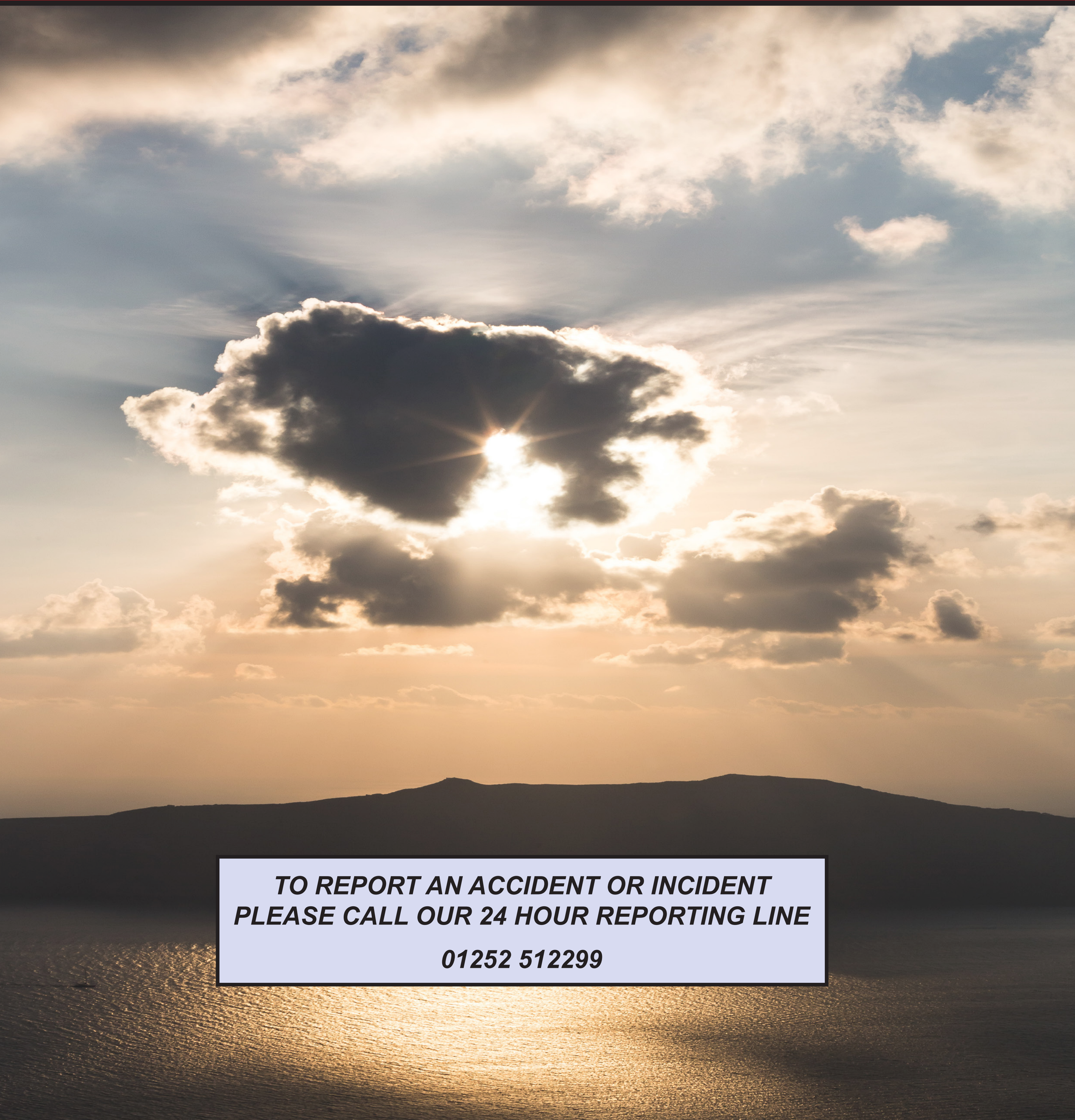
Air Accidents Investigation Branch

AAIB Bulletin 4/2016



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

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

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Summaries of Aircraft Accident Reports

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

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

Aircraft Accident Report No: 1/2016

This report was published on 15 March 2016 and is available in full on the AAIB Website www.gov.uk

Report on the accident to AS332 L2 Super Puma helicopter, G-WNSB on approach to Sumburgh Airport on 23 August 2013

Registered Owner and Operator	CHC Scotia Ltd
Aircraft Type	Eurocopter AS332 L2 Super Puma helicopter
Nationality	British
Registration	G-WNSB
Place of Accident	Approximately 1.7 nm west of Sumburgh Airport, Shetland Islands
Date and Time	23 August 2013, at 1717 hrs (Times in this report are UTC unless stated otherwise)

Introduction

The accident was reported by the helicopter operator at approximately 1756 hrs on the day of the accident.

