AAIB
Air Accidents Investigation Branch

AAIB Bulletin 5/2015

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 1996.

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

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

Published 14 May 2015

Cover picture courtesy of Richard Ross

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

SPECIAL BULLETINS / INTERIM REPORTS

None

SUMMARIES OF AIRCRAFT ACCIDENT ('FORMAL') REPORTS

None

AAIB FIELD INVESTIGATIONS

COMMERCIAL AIR TRANSPORT

FIXED WING

BAE ATP	G-BTPF	07-Oct-14	3

ROTORCRAFT

None

GENERAL AVIATION

FIXED WING

CZAW SportCruiser	G-EWZZ	09-Aug-14	14
Pietenpol Air Camper	G-OHAL	25-Jul-14	41

ROTORCRAFT

None

SPORT AVIATION / BALLOONS

Schleicher ASW 20 L	G-LYSA	18-Jun-14	45

AAIB CORRESPONDENCE INVESTIGATIONS

COMMERCIAL AIR TRANSPORT

Airbus A320-214	G-EZUC	30-Jan-15	59
Beech 200 Super Kingair	G-KVIP	31-Dec-14	60
British Aerospace ATP	G-BTPC	15-Jan-15	62

GENERAL AVIATION

Cessna 172S Skyhawk	G-MEGS	11-Jan-15	64
Extra EA 300/200	G-TWOO	06-Dec-14	65
Jodel DR1050 Ambassadeur	G-AYLL	04-Nov-14	66
Robinson R44 Raven	G-CEDG	25-Feb-15	68
Robinson R44 II Raven	G-HECK	05- Dec-14	70

SPORT AVIATION / BALLOONS

Kiss 450-582(2)	G-PGHM	21-Nov-14	71
P&M Aviation Quik GT450	G-MCFK	06-Nov-14	72
Team Minimax 91	G-CGGX	16-Nov-14	74

CONTENTS Cont

MISCELLANEOUS

ADDENDA and CORRECTIONS

Vans RV-8	G-NRFK	02-Oct-14	79

List of recent aircraft accident reports issued by the AAIB 80

(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.

SERIOUS INCIDENT

Aircraft Type and Registration:	BAE ATP, G-BTPF
No & Type of Engines:	2 Pratt & Whitney Canada PW126 turboprop engines
Year of Manufacture:	1989 (Serial no: 2013)
Date & Time (UTC):	7 October 2014 at 2035 hrs
Location:	Outbound from Bournemouth Airport, Dorset
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	31 years
Commander's Flying Experience:	2,570 hours (of which 325 were on type) Last 90 days - 43 hours Last 28 days - 16 hours
Information Source:	Crew reports and AAIB enquiries

Synopsis

Shortly after levelling off at FL70, the commander, who was flying the aircraft manually, reported two occurrences of an uncommanded input into the aileron controls that caused the aircraft to roll first to the left and then to the right. During the subsequent descent and return to Bournemouth the fluorescent flood lights in the cockpit were seen to flicker. After the aircraft was parked on the stand, the lower hatch was opened and smoke was seen to come from the bay. An investigation carried out by the operator and tests on a number of components did not identify any faults that would have caused any of these reported symptoms.

Introduction

This serious incident occurred on 7 October 2014 but the AAIB was not informed until 15 October 2014 after components from a number of systems had been replaced and the aircraft had flown without incident for approximately 12 flight hours.

History of the flight

The serious incident occurred during the second sector of a three-sector night when the empty aircraft was being positioned from Bournemouth Airport to London Stansted Airport. Throughout the flight, the aircraft was flown manually by the commander from the left seat. The commander reported that they departed from Runway 26 and climbed to 4,000 ft. After contacting Solent Radar they were instructed to climb to FL70. Approximately one minute later, when flying level at FL70 and at an IAS of 200 kt, the commander reported that the control wheel turned violently to the left with enough force to pull it out of his hands. He arrested the resulting roll using opposite rudder and what he described as an unusually large amount of force on the control wheel, which he estimated to be between 40 and 45 lb. The aircraft began to roll level when the control wheel was displaced 45º to the right. The commander then experienced a 'notchy' feeling through the control wheel and, for a period of three to four seconds, the ailerons were unresponsive when the control wheel was moved 15º either side of the centre position. Full control was regained after three to four seconds. After a further 30 seconds the control wheel was again pulled out of the commander's hands, only this time the aircraft rolled to the right. Once again the roll was arrested with the application of opposite rudder and a force of 40 to 45 lb applied to the control wheel. At no time did any warning captions illuminate on the Central Warning Panel (CWP).

The commander made the decision to return to Bournemouth Airport and instructed the co-pilot to make a MAYDAY call and set the transponder to 7700. The co-pilot informed Solent Radar of the control problems and requested an immediate return to Bournemouth using gentle and wide turns during the vectoring to avoid having to use excessive rates of roll. He also asked for the aircraft to be met by the emergency services.

The aircraft was vectored to a point 16 nm on long finals for a landing on Runway 26 at Bournemouth Airport. As none of the warning lights on the CWP had illuminated, the commander decided to undertake a low-speed handling check during which he gradually used the flaps as the aircraft slowed down. As the handling characteristics were normal, the commander continued with the approach and the aircraft made a normal landing with Flap 20 set. While there were no further control problems, the crew noticed that the fluorescent flood lighting in the roof of the flight deck flickered during the approach.

Approximately 10 minutes after the engines were shut down, the crew reported that the flight deck looked 'smoky / hazy' and there was a strong acrid smell of electrical burning. A ground engineer who entered the flight deck at this time reported that he had just heard a 'bang' from the area of the forward lower fuselage. Acrid white smoke vented from the (No 1) forward lower belly hatch when it was opened.

The crew reported that during the event there was no loss in altitude and in their opinion the bank angle never exceeded 10º. They also stated that the flight conditions were not conducive to icing, there was no turbulence, nor was there any other traffic in the vicinity. Throughout the flight, SYS 1 had been selected on the autopilot flight controller but no autopilot modes had been engaged and the aircraft had been flown manually.

Meteorological information

At the time of the event, the crew reported that the surface wind was from 150º at 2 kt, the visibility was greater than 10 km, there were few clouds at 3,900 ft, the surface temperature was 7ºC and the temperature at FL70 was 5ºC.

System description

Primary flying controls

The primary flying controls are operated directly from the control column through a system of cables, rods and levers. Within the aileron system the control wheels (yokes) mounted on the control columns are connected to each other by chains and sprockets to cable pulleys. The pulleys in turn are connected by a continuous cable loop to quadrants under the left side of the flight deck floor. From there the cables are routed down the left side of the fuselage to a tension regulator/quadrant assembly and then out to each aileron.

A synchro transmitter is mounted adjacent to each aileron. The right synchro provides a signal corresponding to the position of the right aileron to the Secondary Control System (SCS) and the Flight Data Recorder (FDR), whereas the left synchro only provides a signal corresponding to the position of the left aileron to the FDR. A trim tab mounted on the right aileron is manually operated by the pilot by the movement of a trim wheel. Movement of the control wheel by 45º causes the aileron to move by 10º.

The left control wheel is connected directly to its drive shaft and sprocket. The right control wheel comprises an automatic Aileron Control Disconnect Mechanism (ACDM), drive shaft and sprocket. The ACDM consists of a spring housing, C spring and a synchro position transmitter. By applying sufficient force, it is possible for the right control wheel to rotate about its drive shaft, against the C spring, and move independently of the left control wheel.

In the event of a restriction in the aileron primary controls, partial control can be retained by operation of the aileron disconnect unit which isolates the left and right side of the aileron controls. The release unit is manually activated by the pilot pulling the AILERON DISCONNECT handle located on the centre console. This operates an electrical switch that energises the solenoid in the aileron release unit; the system cannot be reset in the air. Operation of the aileron disconnect handle also energises the synchro in the right control wheel and movement of the control wheel against the C spring sends continuous signals corresponding to the control wheel angle to the SCS. A force of 1.5 lb per degree of aileron movement is required to operate the aileron and movement of the control wheel is limited to 30lbf, which equates to 20º of aileron movement. When operating in this mode, the position of the control wheel is not an indication of the displacement of the aileron.

Autopilot

Automatic flight control is provided by two independent autopilots, flight directors and the SCS. Each system incorporates a computer / amplifier, which provides the necessary outputs for the autopilot, flight director and SCS. A flight controller, common to both systems, is located in the cockpit and provides control of the autopilot functions and selection of system No 1 or No 2. Only one autopilot can be engaged at any time.

A primary servo-motor fitted in each of the elevator, aileron and rudder controls converts the outputs from the computer / amplifier into control surface movements. Each servo-motor has a common gearbox driven by two independent motors. An electro-magnetic clutch fitted to each servo-motor is energised when the autopilot is engaged. The electro-magnetic clutch in the aileron control system can be overridden when the force through the control system exceeds the maximum torque of 47 lb ft.

Aileron Standby Control System (SCS)

The SCS operates independently of the autopilot and constantly monitors the position of the flying controls, comparing inputs from the control surfaces against inputs from the cockpit flight controls.

Within the aileron control circuits, the SCS compares the position of the right aileron obtained from a synchro transmitter, against the force synchro transmitter in the right control wheel. If an error is detected by the SCS, then the servo-motor is driven until the error is nulled.

The control circuits for the aileron SCS are contained in the autopilot computer but, they remain separate from the autopilot components and power supplies. The SCS is armed as soon as DC electrical power is provided to the autopilot circuits. Should the SCS operate, then the SCS ENGAGED legend in the flight compartment roof panel and the CWP amber standby controls warning lamp, flashing amber 'attention getters' illuminate and the warning horn will operate.

Electrical power supply

The aircraft electrical distribution system is broadly split into two parallel systems, identified as No 1 and No 2. Each system is supplied by an engine driven 200/115V, 3-phase, variable frequency generator. The electrical power for SCS 1 and SCS 2 is supplied from the No 1 26V AC Busbar and the cockpit fluorescent floodlighting is supplied from the No 1 200/115 AC 3 phase busbar. A block diagram showing the electrical power supply to the SCS from the No1 electrical distribution system is at Figure 1.

The No 1 Transformer Rectifier Unit (TRU) and the No 2 static inverter are mounted next to each other in the forward lower belly hatch (No 1).

Maintenance history

The operator reported that G-BTPF had no history of control problems and the only recent significant event was the report of several possible lightning strikes that occurred two sectors prior to the incident flight, when the aircraft was on approach to Bournemouth Airport. The aircraft was inspected in accordance with the Aircraft Maintenance Manual (AMM) Chapter 04-50-37 and no faults or damage were detected.

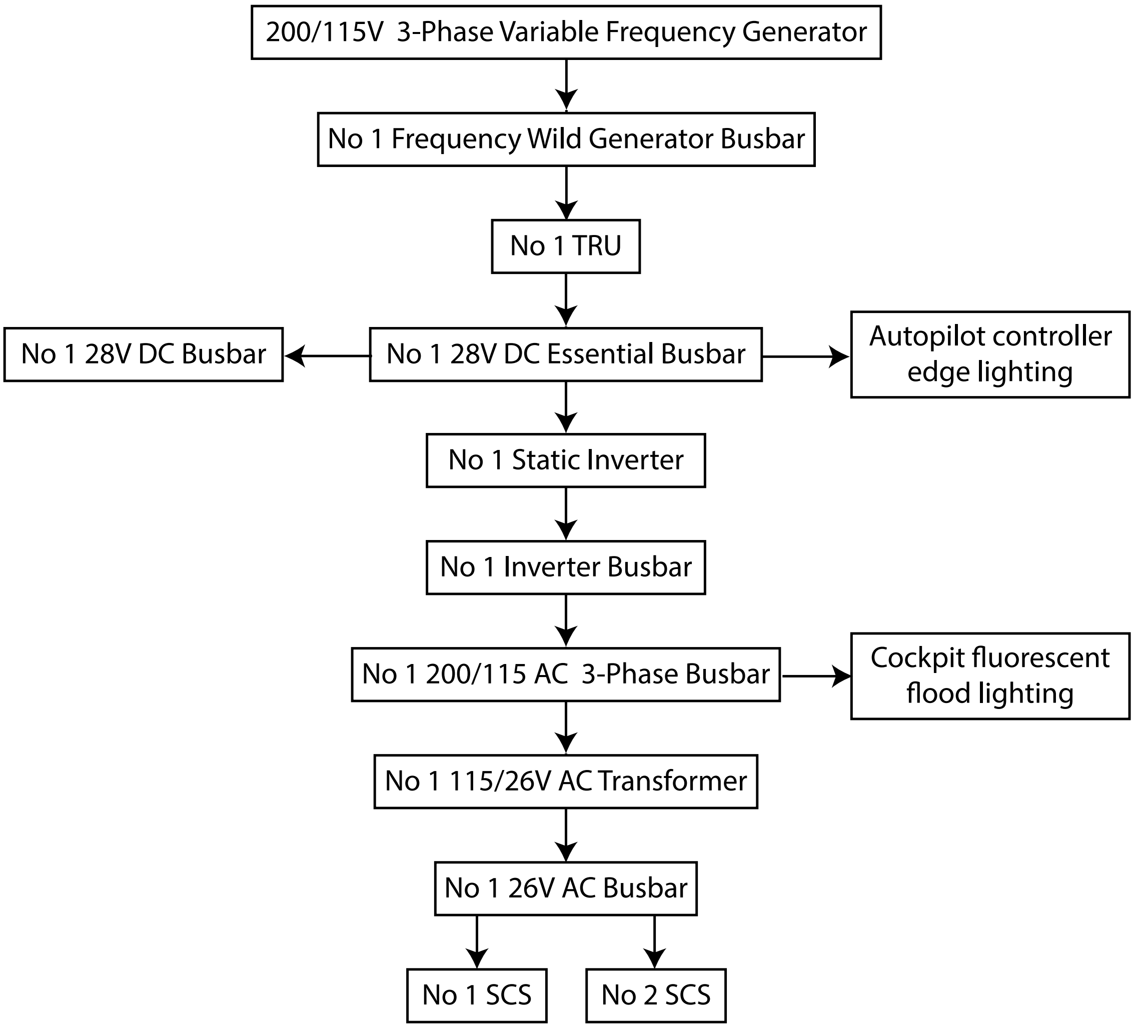

Figure 1
Power supply to the SCS

Recorded information

Due to the delay in reporting the incident to the AAIB, the CVR recording had been overwritten and was therefore unavailable. The FDR recorded over 26 hours of operation, including the incident flight.

The FDR recorded 30 parameters but this did not include autopilot operation, position of the control column, control wheel and rudder pedals and status of the electrical system. These parameters were not required to be recorded. It was therefore not possible to confirm the reported rapid uncommanded control wheel input and any analysis had to consider the once-per-second rate at which control surface positions were recorded. The limitation of this sampling rate results in rapid control surface deflections not being recorded.

The data recorded the aircraft levelling off at FL70 just over four minutes after takeoff. Twenty four seconds later, the aircraft rolled left to -4° and there followed a number fluctuations in the recorded aileron position and roll attitude (Figure 2). The aircraft altitude increased by approximately 80 ft after which a number of fluctuations in the normal acceleration were observed[1]. When comparing these acceleration fluctuations with the pitch and roll attitudes, it was considered unlikely that they were caused by the control surface deflections and more likely to be a period of turbulence.

The maximum aileron deflection throughout this period was 3.8° (maximum travel is ± 15°) and the maximum roll attitude 5.4° to the left.

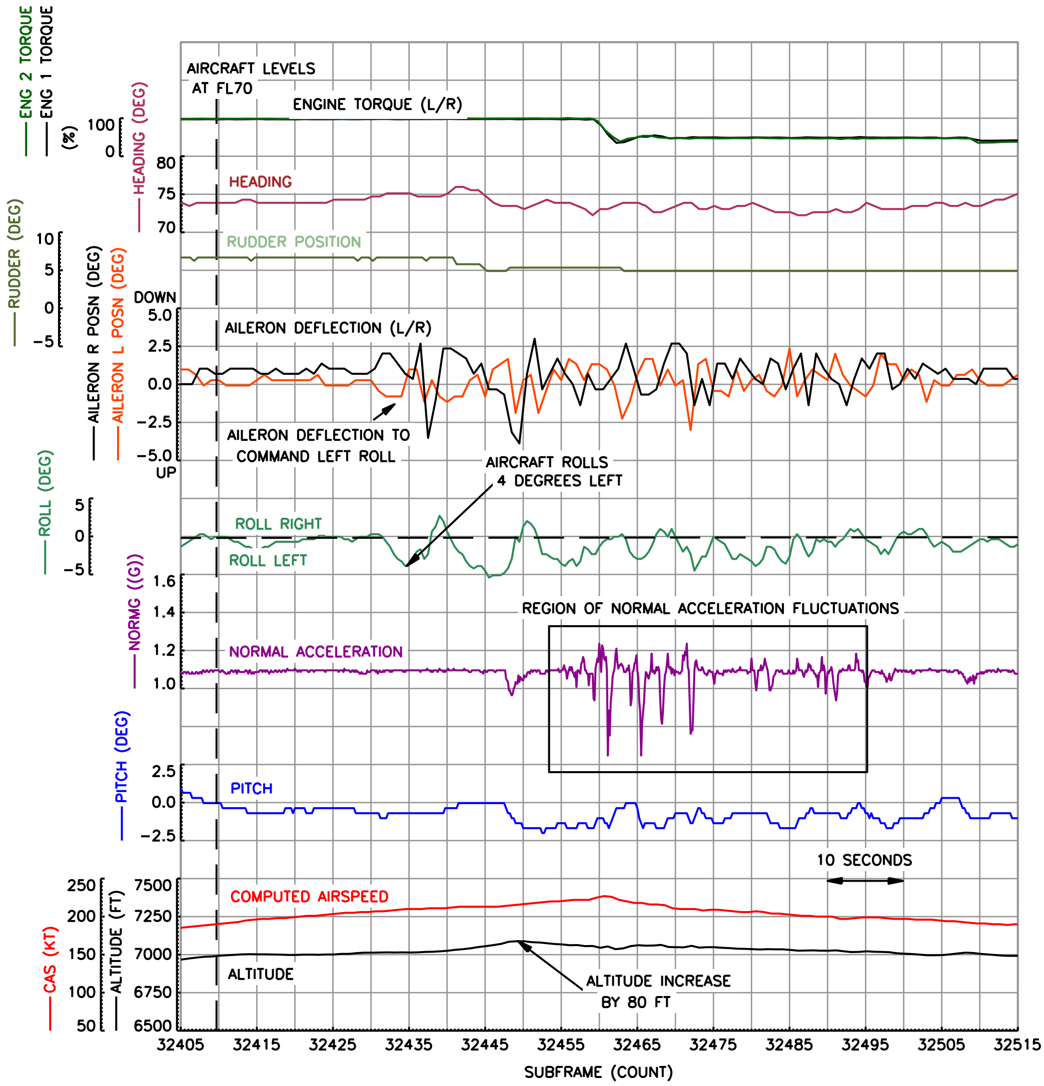

Figure 2

G-BTPF FDR parameters

Footnote

1 The recorded normal acceleration has a drift offset of +0.1g.

Manufacturer's assessment of FDR data

The aircraft manufacturer was requested to comment on the FDR data. They concluded that there was a good correlation between both the aileron deflection and resulting roll attitude, and between the magnitude of the aileron deflection and the resulting roll rates.

