AAIB
Air Accidents Investigation Branch

AAIB Bulletin 8/2018

TO REPORT AN ACCIDENT OR INCIDENT
PLEASE CALL OUR 24 HOUR REPORTING LINE

01252 512299

Air Accidents Investigation Branch
Farnborough House
Berkshire Copse Road
Aldershot
Hants GU11 2HH

Tel: 01252 510300
Fax: 01252 376999
Press enquiries: 0207 944 3118/4292
http://www.aaib.gov.uk

AAIB investigations are conducted in accordance with Annex 13 to the ICAO Convention on International Civil Aviation, EU Regulation No 996/2010 and The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 2018.

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

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

AAIB Bulletins and Reports are available on the Internet
http://www.aaib.gov.uk

Published 9 August 2018

Cover picture courtesy of Stephen R Lynn
(www.srlynnphotography.co.uk)

ISSN 0309-4278

Published by the Air Accidents Investigation Branch, Department for Transport
Printed in the UK on paper containing at least 75% recycled fibre

CONTENTS

CONTENTS Cont

AAIB CORRESPONDENCE INVESTIGATIONS Cont

SPORT AVIATION / BALLOONS Cont

UNMANNED AIRCRAFT SYSTEMS

None

MISCELLANEOUS

ADDENDA and CORRECTIONS

List of recent aircraft accident reports issued by the AAIB

(ALL TIMES IN THIS BULLETIN ARE UTC)

AAIB Field Investigation Reports

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

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

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

ACCIDENT

Aircraft Type and Registration:	Piper PA-28RT-201 Cherokee Arrow IV, G-BHAY	
No & Type of Engines:	1 Lycoming IO-360-C1C6 piston engine	
Year of Manufacture:	1979 (Serial no: 28R-7918213)	
Date & Time (UTC):	11 September 2017 at 0956 hrs	
Location:	Wolferton, Norfolk	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Fatal)	Passengers - 1 (Fatal)
Nature of Damage:	Engine front fuselage, wings and landing gear severely disrupted	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	58 years	
Commander's Flying Experience:	1,129 hours (of which 406 were on type) Last 90 days - 15 hours Last 28 days - 10 hours	
Information Source:	AAIB Field Investigation	

Synopsis

The aircraft was en route from London Southend Airport to Newcastle International Airport. Over the Wash, the pilot reported that the aircraft's engine was rough running and he turned towards the coast, during which time the engine failed. During the forced landing it is likely that the aircraft stalled and then struck a berm (the old sea wall) with a high rate of descent. The pilot and his passenger were fatally injured.

Whilst it could not be positively determined why the aircraft stalled, the investigation revealed that the aircraft's engine had not been maintained according to the manufacturer's instructions whilst it was not used for long periods and parked outside.

History of the flight

Background information

The aircraft had been based at Newcastle International Airport and the pilot flew it via France to Menorca, Spain, in July 2017.

In September 2017, the pilot and passenger flew the aircraft back from Menorca, through France, bound for Newcastle. On 10 September they landed at London Southend Airport after the pilot decided to divert, due to inclement weather, en route to Newcastle and elected to stay overnight.

Accident flight

On 11 September 2017 the pilot planned to continue from Southend to Newcastle. Prior to departure the occupants were seen to take about an hour preparing the aircraft. The aircraft took off at 0908 hrs.

At 0953 hrs, when the aircraft was over the Wash after crossing the Norfolk coast, the pilot transmitted a MAYDAY to the Distress and Diversion Cell (D&D) on 121.5 MHz, stating he had a "VERY ROUGH RUNNING ENGINE," that the aircraft was at 3,300 ft amsl, descending, and he would turn south towards RAF Marham. A short time later he transmitted "THAT'S SMOKE NOW I THINK WE'VE GOT AN ELECTRICAL FIRE…". About one minute later he transmitted "ENGINE HAS FAILED". At this point the aircraft was at about 1,400 ft amsl and D&D informed the pilot the aircraft was 13.5 nm from RAF Marham, to which the pilot replied he would not make it. The controller suggested Great Massingham 9 nm away but the pilot replied he would not make that either and, as the aircraft was passing 1,200 ft amsl, he added "IT'S GONNA BE A FIELD". This was the last transmission received from the aircraft and was 30 seconds before the last radar contact. Figure 1 shows some of the radio transmissions relative to the radar track.

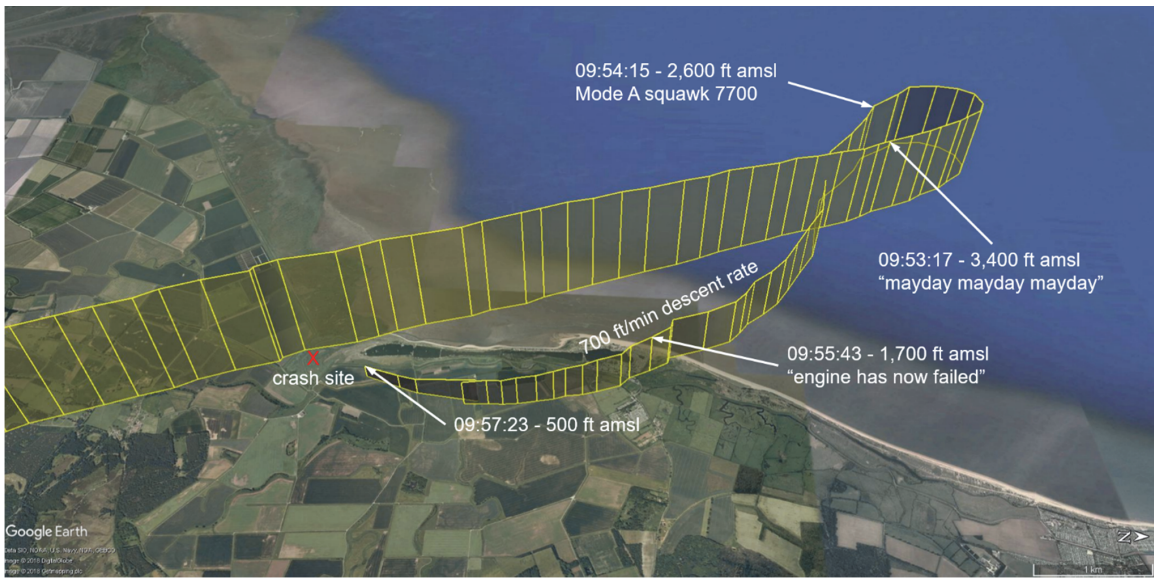

Figure 1

View looking to the west of last seven minutes of the radar track
(altitudes are Mode C ±50 ft, corrected to the QNH 988 hPa)

The aircraft was witnessed at low level just prior to the accident. One witness, about 0.3 nm north-north-west of the accident site, stated that he saw the aircraft flying at about 300 ft agl in a southerly direction over farmland. At the time, he was not aware of any engine noise. When the aircraft was close to the berm (the old sea wall), at about 40 ft agl, he saw it "drop vertically" and disappear from his view.

Another witness, who was working in a field about 0.25 nm south-west of the accident site, stated that he first saw the accident aircraft at a low altitude, flying in about a southerly direction towards the old sea wall. The aircraft had its landing gear down and the propeller was not turning as one blade was stationary, pointing vertically up. When it was about twice the height of the trees on the old sea wall, the aircraft "turned right and stalled". The nose dropped quickly and the aircraft struck the berm.

All the witnesses commented that the weather was fine, with the wind strong, from the west.

The accident site was about 2.5 m south-west of Snettisham, Norfolk. Two of the witnesses were at the scene quickly and administered first aid to the occupants. Police and paramedics arrived soon after, as did an air ambulance helicopter and a Coastguard helicopter. However, the occupants were declared deceased at the scene.

Meteorology

An aftercast produced by the Met Office stated that there was a deep area of low pressure centred over the northern North Sea with strong winds on its southern and southwestern flanks. The forecast low-level winds valid for 1200 hrs across East Anglia and the Wash were expected to be from 260° at 30 kt at 1,000 ft amsl and from 260° at 35 kt at 2,000 ft amsl.

Observations from RAF Marham at 0950 hrs and Norwich Airport at 1020 hrs recorded wind from 230° at 14 to 23 kt with some gusts higher. Marham recorded FEW clouds at 1,900 ft aal, SCATTERED clouds at 2,700 ft aal and BROKEN clouds at 3,500 ft aal. At both airfields the visibility was greater than 10 km and the QNH was 988 hPa.