In exercise of his powers, the Chief Inspector of Air Accidents ordered an investigation into the accident be carried out in accordance with 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 accidents and incidents. It shall not be the purpose of such an investigation to apportion blame or liability.

The AAIB despatched teams of investigators and support staff to Aberdeen and the Shetland Islands early the following morning, to commence the investigation.

In accordance with the provisions of ICAO Annex 13, France (the State of aircraft design and manufacture) appointed an Accredited Representative from the BEA[1], assisted by Advisers from the helicopter and engine manufacturers. Advisers from the European Aviation Safety Agency (EASA) and the UK Civil Aviation Authority (CAA) also participated in the investigation.

Footnote

[1] Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (the French equivalent of the AAIB).

Summary

At 1717 hrs UTC on 23 August 2013, an AS332 L2 Super Puma helicopter with sixteen passengers and two crew on board crashed in the sea during the approach to land at Sumburgh Airport. Four of the passengers did not survive.

The purpose of the flight was to transport the passengers, who were employees of the UK offshore oil and gas industry, to Aberdeen. On the accident flight, the helicopter had departed the Borgsten Dolphin semi-submersible drilling platform in the North Sea, to route to Sumburgh Airport for a refuelling stop. It then planned to continue to Aberdeen Airport.

The commander was the Pilot Flying (PF) on the accident sector. The weather conditions were such that the final approach to Runway 09 at Sumburgh Airport was flown in cloud, requiring the approach to be made by sole reference to the helicopter's instruments, in accordance with the Standard Operating Procedure (SOP) set out in the operator's Operating Manual (OM). The approach was flown with the autopilot in 3-axes with Vertical Speed (V/S) mode, which required the commander to operate the collective pitch control manually to control the helicopter's airspeed. The co-pilot was responsible for monitoring the helicopter's vertical flightpath against the published approach vertical profile and for seeking the external visual references necessary to continue with the approach and landing. The procedures permitted the helicopter to descend to a height of 300 ft, the Minimum Descent Altitude (MDA) for the approach, at which point a level-off was required if visual references had not yet been acquired.

Although the approach vertical profile was maintained initially, insufficient collective pitch control input was applied by the commander to maintain the approach profile and the target approach airspeed of 80 kt. This resulted in insufficient engine power being provided and the helicopter's airspeed reduced continuously during the final approach. Control of the flightpath was lost and the helicopter continued to descend below the MDA. During the latter stages of the approach the helicopter's airspeed had decreased below 35 kt and a high rate of descent had developed.

The decreasing airspeed went unnoticed by the pilots until a very late stage, when the helicopter was in a critically low energy state. The commander's attempt to recover the situation was unsuccessful and the helicopter struck the surface of the sea approximately 1.7[2] nm west of Sumburgh Airport. It rapidly filled with water and rolled inverted, but was kept afloat by the flotation bags which had deployed.

Search and Rescue (SAR) assets were dispatched to assist and the survivors were rescued by the Sumburgh-based SAR helicopters that attended the scene.

Footnote

[2] AAIB Special Bulletin S7/2013 detailed that the helicopter struck the surface of the sea approximately 1.5 nm west of Sumburgh Airport. This position has been further refined.

The investigation identified the following causal factors in the accident:

- The helicopter's flight instruments were not monitored effectively during the latter stages of the non-precision instrument approach. This allowed the helicopter to enter a critically low energy state, from which recovery was not possible.

- Visual references had not been acquired by the Minimum Descent Altitude (MDA) and no effective action was taken to level the helicopter, as required by the operator's procedure for an instrument approach.

The following contributory factors were identified:

- The operator's SOP for this type of approach was not clearly defined and the pilots had not developed a shared, unambiguous understanding of how the approach was to be flown.

- The operator's SOPs at the time did not optimise the use of the helicopter's automated systems during a Non-Precision Approach.

- The decision to fly a 3-axes with V/S mode, decelerating approach in marginal weather conditions did not make optimum use of the helicopter's automated systems and required closer monitoring of the instruments by the crew.

- Despite the poorer than forecast weather conditions at Sumburgh Airport, the commander had not altered his expectation of being able to land from a Non-Precision Approach.

AAIB Special Bulletins S6/2013 and S7/2013, published on 5 September 2013 and 18 October 2013 respectively, provided initial information on the circumstances of the accident. Special Bulletin S1/2014, published on 23 January 2014, highlighted a safety concern relating to pre-flight safety briefings given to passengers, on the functionality of emergency equipment provided to them for UK North Sea offshore helicopter flights.

The AAIB investigation found similarities between this accident and previous accidents resulting from ineffective monitoring of the flight instruments by the flight crew.