FDR serviceability

Review of the entire 26 hours of FDR recording revealed periods of invalid data. After download at the AAIB, the FDR[2] was returned to the operator who sent it to an avionics test facility for re-certification, prior to its re-installation on aircraft.

Testing revealed that the recorder's magnetic tape was badly worn and required replacement. In addition, it was noted that a number of the circuit boards had sustained damage from 'liquid ingress' and the recorder required repair prior to release to service.

In addition to the FDR, a Quick Access Recorder (QAR) was fitted to the aircraft for the purposes of Flight Data Monitoring (FDM). Data recorded by the QAR was sourced from the FDR and comparing the two data sources for the incident flight revealed no differences. As a result, it was considered that the incident flight data was unaffected by the recorder faults.

The operator's Maintenance Planning Document (MPD) requires that the FDR data is checked by performing an annual download. This recorder was last downloaded in August 2013 and the readout report confirmed no serviceability issues. The degradation in the recording quality was considered to have occurred since August 2013.

This event highlights the limitations of using magnetic tape as a recording medium in flight recorders. In May 2014, the EASA published Opinion 01/2014 entitled *'Amendment of requirements for flight recorders and underwater locating devices'*. This document was issued to address a number of items including safety issues relating to the reliability of flight recorders. This included the reliability issues experienced with what EASA classified as 'obsolete' recording technologies such as magnetic tape, magnetic wire and frequency modulation. The issues experienced with these recorder types were proposed to be addressed by:

> *'mandating that obsolete recording technologies are not used anymore on aircraft operated for commercial air transport after 1 January 2019'*

This Opinion is still under consideration by the European Commission.

Radar data

Recorded radar data was provided by NATS which showed that there were no other large aircraft in close proximity to G-BTPF. Therefore, it is unlikely that wake vortex had any effect on this incident.

Footnote

2 Plessey PV1584 recorder Part Number 650/1/14040/016, Serial Number 10012.

Engineering actions following the incident flight

Following the incident flight, the operator conducted a thorough examination of the control system and did not identify any faults or evidence of their having been a control restriction. The aileron disconnect release unit had not operated, the cable tension unit was serviceable and the cables were assessed as being of the correct tension.

A thorough examination was carried out in Zone 130, where the loud bang was believed to have come from and where the smoke was discovered at the end of the flight. The engineers could not identify the source of the smoke, nor could they identify any damage to circuit breakers, relays and wiring in this area. As a precaution, the No 1 TRU and the No 2 Inverter, which are both located in this area, were replaced.

Tests of the autopilot and the SCS was carried out in accordance with the AMM and the systems were assessed as serviceable. These tests included the operation of the autopilot, the autopilot disconnect, the aileron servomotor and the servomotor clutch. A rigging check was also carried out on both aileron synchro transmitters and they were found to be within limits. As a precaution the autopilot flight controller and both computer / amplifiers were replaced and the aircraft was released for further flight.

Examination during scheduled maintenance checks

The aircraft entered scheduled maintenance 20 flight hours and 27 cycles after the incident flight. With the aircraft in a stripped condition, a further examination of the control system and autoflight system was carried out.

There was no visual evidence of damage to any of the cables or pulleys, nor any evidence that a control restriction had occurred. The aileron release unit and the cable tension regulator were examined in accordance with the AMM and found to be serviceable. The fuselage cable tension was checked and the reading of 6.1 on the tension regulator was found to be lower than the target reading of 7.3 obtained from the cable tension graph in the AMM. The tension of the wing cable circuits were also checked and found to be slightly outside the target tension of 88 lbs. The actual cable tensions were established as:

	Left wing	**Right wing**
Up	80 lbs	96 lbs
Down	88 lbs	92 lbs

The aileron position synchros were visually examined and one wire, labelled UB39, on the left aileron synchro was found to be chafed down to the bare metal, Figure 3. This wire provides one of the three secondary outputs from the synchro. The terminals on the contacts on both synchros were found to be corroded.

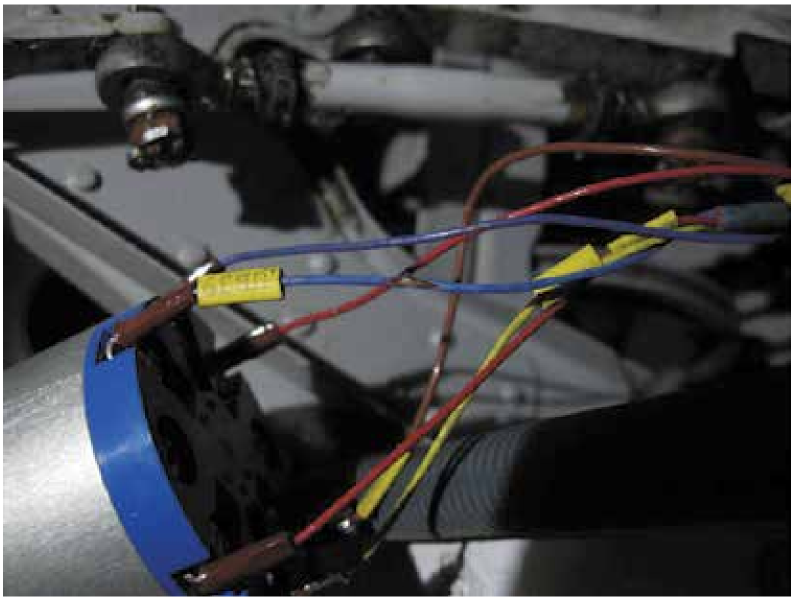

Figure 3
Chafed wire on left aileron position servo

The values from each aileron synchro transmitter received by the Data Acquisition Recorder (DAR) were read using the FDR test set and compared against the expected values recorded in the AMM. The position of the aileron was established using a clinometer. The output from both synchro transmitters were found to be outside of the limits specified in the AMM and therefore both items were replaced. The readings were as follows:

	Test Set Indication (± 10)			
	Left aileron		Right aileron	
Aileron position	AMM	DAR	AMM	DAR
15º up	22	20	542	537
5º up	51	48	571	566
Neutral	65	64	585	583
5º down	79	81	599	603
15º down	108	126	628	654

Further inspections and tests could not identify the source of the smoke or the reason for the reported uncommanded control input. As a precaution the No 1 inverter, both aileron synchro transmitters and the aileron release unit were replaced and the aircraft was released for flight.

Component testing

The following components were sent to an approved overhaul facility for an internal visual examination and functional check to be carried out.

No 1 Static Inverter (s/n D450)
No 2 Static Inverter (s/n C413)
No 1 TRU (s/n 008)
Autopilot controller (s/n 211)
Autopilot computer amplifier (s/n 140)
Autopilot computer amplifier (s/n 154)
Servo actuator[3] (s/n 208)

Visual examination of all the components showed no evidence of heat or smoke damage. With the exception of the autopilot controller (s/n 211), all the components passed the functional tests. The autopilot controller failed the power consumption functional test because the lamps in the edge lighting were open circuit. The lamps were replaced and the controller passed the test.

AAIB comment

The limited parameters recorded by the FDR and the absence of a CVR recording of the incident flight meant there was limited performance analysis that could be undertaken on the reported event. The FDR recording showed that shortly after levelling at FL70 there were fluctuations in the aircraft roll attitude and aileron position. However, the control wheel position was not recorded and the 1 Hz sampling rate of the aileron position may not have been sufficiently high to capture the uncommanded input reported by the pilot.

The crew reported that there was no turbulence, or preceding traffic that might have caused wake vortices. However, fluctuations of the normal acceleration recorded on the FDR were consistence with the aircraft experiencing a period of turbulence.

Throughout the event the aircraft was flown manually by the commander using the left control wheel so the ACDM in the right control wheel would not have been activated. Moreover, the aileron disconnect unit had not operated and the cable tension regulator was assessed as being serviceable by the operator. While the aileron cable tensions were slightly outside the target set in the AMM, they were not considered to have been causal to this incident.

The autopilot was selected to SYS 1, but no flight modes had been engaged. For the SCS to operate, the ACDM would need to be energised by operation of the aileron disconnect unit, with the pilot applying a force on the right control wheel sufficient to overcome the resistance of the C spring. Once activated, the SCS ENGAGED legend in the flight compartment roof panel, the CWP amber standby controls warning lamp and the flashing amber 'attention getters' would illuminate and the warning horn would have operated. However, the aircraft was not

Footnote

[3] The servo actuator is part of the aileron disconnect system.

flown from the right control wheel and the crew reported that there were no warnings or alerts during the incident. For the SCS system to have driven the controls without initiating any warnings in the cockpit there would need to have been failures of a number of components.

It was also not possible to establish if the reports of the flickering fluorescent flood lights on the flight deck during the descent and the uncommanded flying control input were independent faults. While the power supply for the lights and the SCS are taken from the No 1 200/115V AC 3-phase Busbar, there were no other reports of any system using this power supply having been affected. The operator was also unable to identify the source of the smoke and acrid smell.

The components in the autoflight system active during the flight, including the power supplies, were visually examined and tested at an overhaul facility. Apart from the failure of some of the edge lightning in the autopilot controller, which was not considered to be unusual, there was no visual evidence of any of the electrical components having been damaged by heat, or having generated smoke. The functional tests were all assessed as satisfactory.

The chafed wire and corroded contacts found on the left aileron position synchro transmitter would not have affected the SCS as it only provides position information of the left aileron to the FDR.

In summary, the investigation undertaken by the operator, and the tests by the equipment overhaul agencies, could identify no mechanical or electrical fault that could have caused the reported uncommanded input or the smoke seen to emanate from the forward hatch. The aircraft has since flown without a reoccurrence of either fault.

ACCIDENT

Aircraft Type and Registration:	CZAW SportCruiser, G-EWZZ	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2010 (Serial no: LAA 338-14815)	
Date & Time (UTC):	9 August 2014 at 1440 hrs	
Location:	Kingarth, Isle of Bute, Scotland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Serious)	Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	National Private Pilot Licence	
Commander's Age:	53 years	
Commander's Flying Experience:	555 hours (of which 100 were on type) Last 90 days - 29 hours Last 28 days - 1 hour	
Information Source:	AAIB Field Investigation	

Synopsis

Shortly after takeoff from Runway 27 at Bute Airstrip, the pilot reported that the engine appeared to lose power and the aircraft was no longer able to climb. With the area around the airfield unsuitable for a landing he attempted to return to the runway, but in doing so flew into the ground. The aircraft came to rest upside down in a ditch and caught fire. The pilot and passenger sustained serious burns from which the passenger later died.

The aircraft was fitted with a ballistic parachute recovery system which had not been activated during the flight. However, the investigation highlighted a number of issues, concerning such systems, which present a risk to the aircraft occupants and first responders following an accident.

Seven Safety Recommendations were made to address the risk to individuals following an accident involving an aircraft equipped with a ballistic parachute recovery system.

Introduction

The accident involving G-EWZZ highlighted a number of issues concerning the risk of injury to third parties following an accident involving an aircraft fitted with a ballistic parachute recovery system. In order to address these issues, this accident report has been written in two sections. The first will address the accident and the second the ballistic parachute recovery system.

Section One – Aircraft accident

History of the flight

The pilot of G-EWZZ arranged with a group of pilots to fly to Bute Airstrip, near Kingarth on the Isle of Bute, for lunch. He and his passenger travelled separately to Strathaven Airfield, in South Lanarkshire, where the aircraft was based. The pilot could recall little of the day's events and could not remember the time he arrived at Strathaven Airfield, but did recollect that he had conducted a pre-flight inspection and refuelled the aircraft from one or more fuel cans. However, he could not remember how much fuel was in the aircraft before he departed for Bute.

The pilot reported that the flight from Strathaven to Bute was flown without incident. The aircraft was parked with the other aircraft while the pilot and passenger went for lunch in a nearby hotel with the rest of the group. On returning to the aircraft, the pilot conducted a pre-flight inspection during which he noticed nothing abnormal. The outbound journey had been flown using the fuel from one tank[1]. Prior to carrying out the power checks for the return flight the pilot selected the other tank. The pilot reported that the power checks were "fine". The propeller pitch controller was set to the TAKE-OFF position and not adjusted or reselected during the accident flight.

The aircraft was the last of the group to depart Bute, using Runway 27, so none of the other pilots were able to provide further information on the accident. However, the takeoff and part of the flight was recorded by two separate witnesses on their mobile phone cameras.

The pilot thought that he would have selected one stage of flap and recalled that the aircraft "got off the ground, no problem". However, the engine then seemed to lose power. He could not remember the height at which this occurred, nor could he recall any specific features of the loss of power beyond a change in the engine noise and the aircraft not performing as he expected. The pilot checked that he had selected full throttle, the choke was OFF and the tank containing the most fuel had been selected. He did not apply the carburettor heat and could not remember checking the airspeed.

The pilot stated that he initially thought that he might have to ditch in the sea, which was directly beyond the end of the runway so he unlatched the canopy and instructed the passenger to hold it closed. However, the aircraft maintained height and the pilot decided to land back on Runway 27. He then made a series of right turns onto an approximate downwind heading with the intention of flying a low-level circuit. The pilot's last recollection was of the aircraft being nose high, giving him little or no forward visibility before the aircraft struck the ground.

During the accident sequence the aircraft inverted with the cockpit section suspended over a roadside ditch with both the pilot and passenger restrained in the aircraft by their harnesses. The pilot told the passenger to undo his seatbelt but received no response

Footnote

1 The pilot could not recall which tank had been selected on each flight.

before a fire developed. The pilot evacuated the aircraft by dropping into the ditch and crawling underneath the passenger. He then assisted the passenger to escape from the burning aircraft. Both the pilot and passenger sustained serious burns.

Witnesses reported that the fire seemed to start immediately after the aircraft stopped and both the pilot and passenger evacuated the aircraft very quickly. The witnesses called the emergency services and after treatment at the accident site, both the pilot and passenger were flown separately to Glasgow by an Air Ambulance and a Royal Navy Search and Rescue helicopter. The passenger later died of his injuries in hospital.

Airfield description

Bute airstrip is an unlicensed grass airfield located 850 m south-west of the village of Kingarth on the Isle of Bute, Figure 1. It has a single runway orientated 27/09 with a declared length of 480 m. The approach to Runway 27 is through a gap cut in a large area of trees which border the eastern end of the airfield. The sea is 600 m west of the end of Runway 27. Between the runway and the sea is an area of small rectangular fields orientated north-south and the edge of a links golf course.

The terrain surrounding the airfield has a pronounced slope up to the north from the runway. The surface of the fields on the lower slopes was very soft though the ridge just north of the A844 road was relatively firm. There are various power and communication wires crossing the fields parallel to the runway.

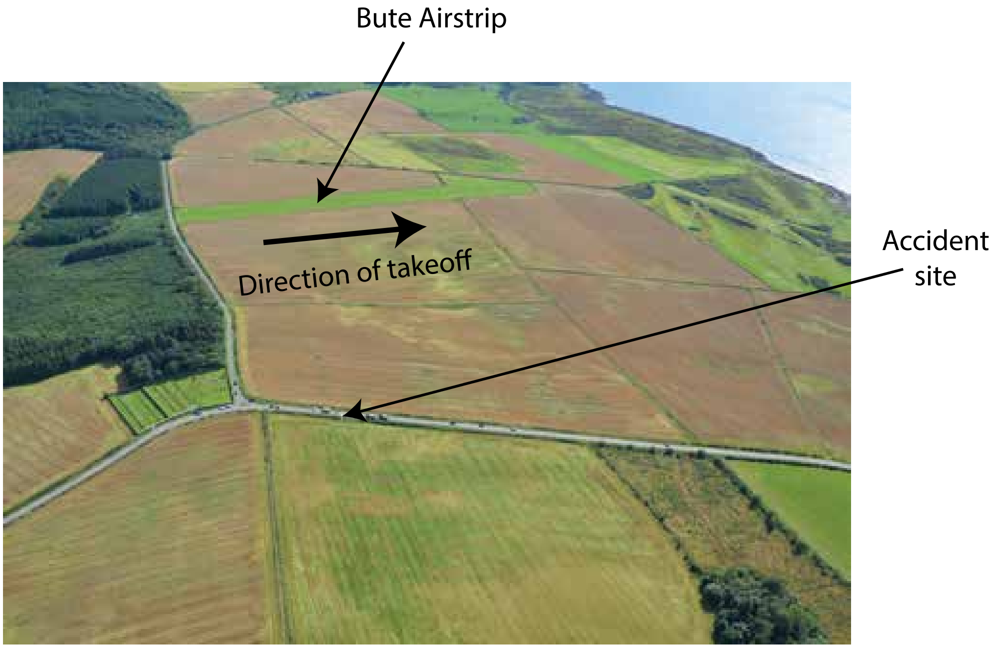

Figure 1

Bute airstrip (Photo courtesy of Police Scotland)

Meteorology

Weather information was acquired by analysing witness mobile phone video recordings and interviews with other pilots who operated from Bute on the day of the accident.