The aircraft was on approximately a southerly track as it flew back towards the coast. A surface wind from 230° at 15 kt, would give an airspeed about 12 kt greater than the ground speed calculated from the radar returns.

Medical information

Post-mortem examinations were carried out on the pilot and passenger by a consultant histopathologist who concluded that both died as a result of multiple injuries sustained in the accident. Toxicology test for drugs and alcohol for the pilot were negative and a level of 1.9% of carboxyhaemoglobin was recorded.

A review of the reports at the RAF Centre of Aviation Medicine concurred that the injuries sustained by the pilot and passenger were consistent with decelerations sustained by the aircraft impacting the ground and, given the level of carboxyhaemoglobin recorded, it was unlikely that they had been exposed to excess carbon monoxide prior to their deaths.

Aircraft's information manual

The '*Piper Arrow IV Information Manual*' states in the '*ENGINE POWER LOSS IN FLIGHT*' checklist '*trim for 79 KIAS*'. It also states in the section titled '*STALLS*':

> *'An approaching stall is indicated by a stall warning horn which is activated between five and ten knots above the stall speed [58 to 63 KIAS]…*
>
> *The gross weight stalling speed of the Arrow IV with power off and full flaps is 53 KIAS. With flaps up this speed is increased 6 KTS...'*

Recorded information

Radar returns from the aircraft were recorded for the flight starting shortly after takeoff from Southend and stopping when the aircraft was about 0.25 nm from the accident site. The returns included height information (rounded to the nearest 100 ft) and indicated that the cruise altitude for the flight was about 4,300 ft amsl. A composite radar track of the last 17 minutes of flight from the Cromer and Debden radar heads is shown in Figure 2 and an expanded plot of the final phase is shown in Figure 1.

Figure 2

Portion of radar track of G-BHAY – final 17 minutes

The aircraft crossed the coastline at 0951:30 hrs and started to descend 30 seconds later. After a further 1 minute 17 seconds (about 3 nm from the coastline crossing) the pilot made the MAYDAY radio transmission (RTF) to D&D (Figure 1).

The pilot then commenced a 180° turn to the left[1] during which he passed his MAYDAY message and reported the aircraft's altitude as 3,300 ft. He completed the message about halfway through the turn, as the sound from the engine (recorded on the RTF) became distinctively rough sounding. The aircraft had descended about 600 ft since the initial MAYDAY call.

At 0954 hrs, with the aircraft now on a reciprocal heading, the pilot changed the radar transponder Mode A squawk to 7700[2]. He then turned the aircraft further to the left towards the nearest point on the coastline, which he crossed 90 seconds later, at about 1,800 ft amsl. At this point he reported the "ENGINE HAS FAILED", before turning onto a southerly track parallel to the coastline. This was just over five minutes since the aircraft started descending over the Wash and about 2.5 minutes after the initial MAYDAY call.

The aircraft continued to descend with the pilot making a RTF transmission at 0956:45 hrs stating that he was "PASSING ONE THOUSAND TWO HUNDRED FEET NOW" and that "IT'S GONNA BE A FIELD". The last radar return was at 0957:23 hrs with the aircraft at about 500 ft amsl, 0.25 nm to the north of the eventual accident site. The average descent rate during the descent from 4,300 ft was about 700 ft/min and groundspeed averaged over the last minute was 60 kt.

Aircraft description

The Piper PA-28RT Cherokee Arrow IV is a four-seat, all-metal, low-wing, single-engine aeroplane fitted with a 'T' tailplane and retractable tricycle landing gear.

The aircraft has conventional flying controls, mechanical trim in the elevator and rudder systems and three-position trailing edge flaps, operated mechanically by a floor-mounted lever in the cockpit. The stall warning system consists of a small pivoted tab, on the leading edge of the left wing, which moves upwards with the onset of stall and sets off an electrical warning buzzer in the cockpit.

The landing gear is retracted by an electrohydraulic system, with hydraulic pressure supplied by an electric pump in the rear fuselage. The landing gear is operated by a two-position toggle lever in the cockpit, next to the engine and propeller controls, and below are three landing gear status indicators. There was a landing gear automatic extension system originally included on the PA-28RT models but in G-BHAY this feature had been removed.

Footnote

[1] At this point, the coastline closest to the aircraft was behind and to its right at less than 2 nm.

[2] 7700 is the code to indicate to ATC that the aircraft is in distress. It shows ATC and other radar listening stations that an aircraft is in difficulties and enables position and altitude information to be seen.

The aircraft is fitted with a Lycoming IO-360-C1C6 four-cylinder piston engine, normally aspirated with mechanical fuel injection and driving a two-blade constant speed propeller. The cylinders are numbered one to four[3] and the lubricating oil pump is driven directly from the end of the crankshaft. There are two overhead valves per cylinder, opened by rockers and push rods and closed by dual concentric springs. There is a single camshaft driven by the crankshaft through the first stage of the accessory gear train and hydraulic tappets and followers lift the push rods. The crankshaft is a single piece forging, carried on three main white metal bearings and oilways through the crankshaft enable the delivery of oil to the big-end bearings. There is a centrifugal bobweight damper between the No 3 and No 4 big-end bearings.

Engine lubrication is by a wet-sump system with a capacity of up to eight quarts of engine oil, six quarts being considered the normal level shown on a calibrated dip stick. Oil pressure is generated by the single-stage gear pump and oil is drawn from the bottom of the sump and delivered by the pump through a cartridge filter into the galleries and drillings within the crankcase to distribute it around the engine. Oil to lubricate the main and big-end bearings is delivered through the main bearing webs in the crankcase and the pistons and cylinders are spray-lubricated from jets beneath each cylinder. Oil from the camshaft lifters passes along the pushrod tubes into the rocker boxes to lubricate the rockers valves and springs and used oil from the rocker boxes drains through external tubes into the sump. Used oil from the crankshaft, pistons and cylinders drains directly back into the sump.

The engine has aluminium alloy pistons, each fitted with two piston rings and an oil control ring. The oil control ring consists of a dual-rail bevelled edge ring, backed by a continuous coil spring. There are four oil drain holes, spaced around the oil control ring grove through the piston skirt.

The engine drives a two-blade variable pitch constant speed propeller. The pitch control of the blades is by a piston and spring assembly which uses engine oil metered through a mechanical governor driven by the accessory gearbox on the rear of the engine. Propeller rpm is set by a lever next to the throttle in the cockpit.

The ignition system consists of two engine-driven magnetos and two spark plugs per cylinder. Ignition and the magnetos are controlled by a four-position key switch in the cockpit.

Maintenance history

The aircraft had a comprehensive set of maintenance records and journey log and had a valid Airworthiness Review Certificate scheduled to expire on 18 March 2018 following its annual inspection on 14 March 2017. The last entry in the journey log was on 13 August 2017 and showed 31 hours remaining to its 50-hour check.

The aircraft had been owned by a syndicate since 1987 and was usually kept in a hangar at Newcastle International Airport, maintained on behalf of the syndicate by an aircraft

Footnote

[3] The No 1 and No 2 cylinders are on the front right and left side of the engine and the No 3 and No 4 cylinders are on the rear right and left side of the engine.

maintenance company based at Carlisle. The aircraft log book shows that it had been flown by only two different people, with most of the flying by the accident pilot.

Only one flight (in October 2015) was recorded in the journey log between January 2015 and October 2016. The aircraft had been parked outside at Newcastle, some 9 nm from the sea, from November 2015 to July 2016, including a prolonged period of inclement weather during December 2015. It is not known whether measures were taken to prevent deterioration to the aircraft or its engine during the long period of parking.

The annual maintenance requirements during the period of inactivity of October 2015 to October 2016 had not been carried out. On 10 October 2016, the aircraft was authorised for a single ferry flight from Newcastle to Carlisle for the now-overdue annual maintenance inspection, this flight was recorded in the journey log as 20 minutes. The aircraft was then stored in a hangar at Carlisle and eventually underwent its most recent annual maintenance inspection, during March 2017.

Annual inspection

The March 2017 annual inspection was carried out in accordance with CAP 766 *Light Aircraft Maintenance Programme.* This included an engine oil and filter change and the engine was recorded as running on Aero Castrol 80+. An engine compression check was carried out and all the four cylinders were found to be satisfactory (‘*73 or 74 over 80*’), within the limits laid down by the engine manufacturer. There were no defects recorded in the documentation during the annual inspection. When the aircraft was released to service it was recorded as having accumulated 4,881:30 airframe hours, 1,065:45 engine hours and the propeller overhaul had zeroed its flying hours. The engine was last overhauled on 26 May 2004[4] and had thus consumed just over 50% of its 2,000-hour overhaul life at the time of the accident.

