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft's engine started misfiring soon after takeoff, accompanied by a drop in rpm. There was insufficent height available to make a suitable landing field, and the aircraft landed in a pig farm. It struck a pig shelter on landing and overturned. Neither occupant suffered serious injury.

History of the flight

The aircraft had flown on the morning of the accident with no reported incident. The pilot arrived at the airfield at lunchtime and prepared the aircraft for a local flight, with the aircraft owner as his passenger. There was a light north-westerly wind, with good visibility and a temperature of 26°C. The grass Runway 24 was in use.

The engine was still warm from the previous flight and, after some initial difficulty, it started and ran normally. Engine performance during ground checks was satisfactory. Immediately after liftoff on the takeoff roll, the aircraft sank back onto the runway, landing firmly on its main wheels. When the aircraft had accelerated further, the aircraft lifted off once more and the pilot attempted to establish a normal 60 kt climb.

Soon afterwards, the engine started to sound rough. The pilot noticed that engine rpm was falling, and selected the electric fuel pump on, but the engine did not recover. He lowered the aircraft nose to maintain 50 kt IAS and identified a field ahead and slightly to the left for a forced

landing. He transmitted a short radio call announcing the problem and his intention. It very soon became apparent that the aircraft was too low to reach the chosen field and that it was descending quickly towards a pig farm. There was only time for a small course correction before the aircraft touched down and the left wing collided with a pig shelter. The landing gear seemed to strike an obstacle and the aircraft pitched nose-down, turning over and coming to rest upside down.

Neither occupant suffered serious injury. The canopy would not open but both occupents were able to exit the aircraft via the roof, once the panel was removed.

The pilot observed that the engine appeared to have started misfiring loudly, which he thought could have been due to an ignition or fuelling fault, and that the volume of the misfire did not reduce with reducing rpm. He also did not rule out carburettor icing. There had been insufficient time to attempt a restart or secure the engine prior to the forced landing.

ACCIDENT

Aircraft Type and Registration:	Pulsar, G-LWNG
No & Type of Engines:	1 Rotax 582 piston engine
Year of Manufacture:	1992 (Serial no: PFA 202-11866)
Date & Time (UTC):	8 March 2012 at 1330 hrs
Location:	Grove Farm Airstrip, Leicestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to nosewheel strut and engine support mount
Commander's Licence:	Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	1,271 hours (of which 11 were on type) Last 90 days - 4 hours Last 28 days - 0.7 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Summary

Whilst landing at an unfamiliar airstrip, the pilot slightly undershot the runway threshold, resulting in damage to the nosewheel strut and engine support mount.

History of the flight

The aircraft had departed Wellesbourne Airfield in good weather conditions, with a light, north-easterly wind at 5-7 kt. After letting down into a right-hand circuit for Runway 29 at Grove Farm, the pilot decided to overfly the runway in order to assess the condition of the surface, as he had never landed there before.

On the next approach the pilot stated that, in order to land at the start of the 350 m runway, he cut the power a little early, which resulted in the aircraft touching down in the field before the runway. The surface was level, with a short crop and with no discernible boundary between the field and the runway. However, as the aircraft rolled onto the runway the pilot felt a sharp jolt. He continued to taxi the aircraft to the hangars where, after shutting down, he discovered that the nose landing gear strut was bent and the lower engine cowling was distorted in the region of the attachments of the lateral engine supports.

The pilot subsequently inspected the area in which he had touched down and discovered that a ridge of soft soil approximately 150 mm high ran across half the runway width at the 29 threshold. The remaining half of the threshold was level with the field. The pilot had not seen the ridge prior to his touchdown in the undershoot area.

ACCIDENT

Aircraft Type and Registration:	Pulsar XP, G-BUZB
No & Type of Engines:	1 Rotax 912 piston engine
Year of Manufacture:	1993
Date & Time (UTC):	22 May 2012 at 1530 hrs
Location:	Private airstrip near Lymm, Cheshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to left landing gear, propeller and fuselage underside
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	199 hours (of which 7 were on type) Last 90 days - 15 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft was landing on a 500 m long grass airstrip. The strip was orientated east-west and the surface wind was westerly at about 10 kt, the windsock indicating that it was blowing directly along the strip. Upon touchdown, the left landing gear seemed to receive a small 'thump' and the aircraft rolled to an abrupt stop in about half the usual landing distance, during which it pitched forward onto its nose. The propeller broke and the engine, which was at idle power, stopped. The pilot secured the aircraft and vacated normally.