The video shows excellent visibility with no low cloud. The other pilots reported the surface wind as from approximately 260º at 13 to 17 kt. The temperature recorded at 1420 hrs at Prestwick Airport, 20 nm to the south-east, was 16ºC, the dew point was 10ºC and the QNH 1022 HPa.

Aircraft description

General

The SportCruiser is a single-engine, all-metal aircraft fitted with a tricycle landing gear and wheel fairings. It has two side-by-side seats, each fitted with a four-point harness. Access to the cockpit is through a one piece canopy that is connected to the fuselage by two swivel hinges located on the forward sides of the canopy frame. The canopy cannot be jettisoned and entry and exit from the cockpit is only possible by raising the canopy about the forward hinges.

G-EWZZ was a home-built aircraft, designed under the EASA Light Sport Aircraft specification, and operated under a Permit to Fly issued by the Civil Aviation Authority (CAA) on the recommendation of the Light Aircraft Association (LAA).

Flying controls

Two interconnected control columns operate the aileron and elevators via a series of control rods and bell cranks. The rudder is controlled by steel cables connected to the rudder pedals. The flaps are electrically actuated. The aircraft is also equipped with an aileron and elevator trim system utilising trim tabs fitted to the elevator and right aileron. The trim motors are controlled by buttons on the control column and the position of the trim is shown on two indicators located on the left side of the instrument panel.

Although there is no record in the aircraft documentation, at the time of the accident G-EWZZ was fitted with an autopilot that could control the aircraft in roll and pitch. The pilot stated that since he purchased the aircraft in September 2013, he had not fitted or removed any parts which might relate to an autopilot.

Fuel system

Fuel is stored in two 57 ltr fuel tanks located in the leading edge of each wing. The fuel flows from the tanks through strainers to a selector valve mounted on the centre console. It then passes through a gascolator and electrical fuel pump mounted on the engine side of the firewall. The fuel then flows through an engine drive pump to the two carburettors. A sensor between the mechanical fuel pump and carburettor provides information on the fuel pressure.

Engine

G-EWZZ was fitted with a Rotax 912 ULS piston engine equipped with a double contactless ignition system. Each ignition system had its own control unit, ignition coils and spark plug. The electrical supply for the ignition system was independent of the aircraft battery.

Carburettor heating was obtained by moving a flap in the engine bay to direct warm air from around the engine into the engine air intake. The carburettor heat control was mounted on the instrument panel.

Propeller

The following propellers had been approved for used on the Rotax 912 ULS engine fitted to the SportCruiser:

- The Woodcomp Klassic, ground adjustable, three-bladed propeller which has a weight of 2.5 kg.
- The Woodcomp SR 3000/2, two-bladed, electronically operated variable pitch propeller, which has a weight of 11 kg.
- The Woodcomp SR 3000/3 electronically operated variable pitch propeller, which has a weight of 12.48 kg.

The aircraft documentation recorded that a Woodcomp Klassic propeller was fitted to G-EWZZ. However, at the time of the accident it was found fitted with a Woodcomp SR 3000/3 variable pitch propeller, serial number 0988.

Propeller pitch controller

Photographs of the cockpit, taken prior to the accident, show that G-EWZZ was also equipped with a CSC-1 propeller pitch controller. The engine rpm and manifold pressure is sent directly from the engine to the controller where the values are shown on the display. The controller can be operated in manual mode, where the pilot can manually adjust the rpm, or in automatic mode, where the rpm is maintained at a preset value. The controller always defaults to manual mode during engine start. By operating a push mode select button the pilot can sequence through the climb and cruise settings; the default cruise setting is 5,000 rpm. However the system does need to be set up correctly, the installation should be inspected by an LAA inspector and the operation of the system should be checked during the annual check flight. No records were found that any of these actions took place.

Instruments

G-EWZZ was fitted with a Dynon D100 Electronic Flight Instrument System (EFIS), Dynon D120 Engine Management system (EMS), ASI and altimeter. The EFIS integrates and displays the flight information including airspeed, altitude, magnetic compass, turn-rate, slip/skid ball, bank angle and vertical speed. The EMS displays the engine information including rpm, oil pressure, oil temperature, cylinder head temperature and exhaust gas temperature. The pilot stated that when he purchased the aircraft there had been an intermittent fault in the EMS, which did not affect the EFIS, which he fixed by replacing a pin in the plug which provided electrical power to the unit. The aircraft was not equipped with the optional vane-type stall warner that can be fitted to the leading edge of the left wing. However, the pilot stated that the EFIS would provide an audio warning when the aircraft approached the stall, but due to spurious warnings he had disabled this function.

Accident site

The accident site was approximately 590 m north of Bute Airstrip along the line of a fence and ditch that ran parallel to the A844. With the exception of the field to the north of the road, which contained a crop of corn approximately 0.4 m high, there were no other suitable areas in the immediate vicinity in which to land. See Figure 2.

Figure 2

Accident site

Ground marks and paint flakes from the right wingtip show that the aircraft touched down on the right mainwheel and nosewheel at a relatively shallow angle, banked to the right on a heading of approximately 115º(T). The nosewheel broke off and the aircraft continued to slide forward with the inner section of the left wing striking and knocking over several fence posts. After approximately 10 m the front section of the aircraft dropped into a ditch and the aircraft turned over onto its back with the fin coming to rest in a hedge. Propeller cut marks in the ground indicated that the engine was still producing power when it struck the ground.

Foliage in the ditch, the fence posts and foliage on the north side of the ditch were all badly burnt, whereas the grass on the south side of the road was not. This burn pattern was consistent with the direction of the wind.

Damage to the aircraft

General

The aircraft had been extensively damaged by fire and the cockpit area and instrument panel had been destroyed. Most of the aluminium control rods in the centre section of the aircraft had melted, though the steel fittings remained intact. This indicated that the temperature in the area of the cockpit had reached between 650ºC and 1,200ºC. The left wing had sustained more damage than the right with the inner section of the fuel tank having been destroyed by fire. A large dent on the leading edge of the inner section of the left wing was consistent with it having hit the fence posts. The right wing was mostly intact and the right fuel tank contained a small quantity of fluid that was not recovered. The base of the fin and the left stabiliser were both damaged by the heat.

Controls

All the control surfaces moved freely and there was continuity between the rudder pedals and the rudder. Examination of the elevator electrical trim motor revealed that the operating screw was at 30% of its range of travel.

Due to the damage and disruption to the aluminium control rods it was not possible to establish continuity for the elevator and ailerons. However, all the steel connecting rods and fittings were still connected and therefore it is unlikely that there had been a disruption in the flying control system. The flap electrical drive motors had also been destroyed and the control rods extensively damaged; consequently it was not possible to establish the position of the flaps from the wreckage. It was also not possible from the video to determine the position of the flaps prior to the accident.

Engine

The engine and carburettors had been extensively damaged and the insulation on the electrical wiring had melted. Consequently, it was not possible to determine the serviceability of the carburettors and ignition system. Two of the propeller blades had failed close to the blade root in a direction consistent with the engine producing power at the time of impact. The third blade had failed approximately 16 cm from the blade root and the direction of failure indicated that the blade was not rotating when it failed. The engine could not be turned by hand.

The engine was taken to a Rotax approved service centre where it was dismantled and the parts examined. The fuel pump diaphragm and non-return valves were intact and there was no debris on the magnetic plug. All the major components were intact and the inspection revealed no obvious reason why the engine might have lost power. There was also no evidence of any parts of the engine having overheated while the engine was operating. The bearing shells that supported the crankshaft showed evidence of having started to melt after the engine stopped rotating. The No 1 and 2 cylinder connecting rods moved freely, but the No 3 and 4 were very stiff to move. The No 3 and 4 cylinders were closest to the source of heat and it is believed that the stiffness was caused by the bearing shells on the connecting rods having started to melt.

Examination of the propeller

The propeller was examined, under the supervision of the AAIB, by the UK agent. The propeller was identified as a Woodcomp SR 3000/3/1700/R/T/CS/C, serial number 0988. While the AAIB did not have access to the propeller log book, it was established that the propeller had been manufactured in October 2008 and fitted to another SportCruiser, registration G-CFPA. The propeller was damaged in an accident that occurred in October 2010 and was returned to the factory for overhaul in March 2011.

The propeller back plate and hub was intact, but displayed evidence of heat damage. All three pitch limit microswitches and the electrical wires to the electrical motor had been damaged by heat. The two fine pitch microswitches were established as being at, or close to the electrical fine pitch stop and the course pitch microswitch was assessed as being in transit between the course and fine pitch limit. From the angle of the root of one of the blades it was established that the blade pitch was at 16.6º. The blades are normally set to give a fine pitch limit of 18º and a course pitch limit of 28º. However the agent advised that on the Rotax 912 ULS, 18º of blade pitch gives a static rpm of around 5,450 rpm and some owners set the fine pitch stop at 16.5º in order to get a static takeoff rpm of 5,650 rpm.

The electrical motor was tested and found to operate in both directions. The propeller hub was dismantled and all the components were examined. The mechanical pitch stops were all close to, but not touching, the mechanical fine stop set at 12.5º. The blades turned freely in the hub and with the exception of the blade centring cone and the blade bearings all the components were in relatively good condition. The blade centering cone had two rows of dimples formed by contact with the bottom of the three blades. It is possible that this damage was caused by inadequate preload which allowed the centering cone to rotate. The grease on the bearings had dried out, possibly as a result of the post-crash fire. The outer races on the bearings were all heavily indented. None of these factors would have prevented the propeller from operating normally.

The assessment was that the propeller was probably operating satisfactory at the time of the accident with the blade pitch at the electrical fine pitch stop position of 16.6º. On the Rotax 912 ULS engine this pitch angle would give a maximum static rpm at takeoff of between 5,600 to 5,650 rpm.

Testing of fuel

The AAIB was provided with two 1 litre samples of fuel that had been taken from two fuel cans believed to have been used to refuel G-EWZZ prior to the flight to the Isle of Bute. Testing established that both samples were consistent with unleaded gasoline with no evidence of contaminants in either sample.

It was not possible to recover or test any of the fuel that remained in the right fuel tank.

Pilot Information

The pilot held a National Private Pilot's Licence (NPPL) issued in April 2010 with a Simple Single Engine Aeroplane (SSEA) rating issued in October 2011. His logbook showed that he had met the ongoing validity requirements for the SSEA rating, the last instructor signature was dated 12 February 2013. However, this rating requires additional differences training to operate aircraft with variable pitch propellers. Such training is recorded by an entry and signature in the pilot's logbook by a suitably qualified instructor; there was no record that this additional training had been completed.

Medical

Pilot

The pilot had a Declaration of Medical Fitness to Fly, issued in April 2010, which was valid for five years. The burns that the pilot sustained in the accident totalled about 40% of his body surface area, which required extensive medical treatment during an extended stay in hospital.

Passenger

The passenger's burns totalled approximately 80% of his body surface area of which 60% were full thickness. This was beyond the limits of survival and he subsequently died in hospital. A post-mortem examination was conducted by a pathologist on behalf of the Procurator Fiscal. A specialist aviation pathologist interpreted the report on behalf of the AAIB.

The aviation pathologist commented that there was no evidence of significant impact injuries and the pathologist who carried out the post-mortem, commented that the distribution of the burns suggested that they occurred while the passenger was in his seat.

The aviation pathologist also commented that this was a survivable accident and that while commercially available fire-resistant flying clothing might not have altered the fatal outcome, their protective benefits should be highlighted to light-aircraft pilots. The CAA Safety Sense leaflet No 1 '*Good Airmanship Guide'* suggests that pilots and passengers:

> *'Wear clothes that cover the limbs and will give some protection in the event of fire. Avoid synthetic material which melts into the skin.'*

Last flight test report

The last flight test was carried out as part of the Permit to Fly renewal (revalidation) and was dated '*21.1.14*'. The report recorded the following:

'Max static rpm	*5,420 rpm*
Actual loaded weight at take-off	*595 kg*
Actual C of G position at take-off	*540 mm aft of datum*
Time to climb, 1000ft to 2,000ft	*78 secs*
Climb at	*73 mph*
Minimum airspeed achieved	*Flaps up 41 kts'*

Weight and Balance

Aircraft empty weight and balance

The last documented weight and balance of the aircraft was dated 18 January 2010. While the documentation did not record which propeller was fitted, the initial flight test report, dated 30 June 2010, stated that it was a Woodcomp Klassic. LAA inspectors who undertook the inspection for the issue and renewal of the Permit to Fly between 2011 and 2014 all recorded that the Klassic propeller was fitted. However, there is photographic evidence that shows that G-EWZZ was fitted with the Woodcomp SR/3000/3 variable pitch propeller on a number of occasions between 2011 and the date of the accident. The pilot also stated that when he purchased the aircraft in September 2013 it was fitted with the Woodcomp variable pitch propeller and that he had at no time removed or replaced this propeller. The fitment of the heavier variable pitch propeller would have an effect on the weight and balance of the aircraft.

The Maximum Takeoff Weight of the SportCruiser is 600 kg and the operating Centre of Gravity (CG) range is 405 to 507 mm aft of the aircraft datum. The aircraft weight and balance report, dated 18 January 2010, made no reference to an autopilot having been fitted to the aircraft and recorded the empty weight and position as:

'Empty weight	*373.70 kg*
Empty CG	*441.64 mm aft of datum'*

Following the accident the empty weight and balance was calculated by the LAA, with the Woodcomp SR 3000/3 variable pitch propeller and autopilot fitted, as:

'Empty weight	*393.7 kg*
Empty CG	*368.3 mm aft of datum'*

Aircraft weight and balance at the start of the accident flight

As a result of the fire damage, and injuries sustained by the occupants, it was not possible to make an accurate calculation of the weight and balance of the aircraft at the start of the accident flight. Both the pilot and passenger's weights would have increased as a result of their medical treatment and therefore the weights were estimated by reducing their post-accident weights to give a predicted pre-flight weight of 100 kg and 110 kg.

The amount of fuel on the aircraft was unknown, but to allow for the planned flight, with a small reserve, it was unlikely to be less than 20 ltr of fuel weighing 14.8 kg.

The minimum aircraft weight, and position of the CG, was estimated at the start of the accident flight to have been:

'Aircraft equipped with Woodcomp Klassic propeller

Take-off weight	*598.5 kg (limit 600 kg)*
Take-off CG	*539 mm aft of datum (limit 405 to 570 mm)*

Aircraft equipped with Woodcomp SR 3000/3 propeller and autopilot	
Take-off weight	*618.5 kg (limit 600 kg)*
Take-off CG	*536 mm aft of datum (limit 405 to 570 mm)'*

Video analysis

Two witnesses, one standing close to the threshold of the airstrip and the second standing approximately 500 m from the start of the takeoff run and close to the accident site, videoed the accident flight. While both videos recorded the audio it was difficult to detect the noise from the engine above the noise generated by the wind.

The video clip taken close to the threshold lasted for 21 seconds and started during the aircraft takeoff run. There appeared to be nothing unusual about the rotation or initial climb; the aircraft then levelled off and descended before levelling off again.

The video clip taken close to the accident site lasted for 1 minute 34 seconds. It was not possible to establish an engine speed from the audio recording but analysis of the flight path established the following:

- The runway is approximately 480 m long and the takeoff run was estimated to be between 135 and 141 m.
- After takeoff, the maximum pitch attitude of the aircraft during the climb was estimated to be 20º.
- After reaching a height of approximately 50 ft above the ground, and 90 ft above sea level, the aircraft made a small descent before levelling off.
- At times during the remainder of the flight the aircraft appeared to porpoise during which it gained and lost some height.
- As it crossed the electrical pylons close to the accident site, the wings were level and the height was estimated to be 40 ft above the ground and 120 ft above sea level.
- Towards the end of the video the aircraft had a high nose attitude and the wings were initially level. It then banked to the right and started to descend maintaining the nose-high pitch attitude.
- The accident site was 90 ft above sea level.

ATSB report on partial power loss

In 2013 the Australian Transport Safety Board published a safety report on managing partial power loss after takeoff in single-engine aircraft[2]. The key messages in their report were that in order to prevent or minimise the risk of harm following a partial power loss pilots should emphasise:

> *'Pre-flight decision making and planning for emergencies and abnormal situations for the particular aerodrome.*
>
> *Conducting a thorough pre-flight and engine ground run to reduce the risk of a partial power loss occurring.*
>
> *Taking positive action and maintaining control either when turning back to the aerodrome or conducting a forced landing until on the ground, while being aware of flare energy and aircraft stall speeds.'*

Analysis – aircraft accident

General

G-EWZZ was a home-built aircraft that had been fitted with unrecorded modifications, which meant that it was not in compliance with its Permit to Fly. Calculations show that with these modifications the aircraft was likely to have been over its approved MTOW of 600 kg when it departed Bute.

The pilot reported that the aircraft flew satisfactorily on the outbound flight to Bute and that it was during the climb from the airstrip on the return flight to Strathaven that he experienced the symptoms that caused him to believe that he had a partial loss of engine power. The lack of performance could have been due to a combination of factors including a technical fault, handling and aircraft weight.

Aircraft weight

Aircraft weight will affect an aircraft's climb performance and handling qualities. G-EWZZ departed Strathaven without incident and given the greater fuel load would have been approximately 10 kg heavier than when it departed Bute. Therefore, although the aircraft was probably overweight, it is unlikely that this, alone, affected its performance to an extent that it could not have sustained a positive rate of climb.