Aircraft usage since the annual inspection

After the March 2017 annual inspection, all the flying recorded in the log was by the accident pilot and included flights over several days through France, arriving in Menorca on 12 July 2017. The journey from Newcastle to Menorca was via Le Touquet, Fleres, La Roche-sur-Yon and Carcassonne and totalled a flying time of 10 hours and 45 minutes.

Whilst flying to Carcassonne, the pilot encountered a landing gear problem whereby it did not satisfactorily indicate locked down. After visual confirmation with ATC he landed safely and then flew on to Menorca with the gear down. In Menorca, he had three replacement landing gear microswitch assemblies shipped and a local aircraft mechanic replaced the microswitches on the left and right main landing gears.

Three 45-minute flights were recorded whilst the aircraft was in Menorca, between 17 July and 13 August 2017.

Footnote

[4] The time between overhauls may be carried out on a calendar 12 year or 2,000 flying hours basis. The operator/owner can decide to apply either. The majority of engines are overhauled on a flying hours basis but require regular inspections and checks to ensure serviceability as they often take more than 12 years to accrue 2,000 flying hours.

Engine anti-deterioration measures

The engine contains ferrous and non-ferrous alloys; the external surfaces have anti-corrosion treatments such as paint or metallic plating, the internal surfaces in general rely on the properties of the lubricating oil for protection. However, many of the internal surfaces are subjected to heat and corrosive products during the combustion process which are kept at bay by additives within the oil. When the engine stops running the internal surfaces and components are left with a coating of oil but if the engine is not run for a period this coating becomes less effective, especially if an engine is subjected to a moisture-laden environment. Ferrous components such as the cylinder liners, crankshaft and connecting rods can develop surface corrosion in the form of rust. In areas where there may be more reactive deposits from the combustion process, such as the cylinder liners, surface corrosion may develop into pitting corrosion.

There are methods to prevent deterioration by a process known as 'inhibiting' and the engine manufacturer, Lycoming, issued specific guidance on this in Service Letter Number L180B, dated 13 November 2001.

Accident site

The accident site was on private agricultural land towards the top of a berm (the old sea wall) which formed part of the secondary inland sea defences on the north Norfolk coast. There was a line of coniferous trees to the west of the accident site, visible in Figure 3; these were about 25 ft high.

Figure 3
Accident site

The pilot was found in the left front seat and his passenger in the right front seat and the aircraft was upright on a northerly heading, complete except for the upper engine cowling which had detached during the impact and landed nearby. The windscreen had fragmented and the fuselage distorted in the severe vertical deceleration, so that the door frames and roof section were cut and folded back by the emergency services to release the pilot and passenger. The landing gear had been in the down position but the nose gear had been forced back up into its bay by the impact. The right main landing gear had been forced rearwards and detached from the wing whilst the left had remained attached but was also distorted rearwards.

One of the propeller blades was intact and the other blade had bent backwards under the nose of the aircraft. The propeller showed no signs of rotating when the aircraft hit the ground. There were no ground marks behind the aircraft and the only ground marks apparent were within the 'footprint' of the aircraft which were only visible after the aircraft was lifted during recovery.

Both wing tanks contained fuel and approximately 40 imp gal (48 US gal) were drained from the fuel tanks at the accident site. The top of the engine was exposed and the crankcase had a large hole near the base of the No 4 cylinder, exposing the remains of the No 4 piston connecting rod. Figure 4 shows the damage to the crankcase.

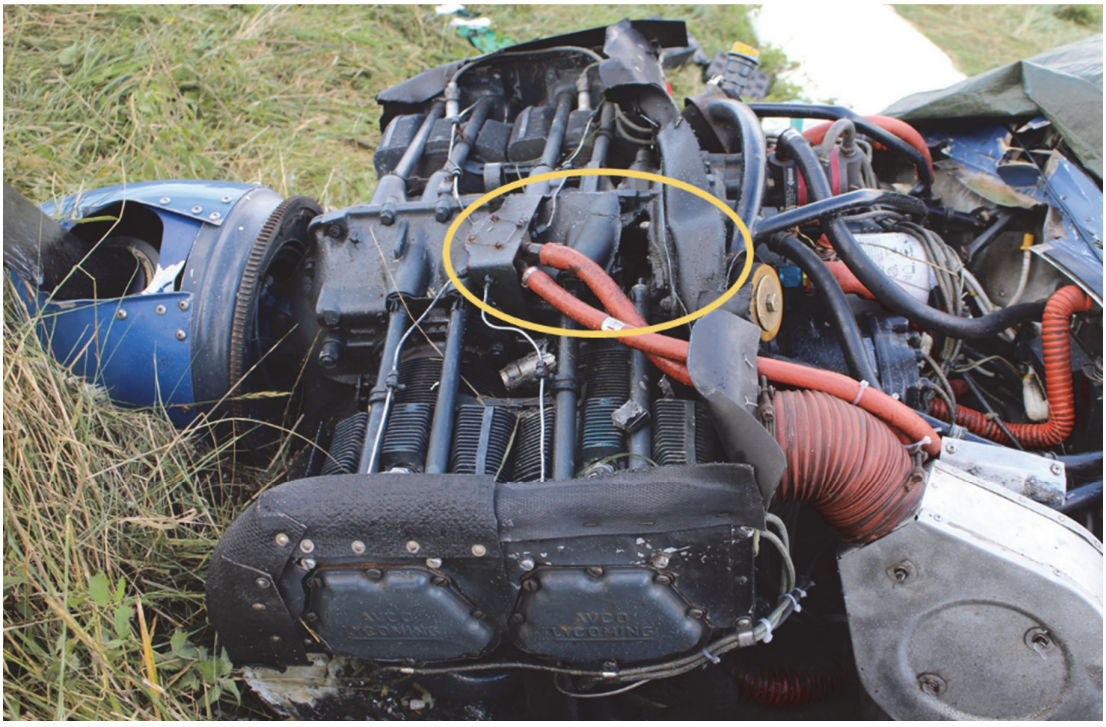

Figure 4

Crankcase damage

The battery was damaged and was disconnected and made safe at the accident site. The ignition master key had bent and was found on the cockpit floor; the key switch was damaged but appeared to be in the BOTH position.

The pilot and passenger were wearing three-point safety harnesses which had been cut by the emergency services during the rescue operation. The safety harness webbing, attachment points and buckles were intact and in good condition.

The luggage bay included items used in the care and maintenance of the aircraft, with a plastic storage box carrying nine 1-litre plastic engine oil containers. Four were labelled *Total Aero DM 15W50* and five were labelled *AeroShell W15W-50*, all labelled in French. The four *Total* containers were empty. Three microswitch assemblies were found in one of the flight bags with associated paperwork, two in a used condition and one still in its manufacturer's packaging.

After the initial examination the wings were removed to enable recovery to the AAIB headquarters for more detailed examination.

Aircraft examination

Structure

Detailed examination showed that the rudder, tailplane and elevator were attached correctly and relatively undamaged but that the area beneath the engine and cockpit around the fire wall was crushed and severely buckled upwards and rearwards by the vertical deceleration when the aircraft struck the berm. The entire underside of the fuselage was covered in engine oil and oil was still seeping from fuselage skin joints and seams. Figure 5 shows the condition of the forward underside of the fuselage and Figure 6 shows oil seeping from the fuselage skin joints.

Figure 5
Forward underside of the fuselage

Figure 6
Oil seeping from the fuselage skin joints

Flying controls

There was continuity of the pitch and yaw flying controls up to the instrument panel although the elevator controls had detached from the yoke shaft linkages due to the disruption of the firewall and cockpit floor. The elevator trim wheel position indicator showed a down (DN) trim setting. There was no evidence of any disconnection or restriction of the controls in flight and marks between the flaps and wings made during the impact, and the linkage and lever positions, showed that two stages of flap had been set.

Cockpit and instruments

The nature of the impact meant that little extra useful information could be extracted from the cockpit instruments, except for the barometric altimeter setting of 987 hPa.

None of the circuit breakers had tripped. The aircraft systems master switches were consistent with an interrupted engine-out forced landing: battery master switches ON, fuel pump OFF, landing and anti-collision lights ON and the pitot heat OFF. The transponder 'squawk' was set at 7700.

The stall circuit breaker was correctly set and there was electrical continuity to the warning buzzer. The stall tab fitted to the left wing leading edge was undamaged and correctly opened and closed the circuit when tested. The buzzer was removed and bench tested and was found to operate correctly.

There was no evidence of fire within the aircraft or in any of its components and systems.