It was evident that the left landing gear leg had failed and that the wheel no longer tracked correctly. The pilot surmised that the leg had been subject to an undetected sideways load or that the wheel had caught a rut or hole at touchdown. However, there had been no appreciable crosswind and a strip inspection revealed no obvious irregularities.

ACCIDENT

Aircraft Type and Registration:	Reims Cessna FRA150L Aerobat, G-PHLY
No & Type of Engines:	1 Continental Motors Corp O-240-A piston engine
Year of Manufacture:	1973 (Serial no: 0214)
Date & Time (UTC):	10 June 2012 at 0940 hrs
Location:	Netherthorpe Airfield, South Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Extensive damage to airframe and engine
Commander's Licence:	Private Pilot's Licence
Commander's Age:	17 years
Commander's Flying Experience:	75 hours (of which 75 were on type) Last 90 days - 6 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the flying school, including a statement by the pilot

Synopsis

The aircraft failed to become airborne while taking off up-slope in light winds at close to maximum takeoff weight. It overran the runway and came to rest inverted but neither occupant was injured.

Description of the event

The pilot intended to conduct a local flight from Netherthorpe airfield, carrying one passenger. Runway 24 was in use, which is a grass runway, 553 m long with a takeoff run available of 490 m. The weather was suitable, with broken cloud cover, good visibility and a surface wind from 200° at 5 kt. Runway 24 has an uphill gradient of 1.9%, and it was reported that some other aircraft had taken off on Runway 06.

With all normal checks completed satisfactorily, the pilot commenced the takeoff run. At 60 kt he pulled back on the control column and the aircraft became airborne for a short while before sinking back onto the runway. The pilot applied full wheel brakes but could not prevent the aircraft leaving the end of the runway. It struck a hedge and turned over, coming to rest on its back. The pilot assisted his passenger out of the aircraft and then vacated the aircraft himself.

According to supplied weight and balance information, the aircraft would have been close to its maximum takeoff weight. It was reported to have been configured correctly, with wing flaps at 10°. A performance

calculation carried out at the AAIB indicated that the aircraft was capable of taking off with the recommended safety margins within the distance available, although performance would have been reduced by the uphill gradient.

The flying club's Chief Flying Instructor commented that the accident was probably due to an incorrect takeoff technique, combined with a delayed decision to abandon the takeoff attempt.

ACCIDENT

Aircraft Type and Registration:	Robinson R44 II Raven II, G-ROAD
No & Type of Engines:	1 Lycoming IO-540-AE1A5 piston engine
Year of Manufacture:	2007
Date & Time (UTC):	18 June 2012 at 2030 hrs
Location:	Private site near Corby, Northamptonshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	One rotor blade damaged
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	3,000 hours (of which 401 were on type) Last 90 days - 4 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The helicopter was being manoeuvred at a private landing site prior to departure. The pilot lifted the helicopter to an approximate 8 ft hover height and taxied at about 5 kt towards a gap between trees. The pilot's attention was mainly on a tree on the left side and, in trying to ensure adequate clearance from it, a rotor blade clipped the branch of a tree on the right side.

ACCIDENT

Aircraft Type and Registration:	Slepcev Storch, G-BZOB
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2004 (Serial no: PFA 316-13592)
Date & Time (UTC):	5 July 2012 at 1020 hrs
Location:	2 miles west of Manchester Barton Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to main landing gear, exhaust and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	60 years
Commander's Flying Experience:	1,325 hours (of which 7 were on type) Last 90 days - 19 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft had flown into Manchester Barton Airport from Warrington Airfield. It remained on the ground for about 40 minutes before taking off again for the return flight with the pilot and a passenger on board. Shortly after takeoff, the engine began to misfire, and this continued for about 30 or 40 seconds before the engine stopped. The only available choice of fields for landing was one with a standing barley crop in it. The aircraft suffered damage during the landing in the field, but remained upright and the two occupants were uninjured. The pilot reported that he had changed the selected fuel tank at Barton and considered the problem to be fuel-related.