Technical fault

The pilot could not recall any of the engine parameters or the airspeed of the aircraft during the accident flight. The video evidence showed that the engine was still running at the end of the flight, and the ground marks and damage to two of the propeller blades were evidence that it was still producing power. However, the damage to the engine and aircraft fuel system meant that it was not possible to establish if the engine had sustained a partial loss of power.

Footnote

2 http://www.atsb.gov.au/publications/2010/avoidable-3-ar-2010-055.aspx

The aircraft was fitted with an autopilot and variable pitch propeller; there were no records of either installation on G-EWZZ. The autopilot had been destroyed in the fire, although its presence is unlikely to have caused the accident. Photographic evidence indicates that the variable pitch propeller had been fitted to the aircraft since 2011 without any reported problems. LAA inspectors who carried out the annual permit renewals all stated that the fixed pitch propeller was fitted when they inspected the aircraft.

The last flight test of G-EWZZ was carried out with a fixed pitch propeller, which was different from the type fitted at the time of the accident. The test report recorded a rate of climb, at a takeoff weight close to MTOW, of 770 ft/min. It is not known what the rate of climb would have been with a Woodcomp SR 3000/3 variable pitch propeller fitted.

From the video evidence, the ground run and takeoff appeared to be satisfactory and the initial climb angle reached an estimated 20º before the nose was lowered. This indicated that the engine was producing sufficient power at this time and also suggests that carburettor icing was unlikely.

It could not be determined if the unrecorded modifications or the recent replacement of the pin in the plug that supplied the electrical power to the EMS had affected the operation of the engine, propeller, or the engine and airspeed indications.

Handling

After the initial climb, the video evidence showed the aircraft pitch attitude reducing and the aircraft continued to fly in a near level attitude. In normal circumstances, the aircraft would be expected to accelerate and then continue its climb, which was not the case during this stage of the accident flight.

The pilot identified that the aircraft was not performing as expected and decided to try and return to Runway 27 at Bute. His decision appeared to have been influenced by the area of water ahead of the aircraft and also the fact that neither he, nor his passenger, were wearing or carrying lifejackets. Additionally, the options to conduct a landing were limited owing to the obstacles.

After the pilot perceived the power loss, he unlatched the cockpit canopy and instructed the passenger to hold it shut. It is possible that the passenger was able to hold the canopy in the closed position, which may have had little overall effect on the flight. Equally the effect of a canopy slightly open could have caused additional drag, which might have exacerbated the effect of the loss of engine power and resulted in the pilot being unable to maintain height. However, the effect of the canopy being unlatched could not be determined.

The turn onto the downwind leg resulted in the aircraft flying towards rising ground and there would have been a strong tail wind component, which would have increased the ground speed. Towards the end of the flight the aircraft was seen to be descending in a slightly nose-high attitude and at this point may have been in a stalled condition. The pilot reported that at this stage his forward visibility was poor and he was unaware that the aircraft was descending towards the rising ground.

Section two - Ballistic Parachute Recovery System (BPRS)

Terminology

During this investigation it became apparent that a number of different terms are used to describe a system of deploying an emergency parachute by the use of a rocket. One of the most common terms was Ballistic Recovery System (BRS), which is also the name of the manufacturer of one such system. To avoid confusion, this report will use the descriptor Ballistic Parachute Recovery System (BPRS) as a generic term to describe such systems and the term Ballistic Recovery System (BRS) to refer to the manufacturer of the equipment fitted to the accident aircraft (G-EWZZ).

Aircraft installation

G-EWZZ was equipped with a BRS-6 1350 softpack LSA 'whole aircraft' BPRS. The components in the system are shown in Figure 3 and consist of:

- a parachute pack mounted forward of the instrument panel, aft of the firewall (item 1);
- a number of harnesses and cables to attach the parachute, and the parachute to the aircraft (item 2 and 4).
- a rocket contained in a launch tube mounted above the rudder pedals and between the engine firewall and instrument panel (item 3), which is connected by a cable to the parachute (not shown in Figure 3);
- an activation handle mounted on the instrument panel (item 5).

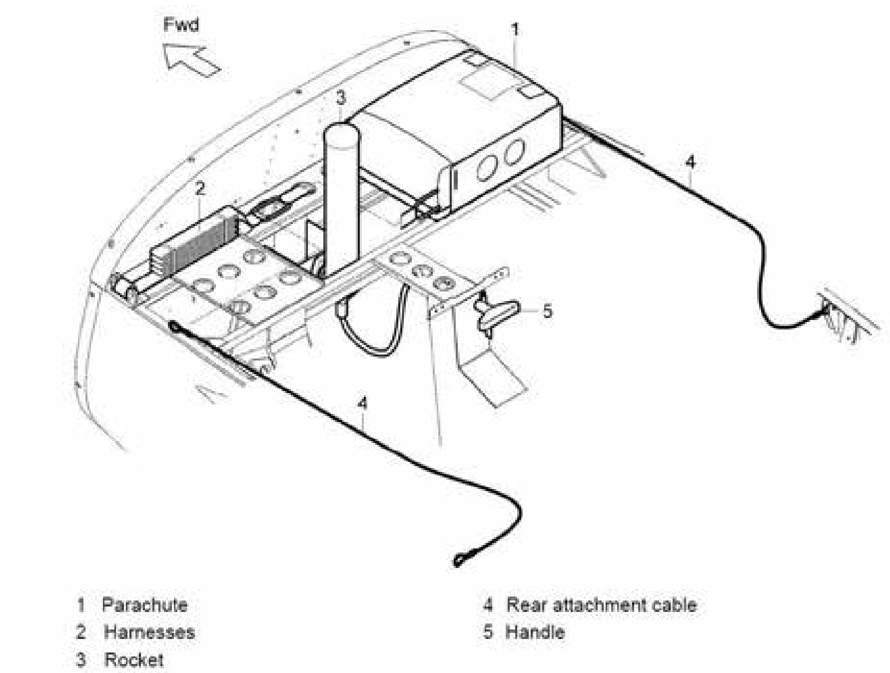

Figure 3

BPRS installation on the SportCruiser

Deployment of the system is achieved by removing the safety pin from the handle (item 5) and pulling the handle rearwards. This action fires the rocket, which on leaving its launcher (item 3) passes through a frangible panel located forward of the canopy. The rocket pulls the parachute from its pack (item 1), to leave the aircraft suspended by the harnesses and cables (item 2 and 4) under the inflated parachute.

Rocket launcher

The construction of the rocket launcher and motor is shown at Figure 4.

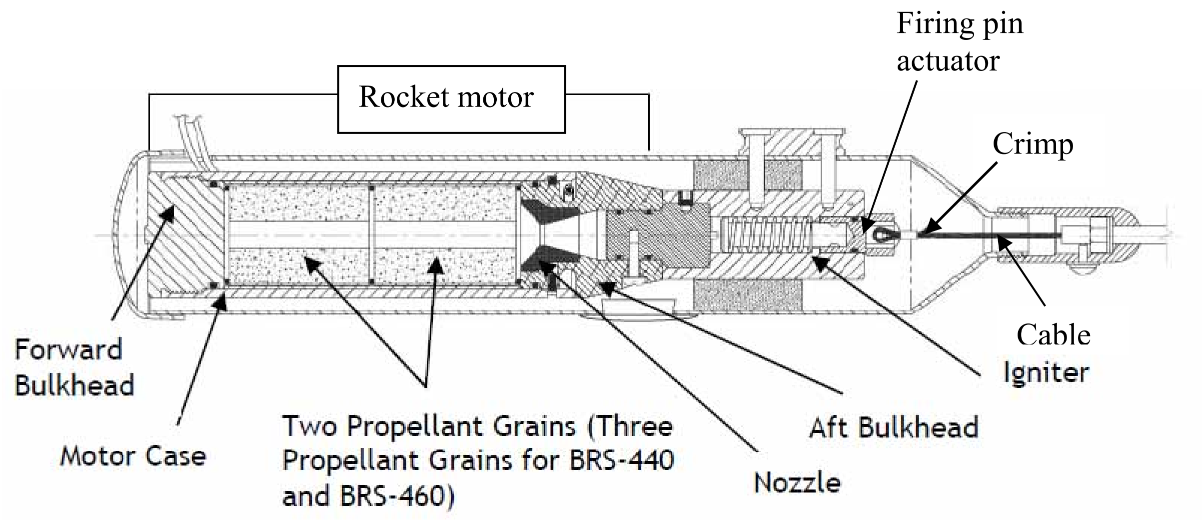

Figure 4

Rocket and launcher

Warning placards

The manufacturer of the system, BRS, required the SportCruiser to have three warning placards attached to the airframe. An orange and black 'Ballistic Warning' placard attached aft of the canopy on each side of the fuselage and a red and grey 'Stay Clear' placard attached on the right side of the parachute egress panel, Figure 5.

G-EWZZ also had a BRS logo attached near the base of the left side of the fin, Figure 6. There were no other placards or logos on the outside of the aircraft to indicate that the aircraft was fitted with a BPRS.

Figure 5

Warning labels required by BRS for the SportCruiser installation

Figure 6

BRS logo on left side of fin

Condition of the BPRS following the accident

The markings on the fin and side of the fuselage warning that a ballistic system was fitted to the aircraft had all burnt off in the post-crash fire. Due to the fire damage to the aircraft it was difficult to identify many of the components in the BPRS system.

The empty rocket motor casing was found lying within the inverted wreckage, approximately 1 m from the firewall where the launcher was fitted, Figure 7.

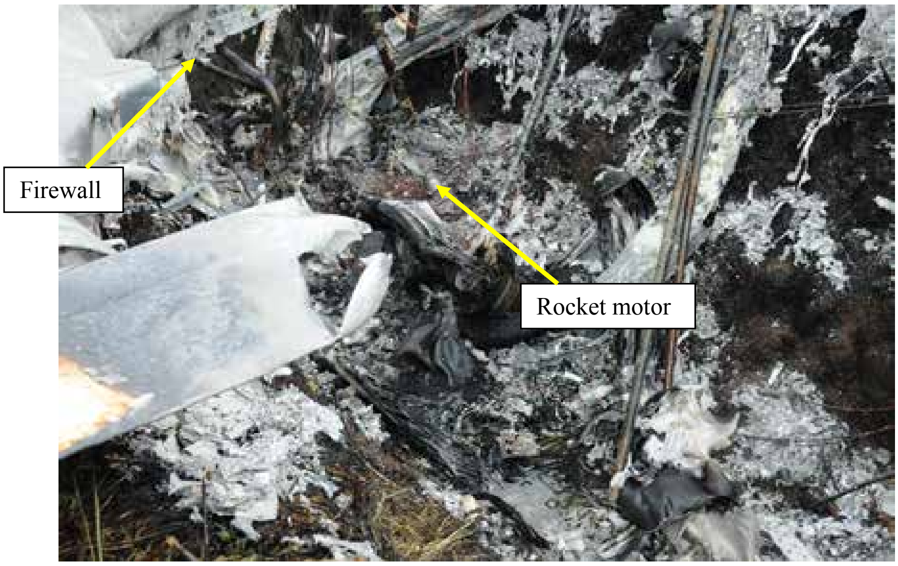

Figure 7
Location of burnt out rocket motor

The rocket casing had been badly damaged by heat and on one side the metal had melted leaving numerous holes. The forward bulkhead on the rocket motor was missing and there was no evidence of propellant remaining in either the rocket motor or nozzle. There was also no evidence of the rocket casing having exploded, Figure 8.

Figure 8
Rocket motor casing

Approximately two thirds of the rocket launcher had been destroyed in the fire and the remaining part had detached from the firewall and combined with other components and molten metal, Figure 9. The cable from the firing handle was not attached to the firing pin actuator which was still fitted in the base of the launch tube. An x-ray examination revealed that both primer cartridges had operated. The police advised that tests carried out on similar primers showed that they generally 'cooked off' at a temperature of approximately 180ºC. The firing handle had been badly distorted, the red paint had burnt off and the outer conduit had burnt away. It is believed that the actuating cable became detached from the firing unit as a result of the crimp, which forms the loop at the end of the cable, having softened and possibly melted in the post-crash fire.

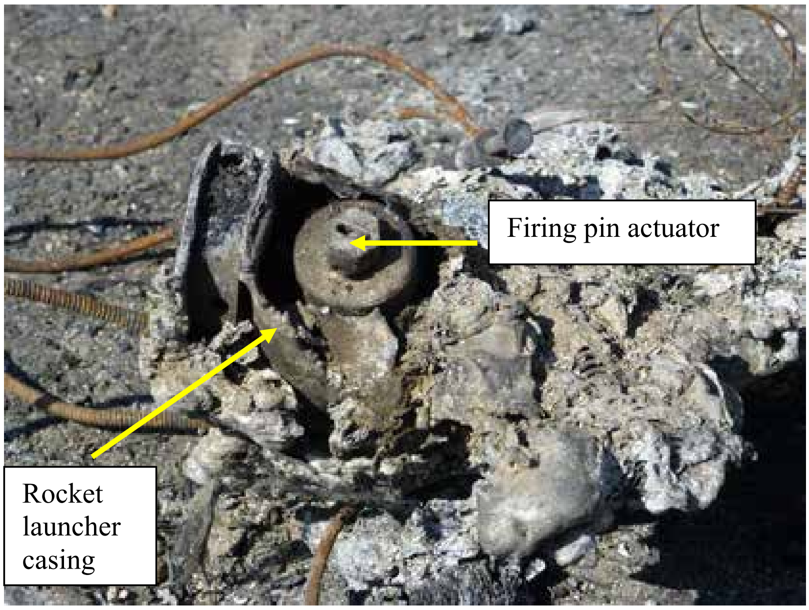

Figure 9

Base of rocket motor launch tube

Advice to emergency workers

The manufacturer, BRS, issued[3] the following warning and advice to emergency workers on the hazards that they might face following an accident to aircraft fitted with a ballistic parachute recovery system.

> *'One potential hazard rescue workers may encounter is an unfired, rocket-deployed emergency parachute system. While these devices are intended to save lives, they have the potential to cause injuries or even death to rescue workers.'*

Footnote

[3] BRS part No 020002-01, Revision A. Owner's manual and general installation guide for BRS-6th Emergency Parachute Recovery Systems.

The guidance contains the following steps that should be taken to disarm the rocket motor.

> *'1. Locate the BRS parachute system by finding the RED activation handle and tracing it to the parachute pack. Note presence or absence of safety pin. Pin if necessary. NOTE: Keep in mind that a badly damaged airplane may have already put the activating housing into a stretched state that could be close to firing.*
>
> *2. Identify the rocket motor launch tube (photos below). Note where the activating housing attaches to the base of the launch tube.*
>
> *3. Cut the activating housing at the base of the launch tube using a bicycle cable cutter (identified below) or equivalent.*
>
> *4. Remove the still-live rocket motor to a secure place and contact BRS for further directions about permanently disabling it.'*

BRS offer the following advice if a rocket motor has separated from its launcher during the accident sequence.

> *'A rocket motor that has separated from the igniter poses no significant hazard, unless it is exposed to fire. Experience has shown that a rocket motor subjected to high temperatures (fire) will not ignite in a normal manner and launch. Rather, they have been observed to burst in a relatively non-threatening display.'*

Report by the Swiss Accident Investigation Board on the dangers from a BPRS

A number of Safety Investigation Authorities[4] have highlighted the dangers from BPRS, following an accident, and have made safety recommendations to address the safety concerns. The Swiss Accident Investigation Board (SAIB) produced a report on the potential risk of BPRS in aircraft to rescue workers and investigators. The report considered the effect of the rocket motor 'cooking off' in a fire which the report stated would generally occur at a temperature of 180º to 220º C. Tests also considered the effect of a 'slow cook off', which simulated the rocket having been in close proximity to a fire.

The SAIB made a number of recommendations on the placarding of aircraft equipped with a BPRS and the actions to be taken following an accident. For the thermal behaviour of rocket motors the SAIB stated:

> *'The results show that these rocket motors can react violently in particularly in a slow cook off scenario with rapid ejection of individual heavy fragments. It is also possible that open energetic substances can remain at the place. First responder teams should know these hazards and should be trained to apply the corresponding counteractive measures'.*

Footnote

[4] An example of concerns raised by SIAs are contained in the following documents:
- Australian Transport Safety Board safety recommendation R20040095.
- National Transportation Safety Board safety recommendations A-04-36 to 41.
- Swiss Accident Investigation Board report number 2148.

Previous Safety Recommendations made by the AAIB

In 2008 a Dyn'Aero MCR-01, 21-YV (call sign F-JQHZ) was involved in an accident which was reported in the June 2009 AAIB Bulletin. On approach to a small private landing field, the aircraft rolled left and crashed in the garden of a private house. The aircraft was fitted with a BPRS, which had not deployed, but was 'live'. It was identified during the investigation that there was a risk to emergency personnel such that any further slight disturbance of the associated aircraft structure, or of the cable itself, by the first responders attending the scene, whilst attempting to gain access to the aircraft's occupants, could have fired the rocket, potentially causing serious injury or even the death to anyone nearby. As a result the AAIB issued the following Safety Recommendations:

Safety Recommendation 2009-007

It is recommended that the International Civil Aviation Organisation publish a Standard which defines internationally agreed warning placards for application to all aircraft fitted with ballistic parachute recovery systems that give as clear an indication as possible at the greatest distance reasonable of the dangers posed to first responders to an accident aircraft fitted with a ballistic parachute recovery system.

Response from International Civil Aviation Organisation (ICAO):

'The safety recommendation states that ICAO publish a Standard which defines internationally agreed warning placards for application to all aircraft fitted with ballistic parachute recovery systems (BPRS), that give as clear an indication as possible at the greatest distance reasonable of the dangers posed to first responders to an accident aircraft fitted with a ballistic parachute recovery system.

ICAO received a similar safety recommendation in 2005 and tasked its Airworthiness Panel (AIRP) to consider the matter. During its deliberations, the Panel concluded, among others, that requiring warning placards in aircraft fitted with BPRS would not increase the safety of response personnel at accident sites, and therefore did not support the recommendation.