Survivability

The lack of ground marks behind the aircraft at the accident site and relatively flat impact with the ground suggest the aircraft was rapidly brought to a stop by the berm. Although the pilot and passenger were wearing their harnesses they received fatal injuries due to the rapid vertical deceleration as the aircraft hit the ground and the structural deformation of the cockpit area and the proximity of solid objects, such as the control yoke and instrument panel.

Propeller and engine examination

The propeller examined showed that, apart from the bent blade, the propeller was in an 'as new' condition which reflected its low usage since its recent overhaul and there was no indication of pre-impact damage.

The engine was examined externally prior to strip down. The equipment fitted to the rear of the engine and accessory gearbox, and the fuel system components, were in good condition except some impact damage when the aircraft struck the ground.

The spark plugs were removed and examined. The No 1 and No 2 cylinder pairs of spark plugs were heavily carbon-contaminated, with thick granular carbon. The No 2 cylinder pair of spark plugs had no visible gap between the electrodes. In contrast, the No 3 and No 4 cylinder pairs of spark plugs were clean, with insulators and electrodes light grey-brown in appearance, indicative of a normal ignition process.

The oil dip stick was not in contact with any oil and was dry. The underside of the sump was covered in a film of engine oil, although there were no obvious signs of leakage or weeping joints around the engine. However, as observed at the accident site, the crankcase had a large hole in its upper surface through which could be seen the remains of the No 4 connecting rod big-end. There was also sign of a partial rupture near the camshaft forward end where a piece of debris had become trapped between one of the cam lobes and the crankcase. The internal crankcase web above the sump had also been holed by debris impact.

The crankshaft was in one piece and but showed signs of rubbing and discolouration due to excessive heat on the rear main journal, the No 4 crankpin and the No 2 crankpin. There were also debris impact marks on the surfaces of the No 3 and No 4 crankpin surfaces. Figure 7 shows the overheated condition of the No 4 crankpin.

The camshaft, pushrods and valve gear were undamaged. However, the hydraulic lifters and followers near the crankcase hole had been ejected and were found loose in the engine bay. In addition, several of the other cam followers were damaged because of debris impact.

When the engine was disassembled approximately one quart of lubricating oil was found within the engine lubrication system, heavily contaminated with ferrous and non-ferrous metallic debris. The oil pump was undamaged, free to rotate and could produce an oil flow. The filter was intact and the element not blocked, although it contained fine debris. The oil pick-up strainer gauze tube within the sump was completely blocked with metallic debris along its length.

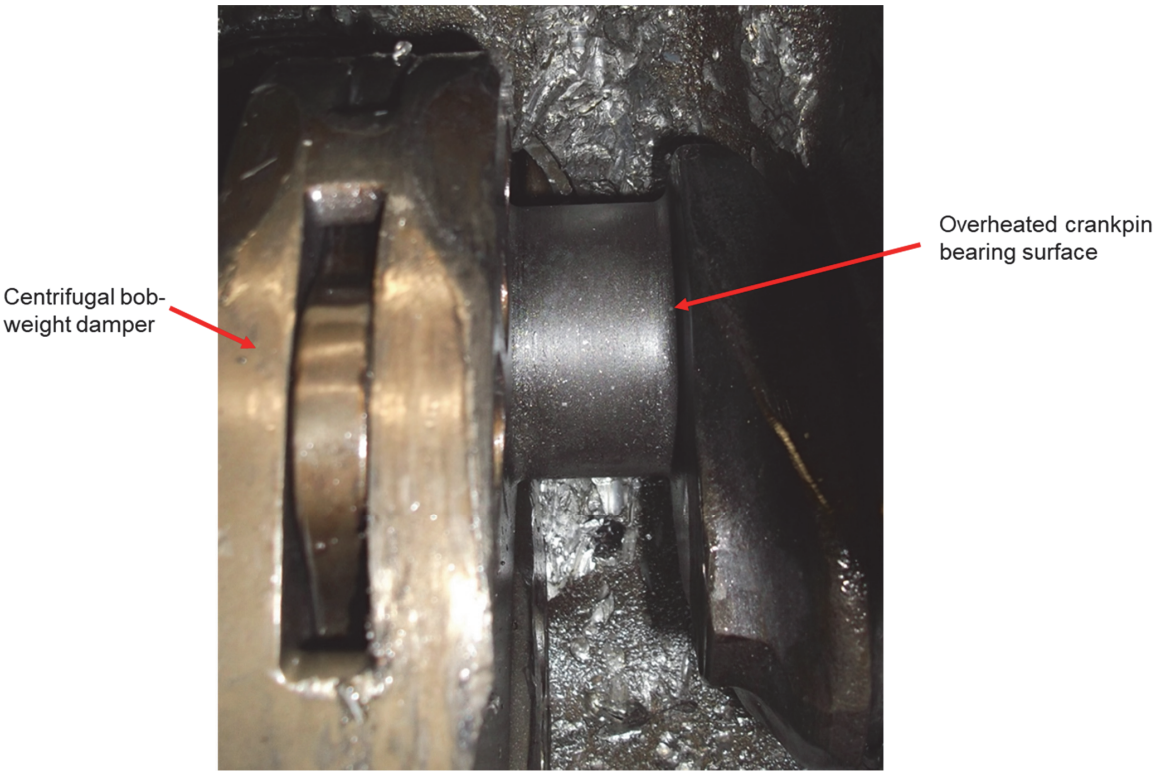

Figure 7

No 4 crankpin condition

Cylinder, piston and connecting rod examination

The No 1 and No 2 cylinder liners had linear scoring within the piston-swept area. There was heavier localised scoring where debris had been picked up on the piston skirt and small areas of pitting corrosion were present in both cylinders, were smoothed by the action of the piston and oil control rings. The pitting corrosion was more prevalent in the No 2 cylinder and heavier pitting corrosion was present at the top of both cylinders, outside the piston-swept area. Figure 8 shows the corrosion in the No 2 cylinder.

The piston skirts were heavily scored on their lower surfaces[5] due to debris entrapment. All the piston rings were in place but were jammed in their grooves by distortion from the scoring and the No 2 oil control ring was clogged with oily sludge and was slightly distorted.

Significant evidence of 'blow-by' was present on both the No1 and No 2 piston skirts, with associated carbon build-up around the piston crowns. The connecting rods were still attached to the crankshaft but were dry of oil and showed evidence of excessive heat, with the big-end bearings starting to disintegrate.

Footnote

[5] In a horizontally opposed engine such as in the case the pistons are considered to present an upper and lower surface to the cylinders.

Figure 8

An example of the pitting corrosion in the No 2 cylinder

By contrast the No 3 and No 4 pistons were in better condition and had stopped in their respective cylinders when their big ends detached from the crankshaft. There was no evidence of blow-by and no scoring of the piston skirts. However, the underside of the pistons was covered in multiple debris strike marks and the No 3 connecting rod was bent and twisted and its half-cap, end bolts and bearing shells pulverised. The No 4 connecting rod and associated parts had similar damage and fragments of the No 3 and No 4 bearings had evidence of excessive heating and swaging whilst under load. Figure 9 shows the condition of the pistons and damage to the connecting rods.

Figure 9

Pistons and connecting rods

Analysis

Operational aspects

The aircraft approached the coastline west of Snettisham, Norfolk, about 2 nm north of the accident site, at about 1,800 ft amsl. The last radar return was at about 500 ft amsl and 0.25 nm to the north of the accident site.

The aircraft's ground speed during the last few radar returns was about 60 kt. The wind recorded at Marham and Norwich was from 230° at 14 to 23 kt with some higher gusts. As the aircraft flew on a southerly track, the airspeed would have been about 12 kt greater than the ground speed; around 72 kt. Whilst this was less than the published recommended glide speed of 79 kt, it was 13 kt above the 'clean stall' speed of 59 kt and 19 kt above the '*full flaps*' stall speed. The witness evidence, that the aircraft was subsequently seen to stall before impacting the ground, was consistent with the ground impact, with high vertical deceleration and low forward speed. It could not be determined when or why the aircraft's airspeed reduced further, towards the stall speed, but as the wind recorded was also gusting by up to an additional 10 kt, the aircraft could have stalled partly due to a decrease in its airspeed due to the windshear caused by the gusty wind conditions.

As the master switches were ON, the aircraft's stall warning buzzer should have sounded. Given the stressful situation the pilot was in it is possible that he did not hear it or did not hear it in time to respond correctly. Additionally, given the low height at which the aircraft was seen to stall, the pilot may have been reluctant to attempt a recovery, by pitching the aircraft down, as he may have been conscious of the vicinity of trees to the west along the berm and wanted to attempt to clear them before lowering the nose.