ACCIDENT

Aircraft Type and Registration:	Zenair CH250 Zenith, G-RAYS
No & Type of Engines:	1 Lycoming O-320-B2C piston engine
Year of Manufacture:	2006 (Serial no: PFA 113-10460)
Date & Time (UTC):	25 May 2012 at 0836 hrs
Location:	Sywell Aerodrome, Northamptonshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to the left main landing gear, nose landing gear, left wing flap, engine and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	64 years
Commander's Flying Experience:	160 hours (of which 35 were on type) Last 90 days - 5 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft was landing on Runway 03L, which has a concrete surface, at Sywell Aerodrome. The weather was fine but with a fresh easterly surface wind of 15 kt. The pilot reported encountering a gust of wind close to touchdown and that the aircraft landed first on the left main wheel. The left main landing gear collapsed and, as the aircraft slewed to the left onto the adjacent grass, the nose landing gear also collapsed. The pilot and his passenger were both wearing lap straps and diagonal shoulder harnesses. Neither was injured and both vacated the aircraft in the normal manner.

ACCIDENT

Aircraft Type and Registration:	EV-97 TeamEurostar UK, G-CDTU
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2005
Date & Time (UTC):	27 May 2012 at 1400 hrs
Location:	Arclid Airstrip, near Sandbach, Cheshire
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to nosewheel, fuselage underside, wingtip, engine cowling, propeller and main wheel fairings
Commander's Licence:	Student
Commander's Age:	49 years
Commander's Flying Experience:	29 hours (of which 29 were on type) Last 90 days - 29 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The student pilot was landing on Runway 20 as part of a qualifying cross-country exercise. The wind was from 120º at 8 to 9 kt. He rounded-out smoothly with right rudder applied to correct for drift caused by the crosswind. On touchdown he held the stick back and centred the rudder in preparation for lowering the nosewheel. At this point the aircraft weathercocked to the left, possibly due to a gust. When he tried to compensate by applying right rudder, he found that it was ineffective due to the low speed and, with the nose still raised, the aircraft ran off the left side of the runway and into a ploughed field. The rough ground bent the nosewheel back and the propeller struck the ground.

The student said he had learned to lower the nose earlier to maintain control as rudder effectiveness decreases.

ACCIDENT

Aircraft Type and Registration:	Mainair Blade, G-MYTU
No & Type of Engines:	1 Rotax 582-2V piston engine
Year of Manufacture:	1994 (Serial no: 1011-1094-7-W808)
Date & Time (UTC):	29 May 2012 at 1315 hrs
Location:	Private strip near Wolvey, Warwickshire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to landing gear, propeller, wing tip and 'A' frame
Commander's Licence:	Private Pilot's Licence
Commander's Age:	58 years
Commander's Flying Experience:	4,011 hours (of which 29 were on type) Last 90 days - 46 hours Last 28 days - 24 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The microlight was being flown on a training flight to practise visual circuits, with an instructor and student on board. The student occupied the front seat. The 345 m grass runway at the private airstrip was orientated 15/30, with the north-westerly direction in use. The surface wind was light and variable, mainly from the west to north-west, and visibility was good with no significant weather.

It was the fourth takeoff, and the microlight became airborne within half of the runway length. Just after becoming airborne, it drifted to the right and the wing struck adjacent standing crops. This caused the microlight to yaw rapidly to the right, damaging the right wing tip and landing gear. Only one blade of the propeller was damaged, which the pilot thought indicated that the engine was not producing full power when it struck the ground. Although damage to the microlight was significant, neither occupant (both of whom were wearing safety helmets) was injured.

The instructor thought that the student's right foot had slipped off the throttle at a critical stage of takeoff. He had been unable to correct the situation in the short time before the microlight drifted and struck the crops.