Safety Recommendation 2009-007, however, took into account the fact that a member of the public may be a first responder to an accident involving an aircraft fitted with BPRS, and thus merits a further consideration.

Notwithstanding, ICAO believes it would be inappropriate to develop a specific Standard in Annex 8, Airworthiness of Aircraft, before the Federal Aviation Administration, the Civil Aviation Authority and the European Aviation Safety Agency take action with respect to Safety Recommendation 2009-008. After which, ICAO would request the AIRP to reconsider the issue and in developing Standards and Recommended Practices (SARPs) for warning placards, if and where necessary, to indicate the dangers posed to first responders *by an aircraft system. Such SARPs may be associated with Notes included in the text, where appropriate, that would give references to harmonized requirements developed by other authorities, particularly in response to Safety Recommendation 2009-008.'*

Safety Recommendation 2009-008

It is recommended that the Federal Aviation Administration, the Civil Aviation Authority and European Aviation Safety Agency, cooperate to require the application of warning placards of a common agreed standard, to be applied to all aircraft fitted with ballistic parachute recovery systems for which they have airworthiness responsibility, to maximise the possibility of first responders being made aware of the danger posed by a live system following an accident. These placards should be applied in such a manner that at least one such placard should remain visible regardless of the stationary attitude of the aircraft.

Response from Civil Aviation Authority:

'The CAA accepts this recommendation. BCAR Section S, the CAA's design requirements for Small Light Aeroplanes, already contains a requirement for an easily distinguishable external warning placard to be fitted to aircraft where the ballistic recovery system is installed, in order to minimise the potential hazard to personnel on the ground. The CAA is currently working with UK General Aviation representative bodies to extend this requirement, for the aircraft for which it has airworthiness responsibility, to require warning placards which would maximise the possibility of first responders being made aware of the danger posed by a live system following an accident such that at least one should remain visible regardless of the stationary attitude of the aircraft. In parallel, the CAA will co-operate with the Federal Aviation Administration and the European Aviation Safety Agency in order to achieve a common standard for the design of these placards.'

Response from the European Aviation Safety Agency (EASA):

'The recommendation has been addressed by ICAO. ICAO published the State Letter AN 6/26-05/46 dated 12 August 2005, warning states of the danger of rocket-assisted parachute systems and amendments to the Manual of Aircraft Accident and Incident Investigation (Doc 9756 part III - Advance edition). The ICAO Airworthiness Panel concluded that requiring a warning placard would increase safety, however in some conditions associated with aircraft accidents such a warning placard would not be visible until personnel are within the danger zone, hence the mandatory carriage of such a placard would be of limited benefit.

As a result of the above ICAO State Letter and Airworthiness Panel review, the Agency considers that no further action is warranted.'

Regulations concerning the use of a ballistic parachute recovery system

ICAO

ICAO has identified the danger from a BPRS and has included the following advice in the ICAO manual of aircraft accident and incident investigation[5]:

> *'An armed and undeployed rocket-deployed emergency parachute system presents a potentially serious safety risk to personnel attending the site of an accident. There is also inconsistent identification and marking of the hazards posed by the rocket and the associated equipment on the external surfaces of the aircraft. Any failure to correctly identify the hazard posed by the rocket at an accident site could result in serious injury or death.'*

EASA

The standard specification for a Light Sport Aircraft is specified in ASTM F2245-11, which refers to ASTM F2316-12 for the airframe emergency parachutes.

ASTM F2316-12 provides information on the design of the system and the labels and warning placards to be affixed to the components and aircraft. G-EWZZ appeared to comply with these requirements. The specification also makes the following statement about fire hazards:

> *'The installation design and location of the extraction device must consider fire hazards associated with the activation of the parachute system and reduce this fire hazard potential as much as possible without compromising function of the evacuation device.'*

With regard to the safety of rescue workers the specification states:

> *'All producers of ballistically deployed rescue systems shall provide on their website or by printed goods made available as requested, explanations or instructions about safetying their systems or disabling their systems as required for the safety of rescue personnel arriving at the scene of an incident or accident.'*

The information on the BRS web site for the equipment fitted to G-EWZZ was restricted to the components that constitute the BPRS and did not provide any information as to where the components were fitted in the SportCruiser, or the routing of the activation cable.

Footnote

5 ICAO Manual of aircraft accident and incident investigation, Part III, paragraph 13.16.4.

British Civil Airworthiness requirements (BCAR)

BCAR Section S is the basis for the issue of Permits to Fly for small light aeroplanes referred to in Regulation (EC) 216/2008 Annex II. Section K refers to microlight parachute recovery systems and states:

> *'S 2003 General*
>
> *It must be shown by analysis or test that:*
>
> > *a) the airworthiness of the aeroplane, the safety of its occupant(s) and personnel on the ground will not be degraded by the installed parachute recovery system;'*
>
> *S 2041 Markings and placards.*
>
> > *d) A warning placard must be placed on the exterior of the aeroplane close to the stored energy device, which is easily distinguishable by ground personnel, warning of the potential hazard.'*

Light Aircraft Association

With regard to the BPRS fitted to the SportCruiser, the LAA Airworthiness Approval Notice[6] states:

> *'For the BRS system, it (Approval notice) only addresses the impact of the installation on the airworthiness of the aircraft and the safety of the system in respect of third parties: it does not address the effectiveness or otherwise of the recovery system itself.'*

Analysis - Ballistic recovery system

General

The emergency response personnel and accident investigators were initially unaware that G-EWZZ was fitted with a BPRS and the initial medical treatment of the occupants was carried out next to the burning wreckage. The possibility that such a system was fitted to the aircraft was only confirmed when the accident investigator, during the initial examination of the wreckage, identified what he believed was a burnt out rocket motor. It was very difficult to identify any of the other components of the BPRS in the aircraft wreckage.

It is normal practice for accident investigators in the UK to review the information in the CAA's civil aircraft registration database, commonly referred to as 'G-INFO', prior to attending the accident site. The installation of a BPRS is not recorded on this database.

Footnote

[6] Reference LAA 338-738, Supplement 5.

Condition of the BPRS on G-EWZZ

As the actuating cable was not connected to the rocket launcher, it was initially assumed that the BPRS had been manually activated and may have started the fire. However, the firing pin actuator was subsequently found to be fitted in the rocket launcher indicating that the rocket motor and igniter had 'cooked off' in the post-crash fire; this means that the BPRS had not been activated during the flight. There was no evidence of the rocket motor having exploded, which would have produced shrapnel. Instead it would appear that the forward bulkhead in the rocket had been blown-off and the rocket had been propelled towards the centre of the cockpit area. The parachute remained in its pack, the steel components survived, but the composite fibre harnesses were destroyed.

Warning placards

The risks to first responders and accident investigators is well documented. For the warning placards fitted to aircraft equipped with a ballistic recovery system, EASA and the CAA have adopted the standards in ASTM F2316-12. While the SportsCruiser is fitted with the required warning placards, they were not considered adequate to alert individuals to the presence of the hazard from the BPRS for a number of reasons.

- The advice to first responders and investigators is that, due to the potential risk from a rocket motor 'cooking off', they should stay clear of an aircraft that has been on fire until the rocket motor has cooled down. However, the aircraft warning placards are relatively small and difficult to read from a safe distance. The ATSM states that the warning placard should be triangular of a minimum size of 1 inch.

- The placards are only fitted around the cockpit area, which on G-EWZZ were destroyed by fire; the wings and the tail section were relatively undamaged.

- There are no warning placards on the lower surfaces of the aircraft and wings, and the existing placards are difficult to see once the aircraft has inverted, particularly if the accident occurs in a crop or thick vegetation. Light aircraft commonly end up inverted during an emergency landing in a field.

- The accident to G-EWZZ occurred at the weekend, when there is no readily available support for sports aircraft in the UK. It was not known what system had been fitted to the aircraft. The SportCruiser website stated that the aircraft could be fitted with an optional ballistic recovery system, but provided no information as to where the components were located on the aircraft. A photograph on this website showed a BPRS warning label affixed to the fuselage just aft of the canopy. From this photograph it was incorrectly assumed that the BPRS would be fitted, as in other aircraft, aft of the pilot's seats. It was only after speaking to another owner and contacting the manufacturer in the USA that it was realised the system was fitted between the engine firewall and the instrument panel.

- The warning label indicating where the rocket and parachute will leave the aircraft was only required to be fitted on the right side of the aircraft. A low resolution photograph of G-EWZZ on the CAA's G-INFO database only showed the left side of the aircraft and therefore the investigators were initially unaware of the location where the rocket would exit the airframe.

- During rescue operations, it is normal practice for the emergency service to remove the top of the cockpit and any other parts of the structure necessary to free the occupants. However, there are no markings on the aircraft as to the routing of the BPRS actuating cable and it is possible, particularly when it is routed through the cockpit roof, that the emergency services could inadvertently disturb the cable and launch the rocket.

Location of BPRS components

In the SportsCruiser some BPRS components are located in positions that present potential risks:

- The rocket motor and rocket launcher is fitted close to the fuel selector and fuel pipes. It is considered that in this location there is a higher risk of a post-crash fire should the BPRS be inadvertently operated during the rescue operation.

- The BPRS firing unit on the SportsCruiser is fitted between the instrument panel and firewall, and above the rudder pedals. The BPRS manufacturers advise first responders to make the system safe by cutting the actuator cable close to the firing unit. With this design it would be challenging to make the BPRS safe with occupants on board, or when the aircraft has been damaged.

Ballistic Parachute Recovery System – Safety Recommendations

It is widely recognised that following an aircraft accident, a BPRS presents a hazard to first responders, casualties and investigators. These systems are becoming more prevalent and are continuing to be developed and fitted to much larger aircraft.

In order for the emergency services to manage the risk from a BPRS, it is considered that:

- Aircraft should be fitted with warning placards that can be identified and read from a safe distance even with the aircraft is in an inverted attitude.

- The placard should provide information on the location of the rocket launcher and the routing of the actuator cable.

- The rocket launcher should be fitted on the aircraft such that following an accident it can be easily disarmed before the casualties are removed from the aircraft.

- There should be a centralised information system that is easily accessible by the emergency services and investigators that contains the following essential information:
  - o The registration of aircraft equipped with a BPRS.
  - o The type of system fitted.
  - o The location of the major components and routing of the actuator cable.
  - o The actions required to make the system safe.

The existing placarding and installation of BPRS appears to focus on the airworthiness of the aircraft and the safety of individuals during normal operation, handling and maintenance of the aircraft. However, these measures do not fully address the risk posed to the aircraft occupants and third parties following an accident. The AAIB previously made Safety Recommendation 2009-007 to ICAO to publish an international standard on warning placards. ICAO responded that it would be inappropriate to develop such a standard until the FAA, CAA and EASA had addressed Safety Recommendation 2009-008. While the CAA acted on Safety Recommendation 2009-008, the EASA felt that the publication of an ICAO State Letter[7] on the risks to third parties from BPRS was sufficient and, therefore, no further action was taken.

As a result of the identified safety issues, and taking into consideration the responses to the previous AAIB Safety Recommendations, the following Safety Recommendations are made for aircraft operating under European Aviation Safety Agency regulations:

Safety Recommendation 2015-006

It is recommended that the European Aviation Safety Agency review the requirement for the placarding of aircraft fitted with a Ballistic Parachute Recovery System so that the warning placards contain information on the location of the rocket launcher and the actuating device, and can be read from a safe distance regardless of the stationary attitude of the aircraft.

Safety Recommendation 2015-007

It is recommended that the European Aviation Safety Agency introduce the requirement that the rocket-launcher in an aircraft Ballistic Parachute Recovery System is fitted in a position where it can be readily disarmed following an accident.

Safety Recommendation 2015-008

It is recommended that the European Aviation Safety Agency disseminate information for first responders and accident investigators to allow them to identify if an aircraft is equipped with a Ballistic Parachute Recovery System. This information system should include details on the actions required to make the system safe.

Footnote

[7] Hazards associated with rocket-deployed emergency parachute systems. Ref AN 6/26-05/46 dated 12 August 2005.

Safety Recommendations 2015-006 and 2015-007 relate to aircraft that are regulated by EASA. Safety Recommendation 2015-008 relates to information dissemination for aircraft that operate in Europe. However, the BPRS is also fitted to aircraft that are not regulated by EASA and are referred to in Regulation (EC) 216/2008 Annex II[8]; these aircraft are regulated by the appropriate National Aviation Authority. Therefore, for the identified safety issues also to be addressed for aircraft referred to in Regulation (EC) 216/2008 Annex II and in addition to address the dissemination of information for BPRS fitted to aircraft operating in the UK, the following Safety Recommendations are made to the Civil Aviation Authority:

Safety Recommendation 2015-009

It is recommended that the Civil Aviation Authority review the requirement for the placarding of aircraft referred to in Regulation (EC) 216/2008 Annex II, fitted with a Ballistic Parachute Recovery System, so that the warning placards contain information on the location of the rocket launcher and the actuating device, and can be read from a safe distance regardless of the stationary attitude of the aircraft.

Safety Recommendation 2015-010

It is recommended that the Civil Aviation Authority introduce the requirement that, for aircraft referred to in Regulation (EC) 216/2008 Annex II, the rocket-launcher in an aircraft Ballistic Parachute Recovery System is fitted in a position where it can be readily disarmed following an accident.

Safety Recommendation 2015-011

It is recommended that the Civil Aviation Authority introduce an information system, for aircraft operating in the UK that allows first responders and accident investigators to identify if an aircraft is equipped with a Ballistic Parachute Recovery System. This information system should include details of the type of system fitted, the location of the major components, routing of the actuator cable and the actions required to make the system safe.

Safety Recommendation 2015-012

It is recommended that the Civil Aviation Authority takes action to ensure that information on the risks from Ballistic Parachute Recovery Systems is disseminated to the emergency services operating in the United Kingdom.

BULLETIN CORRECTION

The date of the accident was incorrectly stated as 9 September 2014; the accident occurred on **9 August 2014**. The online version of the Bulletin was corrected prior to publication.

Footnote

[8] Annex II of Regulation (EC) no 216/2008 of the European Parliament and of the Council of 20 February 2008 on common rules in the field of civil aviation and establishing a European Aviation Safety Agency, and repealing Council Directive 91/670/EEC, Regulation (EC) No 1592/2002 and Directive 2004/36/EC

ACCIDENT

Aircraft Type and Registration:	Pietenpol Air Camper, G-OHAL
No & Type of Engines:	1 Continental Motors Corp C90-14F piston engine
Year of Manufacture:	2008 (Serial no: PFA 047-12840)
Date & Time (UTC):	25 July 2014 at 1130 hrs
Location:	Shenington Airfield, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Landing gear collapsed, engine shock-loaded, damage to lower fuselage
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	1,877 hours (of which 1 was on type) Last 90 days - 64 hours Last 28 days - 21 hours
Information Source:	AAIB Field Investigation

Synopsis

During the final stages of the approach to land, despite the pilot's actions, the aircraft did not enter the flare which resulted in a heavy landing and caused the landing gear to collapse. This was probably the result of a combination of a higher than normal rate of descent, low airspeed and a lack of elevator effectiveness as the aircraft was operating at its forward Centre of Gravity (C of G) limit.

History of the flight

The aircraft was owned and operated by a syndicate, some of whom had limited experience flying tailwheeled aircraft. To increase their experience they engaged the pilot, a flying instructor experienced in flying the Piper Supercub, to give them instruction. Prior to carrying out instruction, the pilot arranged to carry out a familiarisation flight in the aircraft. A member of the syndicate, who had recently completed the aircraft's Permit to Fly airtest, briefed the pilot on its handling characteristics. He stated that this briefing included the expected takeoff, climb and stall speeds together with a recommendation that should a high rate of descent develop during the approach to land, or in the event that the aircraft bounced on landing, that "one should apply at least half throttle instantly".

During the pre-flight preparation it was found that, with the pilot flying solo, the aircraft would be outside of the Centre of Gravity (C of G) limitations. To bring the aircraft's C of G into an acceptable position, a member of the syndicate agreed to fly as a passenger in the forward cockpit. Recalculation confirmed that the C of G was then at the forward limit.

The prevailing weather conditions reported the wind as being from 40º at 9 kt. The pilot's understanding was that the aircraft's landing gear may be susceptible to damage from side loads, so it was decided to fly from Turweston (Runways 09/27 in use) to Shenington (Runway 05) where into-wind landings could be carried out.

The pilot reported that the aircraft did not take off at the briefed speed of 40 mph, but had to be positively rotated at 45 mph. During the climb the pilot noted that the control forces required to maintain the climb where higher than anticipated, despite the use of full 'nose-up' trim. It was reported that the aircraft would not maintain a climb at the briefed speed of 55 mph, but could be trimmed to climb at 65 mph. In order to become more familiar with the aircraft's handling, the pilot performed a series of steep turns and stalls at a safe altitude. No abnormalities were observed whilst completing the turns, but it was reported that the aircraft entered the stall at 50 mph; the stall speed that had been recorded during the aircraft's previous air test was 38 mph.

The aircraft was then flown to Shenington Airfield for an into-wind landing on the grass area alongside Runway 05L. The initial approach was flown at 65 mph, with the engine at low power, full aft trim and a significant rearward stick force required to prevent an increase in speed. The recommended approach speed was 55 mph with a threshold speed of 50 mph. The pilot stated that a "steeper than normal" approach, using sideslip, was flown in order to avoid an "obstruction" in the grass area before the touchdown zone. Prior to touchdown, the pilot recovered from the sideslip and attempted to flare the aircraft. The pilot estimated the aircraft's speed after recovery from the sideslip was between 50 mph and 55 mph, with the engine at low power. Despite moving the control column fully rearwards, the aircraft did not enter a flare before it struck the ground. This resulted in the collapse of the main landing gear, penetration of the lower fuselage by a landing gear strut and the propeller striking the ground. The aircraft subsequently came to rest and both occupants were uninjured.