Witnesses stated that they saw the aircraft with the landing gear lowered before the accident. Examination of the aircraft after the accident found that 'Flaps 2' was selected, and appeared to be trimmed for this configuration, the battery master switches were ON and the fuel pump was OFF. Given these facts, it is reasonable to believe that the pilot had secured the aircraft for a forced landing and chosen a field in which to complete it before the accident. However, it could not be determined which field he intended to land in. Had he turned the shorter distance back towards land, right rather than left, this would have given him more height and time over land with which to make his field choice. He may have turned left as he was sitting in the left seat; this was the more instinctive direction from the left seat and the land was easier to see from this seat.

Carboxyhaemoglobin levels and lack of evidence in the aircraft indicate that, despite the pilot's report to ATC, there was no fire. The pilot may have thought this due to fumes entering the cabin through the aircraft's ventilation system when the engine was failing.

Engineering

It is clear from the evidence that the engine suffered a catastrophic failure which led to its eventual stoppage.

The No 1 and No 2 pistons show significant exhaust 'blow-by' and contamination of the oil control rings and this led to the severe fouling of the No 2 cylinder spark plugs. This was probably the point where the pilot detected the engine rough running and prompted his MAYDAY call. It is known that blow-by can cause pressurisation of the crankcase which in turn causes oil to be ejected from the breather. The breather exit tube is situated behind the nose landing gear bay on the underside of the aircraft and excessive oil loss through the breather tends to cover the area behind the breather and be carried by the airflow rearwards, consistent with the oil-soaked fuselage underside in this case.

As the oil was lost, the temperature of the remaining oil started to rise and this, along with the reduced quantity, meant that lubrication of the main and big-end bearings degraded. It is possible the oil pressure drop had an additional effect on the propeller, causing its pitch to 'hunt' against the main spring in the blade pitch mechanism; this would have manifested itself as an engine pulsation exacerbating the roughness of the engine running experienced by the pilot.

From the rough running report to engine stop was about 2.5 minutes, heard in the background of the ATC recordings. At some point the big-end bearings started liberating wear debris and the evidence indicates that this was happening whilst the oil pump was attempting to draw oil from the sump, explaining the almost total clogging of the oil pick-up strainer with bearing material. This would cause a worsening effect on the bearings as the oil pump struggled to maintain pressure and flow.

In general, big-end bearings are the first to suffer as a lubricating system starts to fail. In this case, the No 4 big-end loosened as its bearing overheated, disintegrated and induced stresses in the half-cap bolts, which failed, allowing the connecting rod to detach from the crankshaft. This allowed the connecting rod free to flail as the engine continued to run for its last few seconds, with the No 4 big-end half-cap, bolts and bearing remains becoming caught up in the bobweight damper sweeping them around between it and the No 3 big-end and connecting rod, causing it to disintegrate. The No 4 connecting rod eventually forced its way out of the crankcase and the engine stopped.

It is noted that in similar engine failure cases in the past, AAIB experience suggests that the No 4 piston, cylinder and associated components are usually the first to degrade and suffer damage.

Initiating conditions

Between November 2015 and July 2016 the aircraft was parked outside at Newcastle International Airport, nine miles from the sea and in inclement weather conditions. There is no evidence that the engine had been inhibited during the aircraft's period of inactivity and it is likely that corrosion took hold during this period. This was evident in the No 1 and No 2 cylinder walls, with localised pitting corrosion at the top of the cylinder and within the piston-swept area. The engine manufacturer's Service Letter (Number L180B, dated 13 November 2001) is clear on the actions to be taken to prevent engine deterioration and notes that active corrosion can occur in a short period of time.

The subsequent annual check, in March 2017, included a compression check, within acceptable limits. Although this is considered a good indication of cylinder, piston ring and valve interaction, it does not necessarily show how well the oil control ring is performing or whether the piston and oil control rings, or the cylinder walls, are starting to deteriorate. There is no requirement to visually check the internal surfaces of the cylinders and pistons at an annual check, so the corrosion would remain undetected and the compression test result would not give cause for concern.

The journey log shows that from October 2015 to March 2017, only 20 minutes were recorded as having been flown. From March 2017, the journey log showed 18 hours and 40 minutes up to 13 August 2017. If the pilot flew a similar route back through France as he had flown outbound, it is possible that an additional 10 hours was accrued, taking the total hours since the annual inspection to approximately 29 hours. Taking this usage pattern into account, it is likely that most of the deterioration around the No 1 and No 2 pistons and cylinders occurred since the annual inspection in March 2017.

Oil consumption

Discussions with the maintenance organisation suggest that it was usual for this pilot to be well prepared and to carry extra tools, spares, fluids and personal equipment in the aircraft. Four empty oil containers were found in the aircraft but there was no record as to when the oil was replenished and, based on 4 litres over 29 hours, an oil consumption rate of about 0.13 litres per hour is reasonable over that period. However, engine oil consumption tends to increase as an engine deteriorates and it is likely that this was the case in this engine.

Staff at the maintenance organisation also suggested that the pilot was particular in his preparations for flight and that it is unlikely that the pilot would have taken off from Southend without the oil dip stick showing at least the recommended level of six quarts in the sump. It is not known whether the pilot had to replenish the oil at Southend to achieve that level but it means that five quarts were lost during the 40 minute flight from Southend to the point where the engine stopped. This suggests a rapidly increasing degradation of the engine during this flight and this degradation may have started before he landed at Southend, without having yet become apparent to the pilot.

Reported smoke in the cockpit

Despite the report of smoke in the cockpit made during the radio transmission, no evidence of fire could be found in the aircraft. It is therefore likely the smoke was due to overheated oil fumes or smoke exiting the engine through the crankcase breach, filling the engine bay and then surrounding the nose of the aircraft before being drawn into the cabin ventilation and heating system.

Conclusion

The accident was likely the result of the aircraft stalling at a low height from which there was insufficient height to recover, during an attempted forced landing following a catastrophic engine failure.

The engine failure was due to oil loss caused by damage and premature wear to the oil control rings. The engine had been inactive for several months, and probably had not been inhibited in accordance with the manufacturers guidance, leading to the formation of corrosion within the engine.

AAIB Correspondence Reports

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

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

The accuracy of the information provided cannot be assured.

SERIOUS INCIDENT

Aircraft Type and Registration:	Sikorsky S-92A, G-CHHF
No & Type of Engines:	2 General Electric CT7-8A turboshaft engines
Year of Manufacture:	2011 (Serial no: 920158)
Date & Time (UTC):	29 January 2018 at 1405 hrs
Location:	On approach to Scatsta Airport, Shetland
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - 19
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	46 years
Commander's Flying Experience:	8,332 hours (of which 4,439 were on type) Last 90 days - 119 hours Last 28 days - 42 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and inquiries made by the AAIB

Synopsis

During a final approach to land at Scatsta the nose landing gear (NLG) failed to extend despite being recycled and the use of the emergency blowdown system. The crew declared a PAN and the decision was taken for ground crew to lever the NLG down manually. This was successfully carried out and the helicopter landed safely. It was found that the automatic nosewheel self-centring mechanism had not operated, causing the nosewheels to jam the nose leg in its bay. The exact cause of the failure of the NLG to centre the nosewheels could not be determined. The operator has taken three safety actions.

History of the flight

The helicopter was on final approach to Runway 24 at Scatsta after having completed a routine passenger flight from the Magnus offshore platform. The crew lowered the landing gear in accordance with the approach checklist. Although the main landing gear status lights, left and right, showed green, the NLG red UNLKD caption remained. The flight crew informed ATC that there might be a technical issue and the helicopter was flown in a visual holding pattern but an emergency was not declared at that point. The crew followed the operator's '*Emergency Operations Procedure (EOP) 8/3'*, recycling the landing gear and twice attempted a blowdown emergency extension, but these actions were unsuccessful. The crew then declared a PAN and sought engineering advice over the radio.

The crew flew a low-level circuit during which ATC confirmed that the nose gear had not lowered. Further engineering advice was sought and after considering various options, the decision was taken to attempt to manually release the NLG externally. The crew briefed the passengers and the helicopter was hover-taxied onto the apron with the emergency services present and under marshalling supervision. The pilot stabilised the helicopter with its mainwheels in contact with the ground and with the nose held in the air to allow the release of the NLG. The pilot then signalled one of the operator's engineering staff to approach the helicopter. The engineer observed that the nosewheels were not centred and by using a suitable length lever, he was able to re-align the wheels. The nose leg then extended with a green 'down and locked' indication and the crew settled the helicopter on the ground. A safety ground lock was fitted and the helicopter shut down without further incident.