ACCIDENT

Aircraft Type and Registration:	Pegasus Quantum 15-912, G-CCFT
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2003 (Serial no: 7961)
Date & Time (UTC):	13 June 2012 at 1710 hrs
Location:	Farm strip near Bourne, Lincolnshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to wing, propeller, trike and pod
Commander's Licence:	Private Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	331 hours (of which 133 were on type) Last 90 days - 9 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft landed on the right hand edge of the private airstrip and struck adjacent standing crops. It suffered extensive damage but the two occupants were uninjured.

History of the flight

The accident occurred on landing after a local flight. Conditions were calm and stable, with a very light easterly wind and occasional light rain showers from overcast cloud. The pilot flew an approach to the northerly of two private airstrips at the farm landing site. The airstrip ran between two standing crops with corn of 2 ft to 3 ft height to the right and a shorter crop to the left.

The approach was mostly made at idle power, so shortly before landing the pilot "blipped" the throttle to warm the engine and ensure proper response. The pilot noticed that the aircraft was lined up with the right hand edge of the strip, but felt he could correct this before landing. However, as the aircraft approached the flare point, it was still lined up with the right hand side.

The pilot started to make a late correction towards the centre of the strip but realised quickly that this manoeuvre would be dangerous so close to the ground, so he levelled the wings and pushed the control bar forward. The aircraft ran into the crops and decelerated rapidly, coming to rest with the trike on its left side and

the wing crumpled. The engine had stopped running during the accident sequence.

The pilot and passenger vacated the aircraft uninjured. Both had some difficulty disconnecting their headset leads and the pilot had to remove his helmet. After a short time he returned to turn off the fuel and electrics.

An inspection by the pilot of the landing strip showed that the aircraft had touched down on the right side of the strip and the right wheel had touched the crops, causing the aircraft to yaw to the right and into further contact with them. The pilot described an approach to the strip which had been leisurely and undemanding. He thought he had become too relaxed, to the extent that he had ceased to exercise positive control of the aircraft or make the decision to fly a timely go-around.

ACCIDENT

Aircraft Type and Registration:	Rans S6-ES Coyote, G-CCTX
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2004 (Serial no: PFA 204-14143)
Date & Time (UTC):	22 May 2012 at 1330 hrs
Location:	Brimpton Airfield, Berkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to nosewheel, propeller, engine mount, radiator, cowling, windscreen and rudder
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	96 hours (of which 68 were on type) Last 90 days - 46 hours Last 28 days - 10 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft had taken off from Membury Airfield and was landing at Brimpton Airfield. The pilot confirmed that grass Runway 07 was in use by looking at the 'T' in the signals square. On final approach he found that there was a crosswind of about 10 kt from the left. The aircraft made a heavy landing and bounced twice, before the pilot elected to go around. On the second approach, which was well executed, the aircraft touched down on its mainwheels first but, when the nose was lowered, the nose landing gear collapsed and dug into the ground, flipping the aircraft onto its back.

The pilot, who was uninjured, managed to climb out unaided and raised the alarm. He assumed that the first, heavy, landing had damaged the nose landing gear which failed on the second, normal, touchdown.

ACCIDENT

Aircraft Type and Registration:	Rans S6-ES Coyote II, G-BYCN
No & Type of Engines:	1 Rotax 582-48 piston engine
Year of Manufacture:	1999
Date & Time (UTC):	9 May 2012 at 1730 hrs
Location:	Causeway Airfield, Northern Ireland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to nose landing gear and propeller blades
Commander's Licence:	Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	328 hours (of which 210 were on type) Last 90 days - 12 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft had taken off for a routine local flight covering the North Antrim Coast. The weather conditions were good with light winds. Returning to land on Runway 34, the pilot used full flap as usual, but noted that the rate of descent was less than expected and he thought he would land long. He explained this to the passenger and then flew a go-around. The second approach was successful but the aircraft floated further down the runway than normal, touching down on the main wheels with the nosewheel raised.

As the nose started to lower, with the speed reducing to about 20-25 mph, the aircraft hit a bump in the runway and was lifted into the air. As it settled back onto the runway on all three wheels, it encountered another bump which lifted the nose sharply upwards before dropping again, bending the nosewheel fork and allowing the propeller to strike the grass. The aircraft came to a halt and the pilot and passenger disembarked normally. The pilot was of the opinion that the bumpy nature of the runway was responsible for the accident; occurring at low speed meant that pitch authority to try and correct the situation was limited.