The Pietenpol Air Camper

The Pietenpol Air Camper is a two-seat, plan-built, parasol-winged monoplane designed in the 1920's. A number of modifications have been produced since the type's initial design which improves the wing and wing strut arrangements, allow the installation of Rolls-Royce Continental engines and improve the landing gear. These modifications have been reviewed by the Light Aircraft Association (LAA) and are considered to form part of the design standard for the aircraft. The design documentation allows the position of the wing to be repositioned from its datum position so that an owner can 'optimise' the aircraft's C of G to meet their requirements.

Prior to its acquisition by the syndicate, the wing of G-OHAL had been positioned four inches forward of the plan datum position. After acquisition by the syndicate, in 2012, the aircraft had undergone a period of maintenance during which time the wing had been repositioned to the original datum point. After maintenance the aircraft had been reweighed and its C of G position recalculated.

In comparison to other aircraft designs, the Air Camper has a relatively low lift to drag ratio. In the event that the airspeed reduces below the desired speed, the nose of the aircraft must be lowered through a greater angle than in an aircraft with a relatively high lift to drag ratio, or engine power increased rapidly to recover the loss of airspeed. These characteristics are normally associated with microlight aircraft rather than aircraft such as the Piper Supercub.

Investigation

The aircraft was examined by the AAIB. No evidence was found of a pre-accident defect or restriction to the rudder and elevator control circuits. During the recovery process the wings had been removed from the aircraft which precluded testing of the 'complete' aileron circuit. There was no evidence of a restriction or defect in the aileron controls. Examination confirmed that the horizontal stabiliser angle was within the limits defined in the approved documentation.

Testing of the pitot static system, from the wing disconnect, to both cockpits confirmed that no leaks were present and that the airspeed gauges were accurate to within 1 mph. The removal of the wings prevented a test of the complete system, but tests on the section of the pitot static system located in the wing showed no evidence of leaks, blockage or restriction.

Inspection of the forward cockpit confirmed that the floor immediately below the seat had been penetrated by a landing gear strut; it had not penetrated the seat pan. The extent of the damage to the lower fuselage was discussed with the LAA who confirmed that, as a result of this accident and a number of other events, they were reviewing the penetration protection provided by a number of aircraft seats.

Using the weights provided by the pilot and the syndicate member who had briefed the pilot, the aircraft's weight and balance were recalculated. This confirmed that the aircraft had been at its maximum takeoff weight prior to takeoff and that the aircraft's C of G was on its forward limit. Based on the difference in the aircraft's weight between the accident flight and the Permit to Fly airtest, the predicted takeoff, climb and stall airspeeds were recalculated with the following results, Table 1.

	Takeoff	**Climb**	**Stall**
Air test recorded speeds	40	55	38
Reported speeds	45 (rotation speed)	65	50
Calculated speeds	43	58	41

Table 1

Aircraft speed calculations

The calculated speeds demonstrate that there would have been an increase in those recorded during the Permit to Fly airtest when the aircraft was operating at its maximum takeoff weight. The reported takeoff speed and the calculated takeoff speed are of the same order. However, the difference between the reported and calculated climb and stall speeds is significant and may have been attributable to the effects of the C of G position. The forward C of G position during the flight would require greater downforce on the horizontal tail to achieve longitudinal trim which would have the effect of further increasing the wing-loading. A secondary effect was a decrease in the ability of the elevator to pitch the aircraft 'nose-up'. In this case the 'fully nose-up' elevator may have insufficient authority to induce a stall and the aircraft may have descended, nose-high without the wing achieving a stalled condition.

The LAA commented that aircraft designs, such as the Pietenpol Air Camper, which have limited elevator effectiveness when operated near the forward C of G limit, show significant differences in the minimum achievable flying speed with small movements of the C of G position. The LAA also commented that small changes in engine power setting can, in such aircraft, produce significant changes in the minimum flying speed due to the improvement in elevator effectiveness, and increased wing lift generation from the propeller slipstream.

Due to the "obstruction" before the touch down zone, the pilot flew a "steeper than normal" angle of descent which resulted in an increased rate of descent. The use of sideslip during the latter stages of the approach further increased the rate of descent. The relatively high stick forces reported by the pilot during the descent may have been influenced by the forward C of G position of the aircraft. The loss of airspeed during the later stages of the approach would have reduced the effectiveness of the elevator and limited its ability to arrest the aircraft's rate of descent. In addition, the engine was operating at a low rpm minimising the effect of the propeller wash over the elevators, further decreasing their effectiveness. The failure of the aircraft to enter a flare before striking the ground was probably the result of a combination of higher than normal rate of descent, low airspeed and a lack of elevator effectiveness.

ACCIDENT

Aircraft Type and Registration:	Schleicher ASW 20 L, G-LYSA
No & Type of Engines:	None
Year of Manufacture:	1978 (Serial no: 20054)
Date & Time (UTC):	18 June 2014 at 1618 hrs
Location:	North Hill Airfield, Sheldon, Devon
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:	BGA Gliding Certificate
Commander's Age:	73 years
Commander's Flying Experience:	Approximately 12,000 hours (of which 11 were on type) Last 90 days - 24 hours Last 28 days - 12 hours
Information Source:	AAIB Field Investigation

Synopsis

The glider was making an approach to the landing site and was witnessed flying at a near constant low height along much of the field. The glider then entered a steep right turn at the upwind end of the field, during which the nose dropped. The glider struck the ground in a steep nose-down attitude, probably as a result of stalling during the turn. The pilot was fatally injured.

It was considered that the pilot probably made an error of substitution by operating the landing gear lever rather than the airbrake. As a result of this accident, the BGA re-issued a Safety Alert letter to owners of this type of glider to inform them of the risks of using the wrong control whilst attempting to operate the airbrake lever.

History of the flight

The pilot was on his fourth flight of the day having previously flown two instructional flights and a short solo flight. In addition, he had participated in a retrieve of the accident glider from a nearby field where it had landed earlier. This involved de-rigging the glider and then re-rigging it after it had been transported back to the airfield. During the winch launch on his third flight, another pilot noticed that the glider airbrake was unlocked and made a radio call to him. The pilot appeared to stow the airbrake and the launch continued normally.

The accident flight commenced at 1514 hrs and lasted 64 minutes. Near the end of the flight, the pilot was heard to call downwind for a hangar landing[1]. After turning onto final approach, the pilot overtook another glider that was at a height of approximately 50 ft on the normal final approach. The pilot of this glider described the speed of the accident aircraft as appearing abnormally high. Subsequently, several witnesses observed the aircraft flying down the centre of the field at an estimated height of between 30 and 100 ft agl in an easterly direction. They all commented that the aircraft was too high to make a normal landing within the field length remaining. Some witnesses reported seeing the flap position cycling through various positions and two witnesses reported seeing the dihedral of the wing changing in a corresponding way[2]. When it was abeam the crash site, the aircraft entered a steep turn to the right at an angle of bank reported to be between 60° and 80°. Most witnesses described the speed of the glider at this point as being abnormally slow and two witnesses described the glider pulling up slightly, immediately before entering the turn. After the aircraft had turned right through approximately 160°, the nose dropped suddenly and the aircraft impacted the ground in a steep nose-down attitude. The observed configuration of the glider throughout this manoeuvre was: flap extended, landing gear up (the landing gear doors were observed to be slightly open by one witness) and airbrake in.

Generally, witnesses who met with the pilot during the day, reported that he appeared fit and well and in good spirits. However, when the pilot was sitting in the glider cockpit just prior to his final launch, one witness reported that he appeared slightly confused and hesitant with the pre-launch airbrake check.

Examination of the aircraft

Examination of the wreckage at the accident site indicated that the aircraft had struck the ground in a steep nose-down attitude. This resulted in bending failure of the small diameter aft fuselage, because of the offset axial compressive loading created by the position of the centre of mass of the tail unit above the fuselage centre line. Impact forces had also fragmented the cockpit section of the aircraft. One of the two wing tip extensions had disengaged, apparently as a result of damage to the attachment rib due to inertia loading. It was noted that a composite grip, subsequently identified as that from the control stick, had separated and come to rest approximately 10 metres ahead of the aircraft.

The wreckage was recovered to the AAIB, where a detailed examination confirmed substantial disruption of the flying control system, the flap operating system and the airbrake controls. There was, however, no evidence of any pre-impact failure. A metallic strip, normally attached to the inner left wall of the cockpit and forming detents for the landing gear lever in the respective up and down positions, was separated as a result of the structural disruption. This damage removed any restraint on the operating lever and mechanism, allowing the inertia force of the impact to displace the single mainwheel forward from an initially retracted

Footnote

[1] A hangar landing is where a glider lands on a different part of the airfield so that it finishes the landing run conveniently close to the hangar for subsequent storage.

[2] With no flap extended, this type of glider exhibits a characteristic dihedral bend to the mainplane in flight. This bend visibly reduces when flap is extended and the centre of lift moves inwards.

position or ensure it remained at the forward extended position. The pre-impact position of the landing gear could not be confirmed by wreckage examination.

Examination of the control stick and the separated grip revealed that the latter was shaped to be held comfortably by the hand and incorporated a 'swollen' profile at its upper end, to limit the possibility of the hand slipping upwards and becoming disengaged. The stick was made up of a tubular metal.

Under laboratory examination, it was determined that the grip, of composite material, had been manufactured from two halves that had been bonded together. Subsequently, a resin coating had been applied to the inner surfaces and allowed to cure. The evidence indicated that this had then been ground down mechanically until it formed an interference fit around the metallic stick. The grip had thereafter been secured by being driven axially onto the end of the tubular metal stick, although the extent of engagement between the handle and the stick was only limited. No adhesive or mechanical fastener had been used to join the grip to the metal tube. As a consequence, the strength and stiffness of the joint was probably sufficient to leave no evidence of inadequacy during normal use but the joint was lacking in attachment strength. The grip had, apparently, separated under the bending and tensile forces created by the pilot's hand gripping the stick firmly during the impact. It is also possible that the grip may have become separated from the stick following an instinctive hard pull back on the control by the pilot, immediately before impact. Once the grip had separated, the top of the tubular stick was exposed.

The grip carried a press-to-transmit button for the radio and a switch to alter the mode of operation of the variometer, an instrument that was not available at the time the aircraft was manufactured. It appears that the grip fitted at the time of the accident was not the one with which the aircraft was equipped on initial manufacture. It is probable that the grip was fitted as part of the implementation of the upgrade of the variometer to enable the mode select switch of the instrument to be incorporated.

The manufacturer of the control grip publishes fitting instructions and these, translated, state[3]:

> *'The mounting in the glider can be done by each (technical experienced) pilot. After removing the old pilot stick and cutting off the wiring the new stick is mounted on the control rod for example with acidfree silicone or thickened resin. Finally the wiring has to be re-build.*
>
> *Before gluing the pilot stick in your glider you should check, if the mounting should be symmetrical of with an angle around the axis of the control rod to reach a better haptic adaptation.*
>
> *The stick has NO aviation approval (as the most pilot sticks in gilders), the mounting has to be checked by an aviation inspector. I will not overtake any responsibility or liability for the usage of this pilot stick in aircrafts or other applications.'*

Footnote

3 The English instructions are a translation, made by the manufacturer, from the original language.

Although the maintenance records of the aircraft appeared to be complete, they covered a period of 35 years, during which time the aircraft had been in the possession of five different owners. Two of these had been based in the Irish Republic, where the aircraft had been registered for seven years.

Meteorology

An automatic weather station is located at Dunkeswell Aerodrome, 1 nm to the east. At 1600 hrs, the recorded weather was: surface wind from 030° at 10 kt, visibility 23 km, few clouds at 2,900 ft, broken clouds at 4,300 ft and temperature of 20.5°C. At 1700 hrs, the recorded weather was: wind from 050° at 11 kt, visibility 20 km, scattered clouds at 2,700 ft, a further layer of scattered clouds at 4,100 ft and temperature 20.4°C.

An anemometer, located on top of the hangar at the gliding site, recorded a surface wind speed of 10 kt gusting to 15 kt at 1615 hrs, and 9 kt gusting to 13 kt at 1620 hrs; both readings from a direction of 022°. The temperature recorded at the site was 25°C but this was from an uncalibrated source.

The pilot

The pilot had extensive experience as a commercial helicopter pilot before taking up gliding in 1998. The majority of his gliding experience was on ASK13 and ASK21 gliders, and he only recorded having flown the ASW20 glider on 10 occasions, amassing just over 11 hours on type.

The pilot was an assistant instructor at the gliding club. He usually acted as the duty instructor at the gliding site on Wednesdays, as he was doing on the day of the accident. He held a Silver rating and a Light Aircraft Pilot's Licence (LAPL) medical certificate.

Comparison of glider types

In the last year, the pilot had flown ASK13, ASK21, SZD51 Junior, DG505 and ASW20 gliders. Apart from the ASW20, these gliders have a single lever control on the left side of the cockpit and this controls airbrake operation. The ASW20 has three levers on the left side of the cockpit controlling landing gear, airbrake and flap operation. The flap lever is uppermost and has a pin that engages with holes in a plate on the canopy rail to retain the lever at discrete flap settings. The airbrake lever is coloured dark blue, operates in the conventional sense and the lever hangs down from the horizontal operating rod on which it is mounted (see Figure 1). However, the pilot can rotate the lever handle around the operating rod so that it can be conveniently positioned; often this will be with the lever in a horizontal orientation resting on the top of the pilot's left leg. The landing gear lever protrudes vertically out of a slot in the sidewall. The lever is retained at each end of the travel by a gate that locks the landing gear in the chosen position; rearwards movement of the lever retracts the landing gear. The handles on the three control levers are similar in size, shape and feel.

The landing gear lever handle is black and the airbrake lever handle is dark blue; although they are different colours, the visual contrast between the two lever handles is small. After the landing gear is extended, with the airbrake still retracted, the two co-responding control levers are very close to each other in the cockpit. In addition, the landing gear lever and, in its natural position, the airbrake lever, would both be orientated vertically.

In Figure 1, the flap lever is shown in the high-speed position (-11°), the airbrake lever is shown in a partially extended position and the landing gear lever is in the down position.

Figure 1

Left internal side wall of an ASW20 glider
(This is not an image of G-LYSA.)

Other events involving misuse of controls

The British Gliding Association (BGA) provided statistical data on incidents and accidents where pilots have incorrectly used the landing gear control instead of the airbrake. Of the 30 such events between 1974 and 2014, 28 involved ASW15, ASW19, ASW20 and Pegase gliders[4] and 19 resulted in the aircraft landing long or overshooting the landing area altogether.

In addition, 14 incidents involved 10 other types of glider in which the flap lever was, mistakenly, operated instead of the airbrake.

In December 2010, the BGA issued a Safety Alert to all registered owners of these gliders informing them of the potential for this control confusion.

The ASW20 glider was last produced in 1990. It was superseded in 1995 by the ASW27, which, with subsequent gliders produced by the manufacturer, had the landing gear lever positioned on the right side of the cockpit. This design change effectively eliminated the possibility of confusing the airbrake lever with the landing gear lever.

Footnote

4 These four glider types have a similar configuration of airbrake and landing gear controls.

Pathology

The pilot sustained multiple injuries in the accident and the pathologist stated that these may have proved fatal in the longer term. However, an injury to the head, caused by the control stick tube, was judged to be immediately fatal.

No medical or toxicological factors were found which could have had a bearing on the cause of the accident.

Airfield information

North Hill is a grass gliding site located one mile west of Dunkeswell Airfield. The operating area is approximately 1,000 m in length and 350 m at the widest point. Two operating strips are normally used, these are orientated 260°/080° and 235°/055° respectively. The field slopes slightly downhill from the intersection of the two strips and the hangar area at the eastern end of the field. On the day of the accident, the gliding club was winch launching gliders from the 055° strip and they were landing to the north of this strip. At the end of the day, pilots landed their aircraft on or near the eastern part of the 080° strip so that they were conveniently close to the hangar for subsequent stowage. An air/ground radio is available and this is used for glider pilots to make information calls. On the day of the accident, a large number of large wrapped straw bales were spread over the field to the north of the crash site. Figure 2 shows a view of the final approach on the day of the accident, and the field to the north containing the straw bales.

Figure 2

A view of the airfield from the direction of the final approach
(The accident site is at the far end of the field, beyond the isolated tree.)

Recorded data

G-LYSA was equipped with a number of cockpit instruments that had GPS capability and could record flight track logs. These were a Naviter Oudie moving map display, a LX Flarm Red Box and a Cambridge Aero Instruments 302 variometer with 303 display. The accident flight was only recorded by the moving map and variometer logger.

Figure 3 shows the final part of the track, in profile, with spot heights and groundspeeds (averaged between successive points). Figure 4 shows the ground track as a time history. These Figures indicate that the glider was downwind abeam the airfield at 700 ft aal, with a groundspeed of 60 kt, and descended to 400 ft aal above the airfield perimeter when established on final approach. Over the next 12 secs, there were minor variations in the glider's height, before it descended at about 1,250 ft/min to 125 ft aal, above a point just east of the airfield's two launch strips. Over the last 20 secs (to the last recorded point), the glider descended to 70 ft aal and then climbed back to 100 ft aal as it commenced a turn to the right. The groundspeed for this last point had reduced to 45 kt. Using the surface wind measured at the site two minutes before the accident, the airspeed at this point was estimated to have been between 52 and 55 kt. The data indicates that the drag of the glider increased during the approach; this is evident from the reversal in the increasing speed trend, while the descent continued.