Helicopter description

The Sikorsky S-92A is a large twin-engine utility helicopter, designed to carry up to 19 passengers and certified for dual-pilot VFR and IFR, day and night operations.

Landing gear

The helicopter is fitted with retractable landing gear consisting of double-wheel air/oil shock absorbers. The main landing gear is installed in the sponsons each side of the fuselage just aft of the cabin area, and the castering nosewheel within a wheel bay beneath the cockpit. The nose gear is non-steerable but its design allows for a 360° caster and has a damper fitted to prevent nosewheel shimmy during taxiing. Differential braking and tail rotor thrust are used to steer the helicopter during taxiing. The nose gear includes a feature which self-centres the wheels during retraction and the manufacturer comments that, when properly serviced, the nose gear should self-centre at all angles up to 180°.

The helicopter is fitted with a landing gear emergency extension system which consists of 3,000 psi nitrogen-filled bottles attached to the nose, left and right landing gear hydraulic actuators. An EMER DN switch is located on the landing gear control panel which activates a solenoid valve to release the gas charge into the extension side of the actuator. The blowdown facility works regardless of the position of the landing gear control handle.

Engineering investigation

Following this incident, the helicopter was withdrawn from service and placed on jacks to carry out fault diagnosis. Retraction checks found that the nosewheels did not initially automatically centre but after several retraction cycles the nosewheels did centre and then continued to work normally. However, the operator thought it prudent to reject the NLG. The complete NLG assembly was replaced with a serviceable item and after functional testing, the helicopter was released to service. The NLG was made safe by discharging its gas pressure and was returned to the manufacturer for examination.

The examination showed the NLG was in a good, but well used, overall condition. There was evidence of leakage around the hydraulic port and 3,250 ml of hydraulic fluid was drained out of the NLG (the correct quantity should be 3,890 ml). It was observed that the

NLG was covered in 'oily/dirty' deposits, with water and grease residue present on the lower piston tube and the lower cylinder cap not tightened to the correct torque. The exact cause of the failure of the centring mechanism could not be identified. The NLG was then rebuilt, charged and tested; it held its charge and the self-centring mechanism operated correctly.

Manufacturer's experience of previous events

The helicopter manufacturer has investigated six reports of previous events where the NLG was off-centre, jammed in the wheel well and failed to extend either by the primary or secondary means. The manufacturer attributed this to improper servicing, whereby a low oil or nitrogen charge in the strut results in the self-centring cams not interlocking correctly, allowing the wheels to remain off-centre when the aircraft weight is 'off-wheels' prior to retraction. In September 2017 the manufacturer issued a letter to operators highlighting this potential problem and the importance of correct fluid quantity and gas charge in the NLG.

Emergency operating procedures (EOPs)

On the incident flight the crew carried out '*EOP 8/3, Landing Gear Will Not Extend'*. The crew later observed that this procedure does not appear to take into account the situation where, despite the emergency blowdown actions being taken, the helicopter remains in an asymmetric landing gear configuration. However, '*EOP 8/2, Landing with the gear retracted*' directs the crew to place the aircraft in a low hover, disembark the passengers and then, after preparations to cushion the helicopter by ground staff, land as soon as practicable. It also advises using the flotation gear to assist in stabilising the helicopter. In this case the crew took these procedures into consideration but, because they were landing at a maintenance base, they had the advantage of additional expertise on hand and the time to identify and rectify the problem. They therefore opted for the action of levering the NLG down. The crew consider that '*EOP 8/3'* should cross refer to '*EOP 8/2'* as the normal action to be taken when maintenance base expertise is not available.

Analysis

Engineering

Although the operator was able initially to replicate the problem, the NLG then started to self-centre during repeated tests. However, mindful of the consequences of the same problem happening again, away from a maintenance base, the decision was taken to return the NLG to the manufacturer.

It is possible that the mechanical defect was so minor as not to leave any evidence to be found at the manufacturer. The manufacturer observed that the signs of leakage around the hydraulic port, and the oily deposits on the NLG, suggested a possible loss of oil by seepage which found its way around the NLG external surfaces. However, the reduced fluid quantity cannot be relied upon to support this notion as it is possible some of the oil was lost during the discharging process, after ground testing and prior to despatch to the manufacturer. In the absence of mechanical evidence, it is not possible to draw a conclusion as to the cause of the malfunction of the NLG self-centring.

Operations

The crew observed that '*EOP 8/3'* did not lead into actions to be taken in '*EOP 8/2'* if the problem with the landing gear remained after the prescribed attempts to lower the landing gear. Although the operator considered both EOPs to be correct, it was acknowledged that '*EOP 8/3'* needs to direct the crew *to 'EOP 8/2'* more clearly. In this case the problem was solved externally using the knowledge and expertise available at the landing site. However, this could not be relied upon, showing the need to align the EOPs for use in a similar incident away from a maintenance base.

Conclusion

The exact cause of the failure of the NLG to centre the nosewheels during retraction could not be determined. However, the operator has taken steps to inform its staff of a potential cause identified in previous cases by the manufacturer. The incident has also highlighted a discontinuity in the operator's emergency procedures, which have also been addressed.

Safety actions

To reduce the risk of nosewheels not self-centring during retraction, the operator is undertaking the following safety actions:

- The manufacturer's letter, '*S92A Nose Landing Gear – Improper Servicing'*, dated 19 September 2017, will be re-iterated to the operator's engineering staff.
- S-92A crews will be reminded of the need to ensure the nosewheels are not canted off-centre after taxiing prior to takeoff (although this does not appear to have been a factor in this incident).
- The operator has also reviewed the EOPs and EOPs 8/2 and 8/3 have been amended and re formatted as EOP 13/2 and 13/4. EOP 13/2 now draws the crew's attention to EOP 13/4 and the actions to be taken to ensure a safe landing with the leading gear retracted, or in an asymmetric configuration.

ACCIDENT

Aircraft Type and Registration:	Cessna 140, G-HALJ	
No & Type of Engines:	1 Continental Motors Corp C85-12F piston engine	
Year of Manufacture:	1946 (Serial no: 8336)	
Date & Time (UTC):	5 March 2018 at 1355 hrs	
Location:	Peterborough Conington Airfield, Cambridgeshire	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to propeller, cowling, wingtip and engine shock-loaded	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	31 years	
Commander's Flying Experience:	3,595 hours (of which 4 were on type) Last 90 days - 161 hours Last 28 days - 78 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The flight was the second training sortie of the day with the same student and consisted of three landings and two go-arounds after bounced landings. After touching down on the planned final landing, the student started to lose directional control. The instructor took control but did not have sufficient time to communicate this. Reacting to the situation, the student applied the brakes, tipping the aircraft onto its nose. The occupants were uninjured but the aircraft was damaged. The instructor stated that he should have taken control sooner but there was not much time to react.

ACCIDENT

Aircraft Type and Registration:	Denney Kitfox MK3, G-KTTY	
No & Type of Engines:	1 Rotax 582 piston engine	
Year of Manufacture:	1994 (Serial no: PFA 172-12001)	
Date & Time (UTC):	9 June 2018 at 1738 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:	Slight bend to right main landing gear. Tailwheel shear pin failed. Hairline cracks to left and right fibreglass downward winglets	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	61 years	
Commander's Flying Experience:	20,968 hours (of which 2 were on type) Last 90 days - 100 hours Last 28 days - 48 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The handling pilot had recently bought G-KTTY and had arranged for type conversion training through the Light Aircraft Association. The accident flight was the owner's second training detail and started with circuit practice at Manchester Barton Airport. On the first circuit, the aircraft landed firmly due to a high sink rate at touchdown. On the next circuit the flight parameters at the threshold were similar, resulting in a second baulked landing go-around. In the initial stages of this go-around, the aircraft's nose pitched up significantly and the aircraft stalled, leading to a wing drop and heavy landing on the right main landing gear. Shortly after touchdown, the right wingtip came into contact with the runway, precipitating a ground loop through 180° to the right, during which the left wingtip also touched the ground before the aircraft came to rest on its wheels.

The pilot reported that the incident was a result of his lack of familiarity with the nose-up attitude required for a go-around. He found it difficult to perceive the correct climb attitude due to the aircraft's nose obscuring forward vision of the horizon; the lack of an artificial horizon for cross-reference further hindered his assessment of the required pitch attitude.