ACCIDENT

Aircraft Type and Registration:	Rans S6-ES Coyote II, G-MZMS
No & Type of Engines:	1 Rotax 582-48 piston engine
Year of Manufacture:	1998
Date & Time (UTC):	24 May 2012 at 1800 hrs
Location:	Chase Farm Airstrip, near Chipping Sodbury, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	64 years
Commander's Flying Experience:	112 hours (of which 85 were on type) Last 90 days - 3 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot was intending to land at the airstrip which has a grass runway running approximately east-west. Having made two approaches to the west which had been abandoned because of a number of sheep at the westerly end of the runway, his third attempt was to be on the easterly runway, hoping to touch down after the sheep (there was effectively zero wind). The final attempt was initially at an angle to the centreline, intending to turn right at a late stage for the actual touchdown. This was to avoid a copse situated close to the threshold.

The pilot misjudged the aircraft's proximity to the trees and it struck one of the trees with its left wing, causing the aircraft to spin to the left and impact the ground close to the runway threshold. Despite severe damage to the aircraft, the pilot was uninjured.

ACCIDENT

Aircraft Type and Registration:	Rotorsport UK Calidus, G-CGLY
No & Type of Engines:	1 Rotax 912 ULS piston engine
Year of Manufacture:	2010
Date & Time (UTC):	20 May 2012 at 1428 hrs
Location:	Field near Falmouth, Cornwall
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to rotor mast fairing, roll control cable and one rotor blade
Commander's Licence:	Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	365 hours (of which 103 were on type) Last 90 days - 19 hours Last 28 days - 14 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and verbal report from the gyroplane manufacturer

The gyroplane was on a local flight from Perranporth, on Cornwall's north coast. Only the pilot was on board, and the weather report, obtained from Perranporth Airfield, gave a northerly wind of 12 kt, good visibility and broken cloud at 3,500 ft with no significant weather.

While flying on a northerly track back towards Perranporth, the pilot flew a 360° steep turn, during which he experienced a loss of engine power. He selected an attitude for straight and level flight and identified a field ahead in which to make a forced landing. The pilot did not see that there were small power lines running across the near boundary of the field. During the approach the gyroplane struck the power lines, causing damage to the main rotor mast fairing, but subsequently landed safely.

The gyroplane was returned to the manufacturer for assessment and repair. The engine performed normally under test and no faults or conditions were found which could have contributed to a loss of engine power.

ACCIDENT

Aircraft Type and Registration:	Skyranger 912(2), G-CCBJ
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2004 (Serial no: BMAA/HB/262)
Date & Time (UTC):	25 May 2012 at 1055 hrs
Location:	Shuttleworth (Old Warden) Aerodrome, Bedfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Damage to engine and propeller, undercarriage and tail
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	141 hours (of which 37 were on type) Last 90 days - 14 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot carried out a standard overhead join for Runway 03 at Old Warden. The weather was generally fine, with a forecast surface wind from 090º at 10 to 15 kt. Whilst overhead, the pilot saw the windsock and estimated that the surface wind was blowing from about 030º, in line with the runway. He flew a normal circuit and approach, but encountered rough air as he crossed the threshold, which caused the aircraft to roll to the left. The pilot applied full power, full opposite aileron and right rudder, but was unable to correct the situation before the aircraft struck the ground to the left of the runway. The airfield fire and rescue service attended the scene and the pilot, who was wearing a full harness and who suffered only a minor injury, was able to vacate the aircraft through the left door.

The pilot considered that the windsock had not been showing the true, steady wind when he viewed it from the overhead, but had been indicating a temporary gust. The actual wind was mainly blowing across the runway from the right.