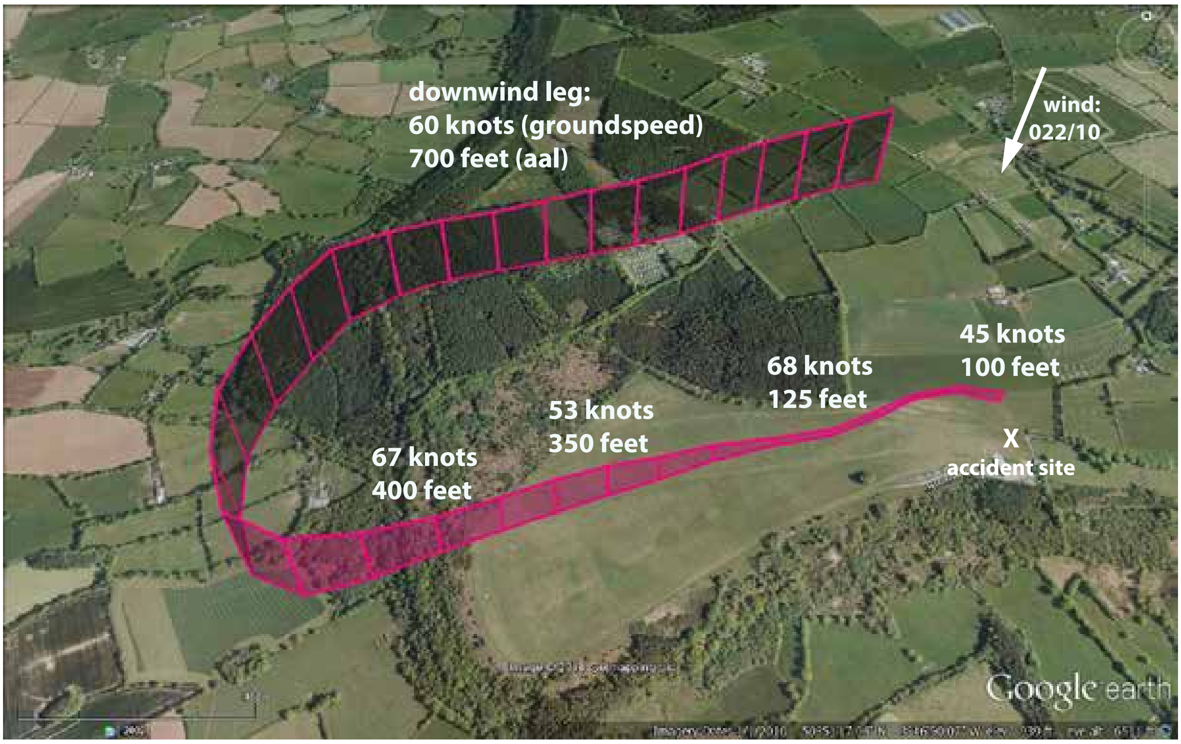

Figure 3

G-LYSA approach to North Hill

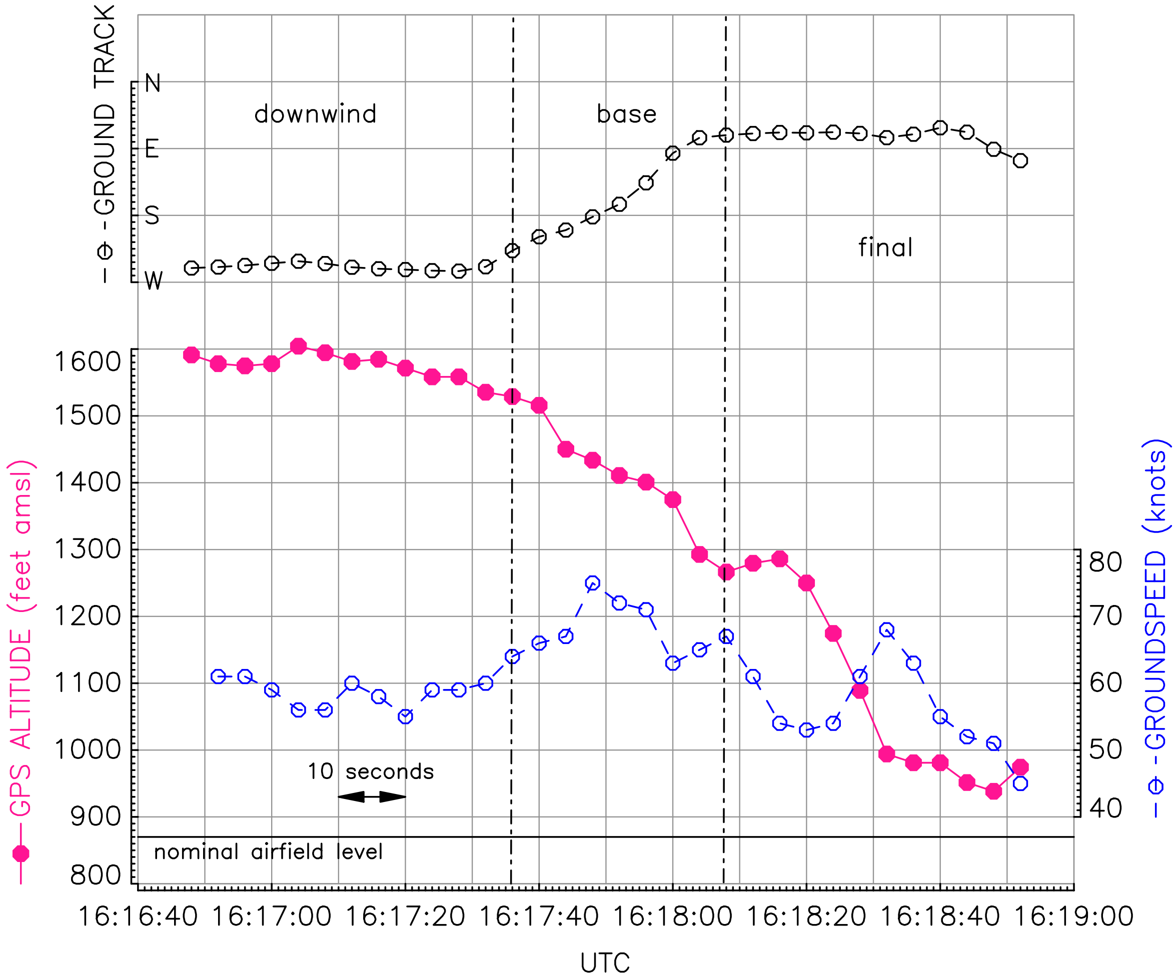

Figure 4

Recorded data for G-LYSA's approach to North Hill

Other factors

The following factors were considered during the investigation.

Fatigue

The pilot departed home at approximately 0800 hrs (local time) that morning, which was one hour earlier than he normally left when he was going to the gliding site. The journey to the airfield was estimated at about 1 hour. Thereafter, he had carried out two short flights in the morning prior to participating in a glider retrieve from a field near the gliding site. A glider retrieve involves dismantling the glider and man-handling the components into the glider trailer. On return to the airfield, the components are removed from the trailer and the glider is reassembled. This process involves a reasonable amount of physical labour. Subsequently, the pilot flew two further sorties, the last of which lasted 64 minutes and terminated in the accident.

Heat

The weather on the day of the accident was warm and sunny; at the time of the final flight, the temperature was above 20°C. The pilot normally wore a hat when flying and would routinely carry some water. However, although there is evidence that he was wearing a hat, no water bottle was found at the accident site.

Unfamiliarity with the aircraft

The pilot was highly experienced and had been flying gliders regularly for 16 years. However, his experience in this model of glider was limited. Although there is no evidence that he was ill-prepared for his flight in the glider, it was relatively unfamiliar to him and this would have imposed an additional workload on him during the flight. This workload would have increased further during the approach and landing phase where it is naturally more demanding. That the airbrake had been unlocked on a previous launch, further indicated that the pilot may have been unfamiliar with the control layout.

It has been recognised that, beyond an optimum level of workload, any further increase leads to a degradation in performance.

> *'As the demands of the task, or the workload, are increased, the standard of our performance increases to an optimum level of workload and performance is achieved. Any increase in workload after this point leads to degradation in performance. At extremely high levels of workload (overload), important information may be missed due to the narrowing or focussing of attention onto only one aspect of the task'[5].*

Analysis

The pilot would normally fly downwind to land with the landing gear deployed. On approach, the glider would often be configured with intermediate flap extended and the airbrake being used by the pilot to control the angle of approach. Although the landing gear and airbrake levers are different colours, the visual contrast between the two lever handles is small. Additionally, after the landing gear is extended, with the airbrake still retracted, the two levers, which are of similar size, shape and feel, are very close to each other and can assume similar orientations. Under these circumstances, there is potential for a pilot to mis-identify the correct control and operate the incorrect one.

Should the pilot inadvertently operate the landing gear lever instead of the airbrake lever, he would then retract the landing gear and not deploy the airbrake. In this accident, the landing gear was observed to be retracted and there was no evidence that the airbrake was being used. Without the airbrake, the glider would maintain a shallow descent angle and this, coupled with the slight downhill slope of the landing zone, would explain the apparent lack of height loss and why the glider continued at its observed height until it was near to the end of the field. (The recorded data indicated that there was an increase

Footnote

5 Human Factors for Aircrew. Green, Muir, James, Gradwell and Green.

in drag during the approach and witness evidence suggested that it was most likely that the variations in drag were caused by the observed flap operation, not airbrake.) At this point, the airspeed was estimated to be between 52 and 55 kt. The aircraft then entered a steep turn to the right, with over 60° angle of bank. A slight pull up on entry to the turn, observed by some witnesses, would have had the effect of reducing this airspeed. At 60° angle of bank, in a steady turn, the effective stalling speed of the glider, with maximum flap selected, is approximately 51 kt. Any increase in angle of bank beyond 60° would have further increased the stalling speed, as would a flap selection less than the maximum. It is probable that, in turning downwind, the combination of reducing airspeed and increasing bank angle led to the aircraft stalling at a low altitude, from which recovery would not have been possible in the height available.

It is probable that the pilot made an error of substitution by operating the landing gear lever rather than the airbrake. He then appears to have operated the flap lever, instead of the airbrake, to control the rate of descent on the final approach to his intended touchdown zone. This error, on this and other gliders of similar control configuration, has been well documented by the BGA. The investigation examined possible factors that could have contributed to this error; heat and physical fatigue, unfamiliarity with the aircraft and control similarity. The possibility that the pilot was suffering from the effects of heat, dehydration and physical fatigue which adversely affected his mental performance could not be discounted. The pilot had been outdoors for much of the day, the weather had been warm, he had been involved in a glider retrieve in the middle of the day and was at the end of his fourth flight, which had lasted 64 minutes. Any fatigue experienced by the pilot would have reduced his performance and his capacity to analyse the situation when it deviated from expected norms. His lack of familiarity with the glider could have increased his mental workload, further adversely affecting his mental performance. Lastly, the similarity in position, orientation, feel and low colour contrast of the airbrake and landing gear controls increased the likelihood of the pilot operating the wrong one by mistake. It was not possible to determine which of these factors led to the error but it is probably that all of them played some part in the accident.

There was no evidence of any pre-impact failure on the glider. However, the apparent separation of the grip from the control stick during the impact exposed the pilot to the tubular end of the stick, with fatal consequences. Other injuries he sustained may have proved fatal in the longer term. The fitting instructions, provided by the manufacturer of the control grip, state that some form of adhesive should be used to secure the grip to the control stick. No evidence was found that any adhesive had been used in the fitting of this grip.

Conclusions

The investigation assessed that an undetermined combination of fatigue, unfamiliarity with the glider and similarity of the landing gear and airbrake controls probably led to the pilot operating the landing gear control, by mistake, instead of the airbrake control. This resulted in the aircraft being configured with the landing gear retracted and the airbrake not deployed for the final approach. With the flaps appearing to be cycled through various positions, it did not seem to descend on the normal final approach path but maintained height until it was near the upwind end of the field. A subsequent steep turn, which put the glider in a downwind position, resulted in it stalling at a height from which it was not possible to effect a recovery.

Safety actions

As a result of this accident, the BGA re-issued a Safety Alert letter to owners of ASW 15, ASW19, ASW20 and Pegase gliders to inform them of the risks of using the wrong control whilst attempting to operate the airbrake lever.

In August 2014, the BGA issued a Safety Alert recommending that control column grips should be fitted in accordance with the instructions supplied with the product, and that pilots should check the stick grip for security as part of the routine daily inspection.

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 A320-214, G-EZUC
No & Type of Engines:	2 CFM CFM56-5B4/3 turbofan engines
Year of Manufacture:	2011 (Serial no: 4591)
Date & Time (UTC):	30 January 2015 at 1440 hrs
Location:	In descent to Milan Malpensa Airport, Italy
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 7 Passengers - 137
Injuries:	Crew - 1 (Serious) 1 (Minor) Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	10,237 hours (of which 6,426 were on type) Last 90 days - 114 hours Last 28 days - 32 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and operator's air safety reports

The aircraft was being operated on a scheduled passenger service between London Gatwick Airport and Milan Malpensa Airport. During their pre-flight preparations, the flight crew noted that only low levels of turbulence were forecast, although there had been a report of severe turbulence over the Alps at FL220.

During the descent, the flight crew asked ATC if there were any turbulence reports along their intended track, and were told that light to moderate turbulence had been reported. The commander warned the cabin crew of the possibility of turbulence and instructed them to secure the cabin. A few minutes later, passing FL220, the aircraft had two brief but severe clear-air turbulence encounters in quick succession.

Two members of the cabin crew were injured in the turbulence encounters so, the flight crew arranged for medical staff to meet the aircraft on its arrival. The injured crew members were taken to hospital where one was found to have suffered a broken ankle and the other severe bruising.

ACCIDENT

Aircraft Type and Registration:	Beech 200 Super Kingair, G-KVIP
No & Type of Engines:	2 Pratt & Whitney Canada PT6A-41 turboprop engines
Year of Manufacture:	1979 (Serial no: BB-487)
Date & Time (UTC):	31 December 2014 at 1757 hrs
Location:	Newquay Airport, Cornwall
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right propeller, right side of nose and right main landing gear door
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	39 years
Commander's Flying Experience:	4,421 hours (of which 142 were on type) Last 90 days - 126 hours Last 28 days - 23 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

After refuelling at Newquay Airport, the pilot was taxiing to depart when the right propeller of the aircraft struck ground equipment. It is likely that the position of a bowser during refuelling, and the pilot's position in the aircraft, contributed to the pilot not seeing the ground equipment before the aircraft struck it.

History of the flight

The aircraft was had arrived at Newquay Airport on an air ambulance flight, and was parked on the most westerly parking stand (Stand 23) on Alpha Apron prior to positioning to Exeter. It was operated by one pilot with a medical technician in the cabin.

The aircraft was refuelled from a bowser parked in front of it. The pilot attended to an administrative task elsewhere while the aircraft was being refuelled and, when he returned, the bowser was still in place. The pilot carried out an external inspection of the aircraft and boarded shortly before the bowser was driven away. After starting the engines he was instructed to make a 90° right turn to join the Alpha taxiway and then make a right turn to proceed to the A2 holding point. He did not receive any guidance from a marshaller nor was this required by the airport operator.

As the aircraft commenced the right turn, its occupants heard a loud bang and felt a "judder". The pilot stopped the aircraft and asked the passenger if he could identify the source of the noise. The passenger indicated that it may have been a piece of equipment moving in the baggage compartment. The pilot recommenced taxiing and, on reaching the holding point, was informed by ATC that he may have hit something. The aircraft returned to the parking slot it had vacated and shut down.

It was night and the weather conditions were "good".

The aircraft suffered damage to its right propeller, right main landing gear door and the right side of the aircraft nose. The propeller had struck a panel on an item of mobile airfield barrier system (MABS) equipment; the panel was found some distance away. The pilot saw the MABS for the first time when he returned to the stand after the incident. As the MABS almost certainly moved as a result of the collision, it was not possible to establish its position before it was struck by the aircraft.

Airfield information

The Newquay entry in the United Kingdom Integrated Aeronautical Information Package stated:

> *'Aircraft parking Alpha Apron stands 20-24 are to follow marshaller guidance.'*

There was no requirement specified for marshaller guidance for an aircraft taxiing out. Nosewheel guidance lines were painted on the apron surface to mark the route for taxiing onto the stand but none were provided for taxiing out. The MABS had been positioned between Stand 23 and Stand 22 and was there to mark the restricted area on the apron. The MABS was not lit.

Analysis

The position of the bowser during refuelling probably obstructed the pilot's view of the MABS whilst he was carrying out his external inspection. Also, the structure of the aircraft probably partially or completely obstructed his view of the MABS from his seated position in the left pilot's seat. Unaware of the MABS he did not select his taxi route to avoid it and the right propeller struck the MABS panel, detachment of which caused the other damage to the aircraft.

ACCIDENT

Aircraft Type and Registration:	British Aerospace ATP, G-BTPC
No & Type of Engines:	2 Pratt & Whitney Canada PW126 turboprop engines
Year of Manufacture:	1988 (Serial no: 2010)
Date & Time (UTC):	15 January 2015 at 0150 hrs
Location:	Coventry Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to both nose gear doors and to the underside of the forward fuselage. Top cover of ground power unit crushed
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	47 years
Commander's Flying Experience:	3,356 hours (of which 2,326 were on type) Last 90 days - 65 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form and Mandatory Occurrence Report submitted by the pilot

Synopsis

After engine start, the flight crew gave the ground crew the signal to remove wheel chocks. As the chocks were removed, the aircraft moved forward and collided with a ground power unit. The aircraft's parking brake was subsequently found not to have been set. A number of procedural factors were identified as contributing to the accident, as well as time pressure arising from the need to depart ahead of an airport closure.

History of the flight

The aircraft was being readied for a flight from Coventry to Dublin. On board were the flight crew of two and approximately 4,600 kg of freight. Loading and final paperwork was completed at about 0145 hrs. Although neither crew member felt that they were rushed, they were nevertheless subject to a degree of time pressure as the flight had been delayed and the airport was due to close at 0200 hrs.