ACCIDENT

Aircraft Type and Registration:	DH82A Tiger Moth, G-AXBW	
No & Type of Engines:	1 De Havilland Gipsy Major 1C piston engine	
Year of Manufacture:	1940 (Serial no: 83595)	
Date & Time (UTC):	17 April 2018 at 1100 hrs	
Location:	Wishanger Park, Frensham, Surrey	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to landing gear, wings, propeller and engine cowling	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	79 years	
Commander's Flying Experience:	23,043 hours (of which 114 were on type) Last 90 days - 1 hour Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot in command (PIC), flying in the front seat, was providing familiarisation training for a new syndicate member, who was in the rear seat. The wind was assessed to be approximately 12 kt at 25° from the left; within, but close to, the crosswind limit for the takeoff. The PIC was satisfied that the new syndicate member was a capable pilot and allowed him to have control for the takeoff. During the takeoff roll, the aircraft became airborne 5 kt below the normal 'unstick' speed. At this time, the PIC called "airspeed" and was about to take control when a gust lifted the left wing. The right wing stalled, causing the aircraft to descend and turn to the right from a height of approximately 10 ft. The aircraft struck a wooden fence running parallel to the grass runway and came to rest on its nose with a buckled landing gear (Figure 1).

The PIC considered that, although the new syndicate member showed good confidence in being able to cope with gusty conditions, he should have demonstrated a gusty crosswind takeoff before allowing the less experienced pilot to take off in such conditions.

Figure 1

G-AXBW where it came to rest to the right of the grass strip

ACCIDENT

Aircraft Type and Registration:	Europa, G-RICS	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	1997 (Serial no: PFA 247-12747)	
Date & Time (UTC):	20 April 2018 at 1700 hrs	
Location:	Baynards Farm, Ellens Green, Surrey	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Minor)	Passengers - N/A
Nature of Damage:	Substantial	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	71 years	
Commander's Flying Experience:	434 hours (of which 385 were on type) Last 90 days - 2 hours Last 28 days - 2 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The accident occurred on landing after a brief flight in the local area; the weather was benign. The pilot flew a stable approach with full flaps into a slight headwind. However, at touchdown, the aircraft bounced about three feet and he elected to go around.

He set full power with the propeller in full fine pitch, but then lost directional control; the nose yawed to the left and the left wing dropped. He noted that the loss of directional control seemed rapid at the low speed being flown. The nose and left wingtip struck the grass 10 m from the edge of the runway and the aircraft slid a further 10 m off the side of the grass strip. The pilot suffered only minor injuries but the aircraft was severely damaged.

The pilot, who had landed many times at this airstrip, thought that his limited flying in the previous four months could have been a factor. He also commented that pilots of "aircraft that have 'springy' undercarriages would benefit from occasional touch-and-go practice at a suitable airfield".

ACCIDENT

Aircraft Type and Registration:	Piper PA-18-150 Super Cub, G-RWCA	
No & Type of Engines:	1 Lycoming O-320-A2B piston engine	
Year of Manufacture:	1982 (Serial no: 18-8309010)	
Date & Time (UTC):	7 April 2018 at 1225 hrs	
Location:	Beccles Airfield, Suffolk	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Propeller blade bent, engine shock-loaded and damage to wings, fin, rudder and windscreen	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	54 years	
Commander's Flying Experience:	188 hours (of which 9 were on type) Last 90 days - 7 hours Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The pilot made a precautionary landing at Beccles Airfield following an engine oil leak and a reduction in oil pressure. This was the first time that the pilot had landed a tailwheel aircraft on a hard surface. During the ground run the aircraft started to ground loop, then nosed over and came to rest inverted.

A photograph of the aircraft taken by the pilot following the accident is at Figure 1.

History of the flight

The pilot departed from his home airfield at Crowfield, near Norwich, on a cross country flight in a PA-18-150 aircraft fitted with a tailwheel.

When the aircraft was abeam Lowestoft, at a height of 1,900 ft, the pilot became aware that oil was dripping onto his left leg. As the oil pressure was satisfactory, at approximately 70 psi, he decided to return to Crowfield which was approximately 20 to 25 minutes away. However, the oil continued to drip onto his leg and cockpit floor, and the oil pressure reduced to 60 psi, which was at the bottom of the green arc on the oil pressure gauge. The oil temperature was normal. The pilot, therefore, decided to make a precautionary landing at Beccles, which was close by. While the pilot did not make an emergency radio call, he did advise the radio operator at Beccles of the situation and joined the circuit late downwind to land on Runway 09.

Figure 1

Accident site
(photograph by permission of the pilot)

The pilot was concerned that the engine might fail and, therefore, decided to fly a high approach, initially aiming for a touchdown point halfway along the concrete section of the runway with the intention of stopping on the grass section of the runway. However, following a subsequent exchange with the radio operator at the airfield, the pilot believed that he was only permitted to land on the concrete section of the runway. This would have been his first landing of a tailwheel aircraft on a hard surface.

The pilot reported that there was a 10 kt crosswind and he was slightly fast and high as he crossed the threshold with full flap selected. The aircraft floated for some distance and bounced following the initial touch down before settling down in a three-point landing attitude. The pilot was aware of the end of the concrete section of the runway approaching and attempted to correct a yaw to the right by the application of full left rudder; he did not apply the wheel brakes. However, as the aircraft decelerated it yawed to the right and the main wheels ran onto the grass and the soft ground at the edge of the runway, causing the aircraft to slowly nose over and come to rest in an inverted attitude. The pilot was uninjured.

Beccles Airfield

Beccles Airfield has one runway, aligned 09/27. The surface of the first 500 m of Runway 09 is concrete and the remaining 250 m is covered in grass. The LDA is 624 m. A Google Earth image of the airfield is at Figure 2.

Figure 2
Beccles Airfield

ACCIDENT

Aircraft Type and Registration:	Piper PA-24-250 Commanche, N7832P	
No & Type of Engines:	1 Lycoming 0-540 Series piston engine	
Year of Manufacture:	1962 (Serial no: 24-3052)	
Date & Time (UTC):	18 February 2018 at 1330 hrs	
Location:	Chiltern Air Park, Oxfordshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to propeller and fuselage underside	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	37 years	
Commander's Flying Experience:	456 hours (of which 21 were on type) Last 90 days - 0 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot had departed from Benson airfield to carry out circuits at Chiltern Air Park which is located 4 nm south of Benson. He had spoken to the owner of Chiltern Air Park to obtain permission and check the runway conditions. After joining the circuit at Chiltern he omitted to select the landing gear down during his downwind checks. During the base and final legs he was focussed on avoiding 'noise abatement' areas, and although he recalled performing a 'reds, blues, greens'[1] 'touch drill' check, he did not consciously check that the green landing gear lights were on. The aircraft touched down lightly on the grass and came to rest on its underside.

The pilot stated that due to the short distance between Benson and Chiltern it was a very quick transition from climb-out, departure checks before needing to focus on joining the circuit. His focus on maintaining a good look-out for other aircraft and correctly joining the circuit contributed to him rushing his downwind checks. He thinks he said the word "undercarriage" on the downwind check but carried out a 'touch drill' without manually selecting the gear down.

Footnote

[1] The 'reds, blues, greens' check on finals is to check that the red mixture lever and blue propeller speed lever are set to full forward and that three landing gear lights are illuminated green to indicate that all three landing gear legs are down and locked.

ACCIDENT

Aircraft Type and Registration:	P&M Aviation PulsR, G-FFFA	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2013 (Serial no: 8673)	
Date & Time (UTC):	18 April 2018 at 0900 hrs	
Location:	Manton Airfield, Wiltshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Substantial damage to wing, landing gear fairing, fuselage and propeller	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	52 years	
Commander's Flying Experience:	260 hours (of which 249 were on type) Last 90 days - 14 hours Last 28 days - 11 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

During landing, the left wheel struck the edge of a hollow which caused the aircraft to bounce and roll to the right. The right wingtip touched the ground and the aircraft pirouetted almost 180° before coming to rest on its right side.

History of the flight

The aircraft was being flown from Cotswold Airport, Gloucester to the manufacturer's facility, at Manton Airfield, Wiltshire for its annual inspection and renewal of the Permit to Fly. The wind conditions were 180° at 10 kt and the pilot elected to use Runway 27, which is a 350 m mown and rolled grass farm field strip, with a steep taxiway down to the manufacturers facility (Figure 1).