ACCIDENT

Aircraft Type and Registration:	X'air Falcon 700(1), G-CFIP
No & Type of Engines:	1 HKS 700E piston engine
Year of Manufacture:	2007 (Serial no: BMAA/HB/540)
Date & Time (UTC):	7 March 2012 at 1157 hrs
Location:	Private airstrip near Kilkeel, Northern Ireland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	The aircraft was extensively damaged
Commander's Licence:	Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	6,791 hours (of which 30 were on type) Last 90 days - 36 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot and weather information supplied by the Met Office

Synopsis

The pilot initiated a diversion to a private airstrip to refuel but this became a weather diversion as conditions deteriorated. A strong westerly wind was blowing across the north-south airstrip, creating turbulence at low level. The pilot discontinued two approaches, due to wind and turbulence, and lost control on the third landing attempt. The aircraft crashed adjacent to the airstrip and the pilot suffered serious injuries.

History of the flight

The pilot reported that his planned flight from Granard Airfield in County Longford, Republic of Ireland, to Newtownards Airfield, in Northern Ireland to the east of Belfast, had been delayed from the previous day due to unfavourable weather. On the day of the flight, the forecast visibility was good with medium level cloud and, although the forecast wind was still strong (averaging 20 kt, the pilot reported), it was a westerly and therefore considered favourable.

Having checked the actual weather conditions at the Belfast and Dublin Airports, on the morning of the flight up to the time of his departure, the pilot was also contacted by the aircraft owner in Northern Ireland, who passed him a wind speed at Newtownards of 14 kt, good visibility and small amounts of cloud at 2,900 ft. The pilot decided the weather was suitable for the planned flight.

The aircraft was fuelled with 32 litres of fuel. The pilot was advised that this reduced fuel load was in consideration of the expected degraded takeoff performance from the runway at Granard, which was described as 'soggy', with the initial 100 m unuseable due to waterlogging. The pilot would have preferred a full load of 57 litres and was concerned that the fuel may be insufficient, but a private airstrip at Kilkeel was identified as an en-route alternate airfield for fuel if required.

The aircraft took off from Granard at 1053 hrs. The pilot had two possible routes in mind and had decided to make a final decision on which to take once airborne. He initially set a course towards Newry but, on seeing stormy weather conditions close to his intended track and being unsure of how much fuel had been used, decided to divert to Kilkeel. His revised route took the aircraft north of Dundalk towards the coast, then across the entrance to Carlingford Lough, keeping higher ground to the north and west. Crossing the lough, wind speed appeared to increase and turbulence became severe, so the pilot began to view Kilkeel as a weather diversion instead of a technical stop for fuel.

The grass airstrip at Kilkeel was about 320 m long and orientated north-south. The airstrip was on the coastal plain, at an elevation of about 90 ft amsl. With a considerable westerly wind blowing, the pilot commenced an approach to the northerly runway but was forced to discontinue it at a late stage when he encountered severe turbulence. He then positioned the aircraft for an approach to the southerly runway but had to discontinue that too because of the gusty wind and turbulence. He then positioned for the third approach, again to the northerly runway, in what he felt were less windy conditions.

At about 30 ft above the ground on short finals, the pilot sensed an increase in wind speed and turbulence. The aircraft began a roll to the right, which the pilot was unable to correct with aileron. He considered that a go-around was not possible due to the angle of bank and available engine power. His last recollection was of the aircraft rolling about 90° to the right and seeing the ground rapidly rising to meet him through the forward windscreen.

The aircraft crashed in the foundations of a partly built house. Despite suffering serious injuries, the pilot quickly extricated himself from the wreckage and was joined by eyewitnesses who administered first aid. One of the witnesses, who had seen the aircraft shortly before the accident, described it appearing to struggle in the strong wind and, seemingly, hovering in the air. The weather conditions deteriorated immediately after the accident, with heavy hail falling.

An eyewitness reported the accident to the Northern Ireland Fire and Rescue Service who arrived on scene at 1220 hrs.

In his report, the pilot noted that he had initially underestimated the strength of the wind, based on the windsock at the airstrip, and believed the winds were in the region of 15 kt. The crosswind limit placarded in the cockpit was 25 kph/15 mph (about 13 kt). He also noted that he had failed to appreciate that deteriorating weather was approaching rapidly from the west, which may have added to the levels of turbulence and led to unusual wind effects.