The flight crew carried out the pre-start checklist and then started the right engine, after which the ground crew were given the signal to disconnect the ground power unit (GPU), positioned directly in front of the aircraft. The commander expected to see the GPU being moved clear of the aircraft, but when this did not happen he signalled the left engine start to the ground crew, which was approved. With the left engine started, the commander signalled for the nosewheel chocks to be removed, which was actioned by the ground crew. Immediately the chocks were removed, the aircraft began to move forward and the first officer saw the ground crew member run clear of the aircraft to the right.

Both flight crew members immediately applied wheel brakes, but as they did so, the aircraft collided with the GPU. The flight crew shut down both engines and informed ATC, who initiated a 'ground incident' alert. There were no injuries and damage was confined to forward parts of the aircraft and the top cover of the GPU.

After the accident the flight crew realised that the parking brake was not set, resulting in the aircraft's movement when the chocks were removed. The commander noted that there had been an expectation that the parking brake would have been set to ON when the crew first arrived at the aircraft. The parking brake was not an item on the turnaround checklist which the crew had carried out earlier, although it was an item on the pre-start checklist which had therefore not been carried out correctly. The commander also observed that the signal to remove the chocks was given before the GPU had been moved clear of the aircraft. Although the flight crew had not felt rushed, the commander believed that they had been under a time pressure due to the imminent airport closure, and that this had been a contributory factor.

ACCIDENT

Aircraft Type and Registration:	Cessna 172S Skyhawk, G-MEGS
No & Type of Engines:	1 Lycoming IO-360-L2A piston engine
Year of Manufacture:	2008 (Serial no: 172S10723)
Date & Time (UTC):	11 January 2015 at 1430 hrs
Location:	Cambridge Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to left wing and hangar door
Commander's Licence:	Private Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	264 hours (of which 150 were on type) Last 90 days - 3 hours Last 28 days 0 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and occurrence report by Cambridge ATC

The aircraft was being taxied from a grass parking area to a refuelling bowser. The pilot turned the aircraft left off the taxiway onto an adjacent apron, where he intended to make a 180° turn to the right. As the pilot's attention was directed to his right prior to making the turn, the aircraft's left wingtip struck the door of a small hangar. The pilot attributed the accident to his positioning close to the hangar prior to the turn and to a moment's inattention to his left wingtip clearance as he prepared to carry out the manoeuvre.

ACCIDENT

Aircraft Type and Registration:	Extra EA 300/200, G-TWOO
No & Type of Engines:	1 Lycoming AEIO-360-A1E piston engine
Year of Manufacture:	1996 (Serial no: 5)
Date & Time (UTC):	6 December 2014 at 1500 hrs
Location:	Wombleton Airfield, North Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Left landing gear leg broken, damage to left wheel fairing, left wing and aileron
Commander's Licence:	Private Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	7,343 hours (of which 300 were on type) Last 90 days - 52 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

After a normal approach and landing on Runway 28 at Wombleton Airfield, the pilot applied the brakes towards the end of the landing roll. He reported that the right brake worked, but the left did not and he was unable to prevent the aircraft ground-looping to the right. The left tyre found sufficient grip on the dry surface that the left main landing gear leg fractured and folded inwards.

The maintenance organisation which examined the aircraft after recovery found no anomalies with the braking system, but advised that they are aware of an issue with earlier Extras whereby the pedal travel becomes progressively longer (and the brakes less effective) over a number of landings. The solution is to remove the brake hydraulic reservoir cap and exercise the brakes to take up the slave cylinder clearance, which is caused by the fact that the reservoir cap is sealed. The company advocates doing this at about 25 landing intervals but when they tested G-TWOO's system, it did not exhibit excessive pedal travel.

ACCIDENT

Aircraft Type and Registration:	Jodel DR1050 Ambassadeur, G-AYLL	
No & Type of Engines:	1 Continental Motors Corp O-200-A piston engine	
Year of Manufacture:	1960 (Serial no: 11)	
Date & Time (UTC):	4 November 2014 at 1043 hrs	
Location:	Lee-on-the-Solent Airfield, Hampshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Fracture of rear fuselage	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	67 years	
Commander's Flying Experience:	870 hours (of which 295 were on type) Last 90 days - 2 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional inquiries by the AAIB	

Synopsis

Following an apparently normal touchdown, the pilot lost directional control of the aircraft, which departed onto the grass beside the runway. Inspection revealed a major failure of the rear fuselage. Although some deterioration of the wooden structure was present, it could not be determined whether this had been a causal factor in the loss of control or a consequence of the ground manoeuvre.

History of the flight

The aircraft was making an approach to land on Runway 35 at Lee-on-the-Solent Airfield. The wind was from 360º and calm as the aircraft approached at an airspeed of 60-65 mph and flared to a three-point touchdown with airbrakes extended. Shortly afterwards, during the landing ground roll, the aircraft started to swing to the right and the pilot corrected by applying left rudder. However, the aircraft continued to the left, leaving the paved surface and turning through approximately 270º before he regained control. The pilot applied power and regained the runway heading but taxied on the grass to the parking area in order to be clear of other departing traffic.

As the pilot shut down and vacated the aircraft, he saw that the rear fuselage had been badly damaged (Figure 1). He had not been aware of the severity of the damage until then.

Figure 1

G-AYLL showing damage to rear fuselage discovered after a ground loop landing incident. (Photograph via pilot)

Discussion

Inspection of the runway revealed distinctive tailwheel tyre marks indicative of shimmy for some distance before the aircraft left the paved surface. Starting at a raised crack in the tarmac surface, the marks continued until the aircraft ran onto the grass, where the tailwheel had struck the remains of a concrete runway gutter.

The pilot was of the opinion that the tailwheel shimmy may have been precipitated by the runway surface condition and major damage caused by striking the exposed concrete debris at the side of the runway, but it could not be ruled out that the fuselage may have failed on touchdown, leading to shimmy and the loss of directional control. Several witnesses who supplied photographs of the rear fuselage to the AAIB commented that the wooden structure appeared wet with possible indications of a 'tidemark', suggesting that liquid water had been present over an extended period. The photographs also appeared to show that deterioration of some of the bonded joints had been present for some time prior to the accident.

The extent to which this deterioration may have contributed to a possible structural failure during an otherwise normal touchdown could not be determined. However, the Light Aircraft Association (LAA) advised that they intended to highlight the particular importance of close inspection of elderly wooden structures in a forthcoming edition of their journal *Light Aviation*.

ACCIDENT

Aircraft Type and Registration:	Robinson R44 Raven, G-CEDG
No & Type of Engines:	1 Lycoming O-540-F1B5 piston engine
Year of Manufacture:	2006 (Serial no: 1639)
Date & Time (UTC):	25 February 2015 at 1050 hrs
Location:	Aspley Guise, Bedfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - 1 (Minor)
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	69 years
Commander's Flying Experience:	1,632 hours (of which 902 were on type) Last 90 days - 4.9 hours Last 28 days - 2.7 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB

Synopsis

The helicopter had settled into a cruise climb shortly after takeoff when the engine rpm started to increase and to hunt. The pilot switched off the governor to control the speed manually and initiated a precautionary landing. However, he believes the engine then failed and, during the subsequent autorotative landing, the helicopter rolled onto its side. At the time of writing, there is no hard evidence of an engine or governor fault but it was noted that the weather conditions were consistent with a risk of serious carburettor icing at any power.

History of the flight

The day before the accident, the owner/pilot collected the helicopter from Sywell Aerodrome to reposition it to a private strip near Salford, Bedfordshire. However, upon starting the engine, the governor increased the engine rpm to above normal value, so he shut it down and sought engineering advice. When the engine was restarted, everything seemed normal and he decided to continue with the flight to Salford, which proved uneventful.

The next day, as planned, he boarded the helicopter with two passengers and a small amount of baggage for a flight to a hotel near Forest Row, East Sussex. The engine start and takeoff were both uneventful and the pilot established a cruise climb profile as he set off en route. At 800 ft, the governor increased the engine rpm beyond the green arc on the gauge and was also hunting, so the pilot switched off the governor and tried to control the rpm manually. He initiated a precautionary landing by lowering the collective lever and commencing a descent but the low rotor rpm warning sounded and he lowered the lever fully. An attempt to raise it again resulted in the horn sounding, so he assumed the engine had now failed and entered autorotation towards a field some 2 km south of where he had taken off.

On touchdown, the helicopter slid forward about 3 m before the skids dug into the ground and it rolled onto its left side. The pilot and one of his passengers exited via the right side doors whilst the other passenger kicked a hole in the windscreen.

In his statement, the pilot considered that he had had a governor failure followed by an engine failure. At the time of preparation of this report, it is not known whether any investigation work is planned on the engine and governor system, but it was noted that the weather conditions were conducive to 'serious icing – any power' according to the official chart on risk of carburettor icing published by the CAA. The pilot does not recall whether he had applied carburettor heat as he reduced power but probably had not done so due to the rapid development of events.

ACCIDENT

Aircraft Type and Registration:	Robinson R44 II Raven, G-HECK	
No & Type of Engines:	1 Lycoming IO-540-AE1A5 piston engine	
Year of Manufacture:	2006 (Serial no: 11416)	
Date & Time (UTC):	5 December 2014 at 1325 hrs	
Location:	Leeds Heliport	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to tail rotor blades, gearbox and drive, and to tail surfaces. Damage to roof of parked vehicle.	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	45 years	
Commander's Flying Experience:	131 hours (of which 15 were on type) Last 90 days - 9 hours Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot and engineering report by the helicopter operator	

The pilot carried out pre-flight checks on the helicopter, which was parked on an apron in front of a small hangar. The helicopter was facing away from the hanger; to its left was a small portable building and immediately to its right was a parked vehicle. The pilot started the helicopter and initiated lift to the hover by raising the collective lever. As the helicopter lifted off, the pilot felt unusual and severe vibrations which appeared to come from the main rotor. He lowered the collective immediately to land, but as he did so the helicopter yawed to the left. The tail boom struck the parked vehicle, causing damage to both the helicopter and the vehicle.

The helicopter operator reported that an engineering investigation did not reveal any abnormality in the main rotor or its control system which could have accounted for the vibrations reported by the pilot.

ACCIDENT

Aircraft Type and Registration:	Kiss 450-582(2), G-PGHM	
No & Type of Engines:	1 Rotax 582/48-2V piston engine	
Year of Manufacture:	2004 (Serial no: BMAA/HB/341)	
Date & Time (UTC):	21 November 2014 at 1130 hrs	
Location:	Near Haverhill, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nosewheel and fuselage	
Commander's Licence:	National Private Pilot's Licence	
Commander's Age:	25 years	
Commander's Flying Experience:	46 hours (of which 24 were on type) Last 90 days - 5 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries	

The pilot had visited the farm field in which he intended to land on several occasions, including the morning of the accident flight, and had assessed that it was suitable for use. He stated that although the approach went well, he did not account for loss of wind speed before touchdown, and the aircraft landed "a bit heavily". The nose landing gear buckled under the trike, breaking the nose cone. The aircraft came to rest after a ground slide of about 20 m. Neither occupant was injured. The pilot stated that the accident was caused by his lack of experience and insufficient speed.

ACCIDENT

Aircraft Type and Registration:	P&M Aviation Quik GT450, G-MCFK
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2014 (Serial no: 8696)
Date & Time (UTC):	6 November 2014 at 1035 hrs
Location:	Plaistow Airfield, Hertfordshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to propeller, pod and right spat, substantial damage to wing
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	1,390 hours (of which 561 were on type) Last 90 days - 28 hours Last 28 days - 11 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The purpose of the flight was to familiarise a reasonably experienced pilot of another type of weight-shift microlight with the Quik GT450. After an uneventful circuit and landing, the pilot told the passenger to taxi the aircraft to the runway and perform another, similar circuit. However, this time, contrary to the pilot's instructions, the passenger adopted an incorrect technique and, despite intervention by the pilot who eventually tried to abandon the takeoff, the aircraft had to be steered left to avoid over-running the runway. During the turn, the aircraft tipped onto its right side.

History of the flight

The pilot, who occupied the rear seat, was conducting a familiarisation flight on the GT450 for the benefit of a passenger who was also a pilot and who had 242 hours experience flying the P&M Aviation Quantum. The pilot briefed his passenger that one of the differences he would need to be aware of is that the control bar should not be pushed forward to initiate lift off at an indicated airspeed of less than 50 mph. With the passenger handling the aircraft, but with prompts from the pilot, they taxied to the threshold of Runway 30, stopped, levelled the wing and set it to neutral pitch. The passenger then set full power and released the brakes. The aircraft accelerated normally and at 50 mph indicated, the pilot told the passenger to start moving the control bar forward. The aircraft lifted off and the rest of the circuit and landing was uneventful.

The pilot then briefed the passenger that he should taxi the aircraft back to the threshold of Runway 30 and repeat the circuit as before. This he did but, instead of lining up and stopping once he reached the runway, the passenger immediately applied full power whilst pushing the control bar fully forward. The pilot immediately pulled the control bar back to neutral, telling the passenger that he needed to minimise the drag until 50 mph was reached, but the aircraft was under full power and seemed to be accelerating normally. Again, on reaching 40 mph, the passenger pushed the control bar forward as far as it would go, effectively stalling the wing, and the aircraft started to slow down.

The pilot pulled the control bar back to neutral and shouted that he had control – at this stage he believed that there was still enough runway left to take off safely. However, this time the acceleration was not as great as he expected and he called an aborted takeoff. In this aircraft, only the front seat occupant can control the brakes. The pilot felt the passenger apply them, immediately causing a skid on the wet grass. The passenger then released the brakes and the pilot instructed him to reapply them; he complied, but did not brake as strongly as previously.

The pilot now realised that they would not stop before the end of the runway and, rather than face a one metre drop onto a road, he steered the aircraft to the left (encountering some resistance from the passenger on the steering bar). Unfortunately, their speed was too great and the aircraft tipped on to its right side before coming to rest.

The passenger could not explain why he had done a rolling start with the control bar fully forward; neither could he explain why he had tried to lift off at 40 mph, beyond saying that "it felt about right". He also admitted that he may have been resting his foot on the brake when the pilot re-took control.

The pilot believes that he may have been too relaxed about the situation because of misplaced confidence in his passenger, on account of the latter's experience and the previously satisfactory circuit.

ACCIDENT

Aircraft Type and Registration:	Team Minimax 91, G-CGGX
No & Type of Engines:	1 Rotax 447 piston engine
Year of Manufacture:	2011 (Serial no: PFA 186-14421)
Date & Time (UTC):	16 November 2014 at 1145 hrs
Location:	Near Ruthin, Denbighshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Severe damage to right fuselage area, landing gear structure and engine mountings
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	49 years
Commander's Flying Experience:	271 hours (of which 84 were on type) Last 90 days - 10 hours Last 28 days - 0 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot had reinstalled the aircraft's engine following an overhaul and carried out a ground run in accordance with the manufacturer's requirements. The pre-departure power checks were carried out and the pilot noticed that the maximum rpm was 5,800 rpm as opposed to the normal 6,100 rpm, but he elected to take off anyway. Shortly after becoming airborne, engine power was lost and during a gentle right turn towards a suitable field the aircraft entered an incipient spin to the right and impacted the ground.

History of the flight

The pilot built the aircraft and installed a Rotax 447 engine fitted with a single carburettor, and carried out formal training to fly it. After approximately 100 hrs of flying he noticed that there appeared to be a reduction in engine power and sent the engine to an engine specialist for investigation. When the engine was returned the problem was recorded as a 'stuck piston ring'. The pilot refitted the engine and carried out the manufacturer's recommended ground running prior to flying. He noticed that the engine still did not appear to be producing the normal power and that the maximum rpm was 5,800 rpm instead of the 6,100 rpm to which he was accustomed. It was also difficult to start, hot or cold. He decided to fly the aircraft to see if this would clear any problem and carried out the pre-flight checks.

The weather included a light wind from the north north-west with visibility 7 km, overcast cloud and an OAT of 10°C and a dew point of 9°C. The aircraft weight was 445 lbs with a maximum permitted takeoff weight of 590 lbs. The pilot selected the maximum diagonal distance across the rectangular field which gave a takeoff direction into wind and a distance available of approximately 300 m. He selected maximum power and the aircraft accelerated more slowly than normal across the field, but became airborne after approximately ¾ of the available distance; he would normally expect to become airborne in less than 150 m. Climb performance was very poor and, at what witnesses estimated as about 60 ft, there was a total loss of power. The pilot lowered the nose and made a gentle right turn towards a field in which to perform a forced landing.

During the turn the right wing stalled and dropped, causing the aircraft to enter an incipient spin. The pilot raised the wing and reduced the steep nose-down attitude prior to impact with the grass surface of a field. He was secured by a four-point restraint harness and was able to brace himself and cross his hands in front of his face before the aircraft struck the ground. The aircraft was severely damaged but there was no fire and the pilot was able to isolate the fuel and electrical systems before exiting the aircraft unaided, sustaining only minor injuries despite severe disruption to the aircraft structure. Emergency services were not called to attend but the pilot was driven to hospital by his wife.

The pilot concluded that the sudden loss of engine power resulted in a loss of airspeed which, when the right turn was initiated, led to the incipient spin. He could not recall his recovery actions but remembered the steep nose-down attitude reducing. He considered that given the engine was not achieving its normal rpm in the power check the takeoff should not have been attempted, and when the engine lost power he should not have attempted the turning manoeuvre. No cause for the loss of engine power was determined.

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:	Vans RV-8, G-NRFK
Date & Time (UTC):	2 October 2014 at 1304 hrs
Location:	Norwich Airport
Information Source:	Aircraft Accident Report Form

AAIB Bulletin No 1/2015, page 58 refers

The occurrence was incorrectly classified as an accident. The occurrence is reclassified as an incident.

The online version of the report was corrected on 17 March 2015.

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

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.

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 southwest 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.

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

http://www.aaib.gov.uk

GLOSSARY OF ABBREVIATIONS

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

AAIB Bulletin 5/2015

AAIB
Air Accidents Investigation Branch