The pilot flew a low pass at approximately 100 ft to ensure the runway was clear and then proceeded to land normally. After approximately 100 m of the landing roll and at 30 kt, the left wheel struck the edge of a hollow, which caused the aircraft to bounce and roll to the right. The right wingtip touched the ground and the aircraft pirouetted almost 180° before coming to rest on its right side (Figure 2). The pilot made the aircraft safe and exited from the cockpit uninjured. It was later noted by the manufacturer that ground near the threshold of Runway 27 may have been disturbed by animal activity.

Figure 1
Accident site – Manton Airfield, Wiltshire

Figure 2
G-FFFA after landing

ACCIDENT

Aircraft Type and Registration:	P&M Aviation Quik GT450, G-CEZX	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2008 (Serial no: 8360)	
Date & Time (UTC):	2 June 2018 at 1330 hrs	
Location:	Abergavenny Airfield, Monmouthshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Extensive damage to the wing, landing gear fairings and propeller	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	59 years	
Commander's Flying Experience:	278 hours (of which 80 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 was taking off from Abergavenny and had climbed to approximately 40 to 50 ft agl when it encountered significant turbulence. This caused the aircraft to weathercock, roll to the right and descend, all of which the pilot was unable to counteract. The aircraft landed heavily and as the mainwheels contacted the ground, the right wing tip struck some shrubs near the side of the runway and spun the aircraft through 180°. Although the aircraft remained upright, and there were no injuries to the pilot or passenger, substantial damage was caused to the wing, propeller, landing gear and fairings. The pilot considered the cause was likely to have been a low-speed wing stall, compounded by the variability of the wind and the effect of the tree line alongside the runway.

History of the flight

The pilot had flown his aircraft from Redlands with a passenger earlier in the day and observed that the wind and level of turbulence had increased as he crossed the River Severn into Wales. During his approach to Abergavenny, he also observed the wind sock was indicating the wind straight down Runway 15 and appeared to be at least 12 to 15 kt. The pilot was unhappy with his final approach, considered it to be unstable and decided to go around. His second attempt was uneventful and he landed. After a short stop the pilot and his passenger prepared for departure to fly to Kemble. During the preparations they held a discussion regarding the effects of the slight upslope of the

runway, the variable wind conditions and the parallel tree line separating the airfield from the A40 (dual carriageway).

The pilot lined up the aircraft on Runway 15 and applied full power and held the control bar back to allow the aircraft to build up speed on the upslope. Rotation appeared normal but as the aircraft achieved 40 to 50 ft agl it encountered significant turbulence, causing it to weathercock, roll to the right and descend. The pilot was unable to counteract this and, mindful of the proximity of the road on the right, tried to steer to the left but found he had limited control authority. The aircraft continued to descend and was now about 10 to 15 m from the right edge of the runway, so the pilot reduced the power and landed heavily. On landing, the right wing tip contacted shrubs at about the same time the mainwheels touched the ground and the aircraft immediately spun around through 180° but remained upright. The ground impact caused damage to the wing and airframe structure, propeller, mainwheel and cockpit fibreglass fairings. The pilot and passenger were uninjured.

Discussion

In the pilot's own analysis of the event, he considers that several factors conspired to cause the accident. He believes that the wing stalled, resulting in the loss of control authority, compounded by the turbulence created by the wind striking the trees. He considers that the stall was due to the slightly low airspeed on takeoff, because of the upslope of the runway.

ACCIDENT

Aircraft Type and Registration:	Pegasus Quik, G-CEMZ
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2007 (Serial no: 8280)
Date & Time (UTC):	12 May 2018 at 1541 hrs
Location:	Carrickmore Airfield, Northern Ireland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Damage to trike unit and wing
Commander's Licence:	Private Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	1,232 hours (of which 364 were on type) Last 90 days - 20 hours Last 28 days - 16 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot stated that he was flying into Carrickmore Airfield having flown from Hunsdon, Hertfordshire. At the time the weather was fine and the wind was from 200° at 8 kt with "slight gusts".

As the aircraft approached the airfield, two other aircraft transmitted that they were back-tracking Runway 26 to depart. As the accident aircraft turned onto final the last departing aircraft took off. After crossing the threshold, the pilot attempted to flare the aircraft, but it continued to descend and landed firmly on the asphalt runway. It bounced onto grass to the right of the runway nosewheel first, causing the aircraft to nose-over before coming to rest on its right wing (Figure 1). The pilot was assisted out of the aircraft having sustained minor injuries.

The pilot reported that being cold after the flight from Hunsdon may have affected his judgment. He also believed he was distracted by the departing aircraft, causing him to slow down to increase separation from them, and that consequently the aircraft had insufficient airspeed to flare properly and stalled onto the runway.

Figure 1
G-CEMZ landing on its nosewheel

ACCIDENT

Aircraft Type and Registration:	Quik GT450, G-TBLB	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2006 (Serial no: 8188)	
Date & Time (UTC):	9 April 2018 at 1630 hrs	
Location:	Longford Airfield, Shropshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - N/A	Passengers - N/A
Nature of Damage:	Damage to pod and wing	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	376 hours (of which 45 were on type) Last 90 days - 1 hour Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot planned to fly his aircraft from Arclid Airfield to Longford Airfield for its Permit to Fly inspection. He noted that the weather forecast both at the departure and destination airfields was light rain and upon arriving at Longford Airfield, the weather was worsening but the pilot considered that it was still safe. On touchdown, the aircraft landed heavily and bounced resulting in damage to the pod and wing.

The uninjured pilot was wearing a lap and diagonal harness and helmet. He reflected that, during training, in the event of 'ballooning' on landing, he was taught to go around, but in this case he attempted to recover the landing.

ACCIDENT

Aircraft Type and Registration:	Skyranger J2.2(2), G-MARO	
No & Type of Engines:	1 Jabiru 2200 Piston Engine	
Year of Manufacture:	2004 (Serial no: BMAA/HB/348)	
Date & Time (UTC):	19 May 2018 at 1330 hrs	
Location:	Strathaven Airfield, South Lanarkshire	
Type of Flight:	Private	
Persons on Board:	Crew -1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Right and nose landing gear, airframe, engine, propeller, cowling and right wing damaged	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	42 years	
Commander's Flying Experience:	156 hours (of which 56 were on type) Last 90 days - 6 hours Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot was conducting touch-and-go landings to maintain skills and demonstrate the aircraft to the passenger who was a new syndicate member. The wind was reported as south-south-west at 15 kt, a few knots higher than forecast. On the third approach to Runway 16, the aircraft was handling normally, crabbing into the crosswind during the approach. On crossing the runway threshold the pilot rounded out and began to straighten and flare the aircraft. The pilot sensed the aircraft begin to sink and elected to go around but it landed hard and the nose gear and right main gear collapsed before the aircraft slid to a stop. The occupants were uninjured.

The pilot stated that the wind conditions were more difficult than anticipated. His first choice of runway, Runway 23, was made unavailable as a crew were setting up a banner for a banner towing aircraft. Runway 16 was the best remaining option as a third option, Runway 27, would have had a crosswind component at the maximum demonstrated for the aircraft.

Miscellaneous

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

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

BULLETIN CORRECTION

Aircraft Type and Registration:	Jetstream 4100, G-MAJC
Date & Time (UTC):	16 October 2017 at 0835 hrs
Location:	Hawarden Airport
Information Source:	Aircraft Accident Report Form

AAIB Bulletin No 7/2018, page 62 refers

In the original report, two items of safety action were omitted:

> Met Office systems allow a SIGMET to be issued that contains smoke related information and, although it is not compliant with the ICAO format or existing templates, a test showed that it was compatible with NATS's systems. In future a SIGMET will be issued when NATS informs the Met Office there is significant smoke in the atmosphere that is affecting aircraft operations.
>
> Work is being undertaken to see whether a 'Securité' message broadcast on 121.500 MHz could be used to promulgate a safety message concerning smoke in the UK FIR.

The above safety items were added to the online version prior to publication.

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

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

Published February 2014.

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

Published June 2014.

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

Published September 2014.

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

Published July 2015.

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

Published August 2015.

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

Published October 2015.

1/2016 AS332 L2 Super Puma, G-WNSB on approach to Sumburgh Airport on 23 August 2013.

Published March 2016.

2/2016 Saab 2000, G-LGNO approximately 7 nm east of Sumburgh Airport, Shetland on 15 December 2014.

Published September 2016.

1/2017 Hawker Hunter T7, G-BXFI near Shoreham Airport on 22 August 2015.

Published March 2017.

1/2018 Sikorsky S-92A, G-WNSR West Franklin wellhead platform, North Sea on 28 December 2016.

Published March 2018.

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

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

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

AAIB
Air Accidents Investigation Branch