Meteorological information

The AAIB obtained aviation forecast material, issued by the UK Met Office the evening before and early on the day of the accident, that was available on-line

for flight planning purposes. The area was situated in a strong westerly airflow behind a cold front which ran from North Wales to the Lake District and south-east Scotland. Until mid-morning, good visibility was forecast, reducing to 5,000 m in occasional showers of rain, snow and hail. An area of worsening weather to the north-west was forecast to encroach on the intended route by about midday. In this area, in addition to the previously mentioned weather, isolated heavy thunderstorms and hail were forecast, with visibility reducing to 2,000 m or even 1,000 m in snow showers.

Very strong westerly winds of up to 45 kt at 1,000 ft had blown through the area overnight and were affecting northern England early on the day of the accident. The forecast winds along the intended flight were from 280º at 30 to 35 kt at 1,000 ft amsl, increasing to 40 kt at 2,000 ft.

Conclusion

At the time of the accident, the airfield at Kilkeel, with its north-south runway and forecast crosswinds of 30 to 35 kt only 1,000 ft above the runway, was an unsuitable diversion for a light aircraft with a 13 kt crosswind limit. Several factors contributed to the accident, beginning at the flight planning stage, when forecast weather conditions for the intended route were available. The pilot was eventually faced with a landing in conditions outside the aircraft's normal operating limits.

ACCIDENT

Aircraft Type and Registration:	Yates JS MW6 (Modified) Merlin, G-MVTD
No & Type of Engines:	1 Rotax 503 piston engine
Year of Manufacture:	1992
Date & Time (UTC):	15 April 2012 at 1600 hrs
Location:	Otherton Airfield, Staffordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Front wheel and front forks
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	64 years
Commander's Flying Experience:	N/K hours (of which 13 hours were on type) Last 90 days - 13 hours Last 28 days - N/K hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries

Synopsis

The microlight aircraft was on a check flight for the Permit to Fly revalidation. After takeoff the engine lost power and the pilot carried out a forced landing. The aircraft landed in a field, just short of the Runway 34 threshold at Otherton Airfield. There were no injuries but the aircraft sustained damage to the nosewheel.

History of the flight

The aircraft was on a check flight for the purposes of revalidating the Permit to Fly. While climbing through 700 ft after takeoff, the engine lost power and the pilot carried out a forced landing. The aircraft landed in a field, just short of the Runway 34 threshold at Otherton Airfield. There were no injuries, but the aircraft sustained damage to the nosewheel. The aircraft had been in storage for several years although the engine had been recently overhauled. An engineering inspection had been performed by an LAA Inspector as part of the Permit to Fly revalidation.

Immediately prior to the incident, the pilot had performed "bunny hops" on the runway, followed by a twenty-five minute flight and a further takeoff and landing. The engine performed normally throughout.

Subsequent examination of the aircraft revealed that a fuel strainer, normally attached to the outlet at the bottom of the fuel tank, was loose in the tank and was also clogged with a "tar-like" substance. The pilot

considered that the aircraft may have been stored with fuel in the fibreglass tank, leading to degradation of the tank material, blockage of the strainer and subsequent fuel starvation. He considered that the fuel strainer may have come loose during removal of the tank.

Miscellaneous

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

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

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

1/2010 Boeing 777-236ER, G-YMMM at London Heathrow Airport on 17 January 2008.

Published February 2010.

2/2010 Beech 200C Super King Air, VQ-TIU at 1 nm south-east of North Caicos Airport, Turks and Caicos Islands, British West Indies on 6 February 2007.

Published May 2010.

3/2010 Cessna Citation 500, VP-BGE 2 nm NNE of Biggin Hill Airport on 30 March 2008.

Published May 2010.

4/2010 Boeing 777-236, G-VIIR at Robert L Bradshaw Int Airport St Kitts, West Indies on 26 September 2009.

Published September 2010.

5/2010 Grob G115E (Tutor), G-BYXR and Standard Cirrus Glider, G-CKHT Drayton, Oxfordshire on 14 June 2009.

Published September 2010.

6/2010 Grob G115E Tutor, G-BYUT and Grob G115E Tutor, G-BYVN near Porthcawl, South Wales on 11 February 2009.

Published November 2010.

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

Published November 2010.

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

Published December 2010.

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

Published September 2011.

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

Published November 2011.

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