Following this accident, the operator of G-WNSB and the Civil Aviation Authority (CAA) took safety actions intended to prevent similar accidents in future and to increase the level of safety of UK offshore helicopter operations in the North Sea.

During the investigation a number of additional safety concerns were identified. In addition to the Safety Recommendations issued in the aforementioned Special Bulletins, this final report contains further Safety Recommendations concerned with the certification of rotorcraft, Helicopter Flight Data Monitoring and offshore helicopter survivability.

Findings

Operational aspects

1. The pilots were properly licensed, qualified and sufficiently rested to conduct the flight.

2. Both pilots had flown into Sumburgh Airport previously and they were familiar with the method of flying a Localiser DME approach.

3. The flight crew had obtained a meteorological forecast for Sumburgh which indicated that the weather conditions would be better than they actually were. Whilst en route to Sumburgh the crew received up to date meteorological reports which indicated that conditions had deteriorated.

4. The flight crew did not obtain up to date weather reports for alternate airports during the final flight sector and did not have a well rehearsed plan for a diversion.

5. The weather conditions at Scatsta, the nominated alternate airport, would probably have precluded making a successful approach, but the flight crew were not aware of this.

6. The company Standard Operating Procedures allowed a variety of Non-Precision Approach methods to be employed; the crew conducted a Localiser DME approach to Runway 09 at Sumburgh Airport using a continuous descent approach technique with a reducing airspeed.

7. The approach was planned and flown by the commander who had engaged the autopilot in 3-axes with V/S mode.

8. The company stabilised approach criteria were met at 1,000 ft amsl. Below 1,000 ft amsl, the flight path deviated from the published vertical profile and the airspeed reduced below the IFR operating limit of 70 kt for 3-axes flight.

9. There was no evidence in the historic FDM data reviewed that the commander had ever continued with an approach to land in weather conditions below minima; his previous 29 approaches to Sumburgh Airport had all transitioned to manual flight at altitudes above 500 ft aal. No FDM events were found that indicated that the commander had flown at low airspeed during an approach.

10. The commander maintained an expectation that he would be able to see the runway at, or before, MDA and the helicopter would land at Sumburgh.

11. In the latter stages of the approach there was a period of some 30 seconds when the flight instruments were not adequately monitored and the helicopter's airspeed continued to reduce unchecked below 80 kt.

12. The Automatic Flight Control System control of the flight path was compromised before the helicopter reached the Minimum Descent Altitude due to the helicopter's low energy state.

13. The 'CHECK HEIGHT' audio alert sounded at the Minimum Descent Altitude (MDA) of 300 ft.

14. The descent continued below the MDA without the required visual references having been acquired.

15. The commander attempted recovery action and ultimately applied maximum collective pitch, but evidence suggests that the helicopter had probably entered Vortex Ring State and the situation was unrecoverable in the remaining height available.

Flight Data Monitoring (FDM)

16. The FDM event rate per flight for the commander was below the operator's AS332 L2 fleet average.

17. Analysis of FDM data showed that flight crew on the operator's AS332 L2 fleet adopted different methods of conducting the Sumburgh Airport Runway 09 Non-Precision Approach. There were variations in vertical descent paths, airspeeds and autopilot upper mode setting in 3-axes and 4-axes.

18. FDM data showed that on the operator's AS332 L2 fleet in the previous two years, the ratio of 3-axes to 4-axes approaches was about four to one.

Engineering aspects

19. No evidence was found of a causal or contributory fault with the helicopter either before or during the accident flight.

20. No evidence was found that would indicate the helicopter had not been maintained or certified in accordance with current regulations.

21. The collective pitch trim system problem identified by the crew during the flight was considered to have had no bearing on the final stages of the flight.

Evacuation and survivability

22. The impact with the water was survivable.

23. One passenger died in the liferaft from a chronic heart condition which was likely to have been exacerbated by the stress of the evacuation.

24. One passenger managed to escape from the helicopter cabin but drowned prior to, or immediately after, reaching the surface of the water. There was insufficient evidence to determine why this had occurred.

25. One passenger was incapacitated by a head injury during or immediately following the impact with the water and most likely drowned without regaining consciousness.

26. One passenger died as a result of being unable to successfully escape from the cabin. [Note: this finding was amended on 13 August 2020 when an addendum was issued.]

27. The pilots were unable to jettison their doors using the emergency lever and had to revert to the normal door opening mechanism to exit from the cockpit.

28. The EBS hybrid rebreathers, worn by the passengers, functioned correctly but were not used by the majority of the passengers, either because they were unaware of the air supply that was available within them, or because they were unable to locate or deploy the mouthpiece.

29. Those passengers who escaped from the cabin used the windows as exits. A number of window panes were displaced during the initial impact; others were removed by the passengers.

30. The majority of passengers who removed window panes reported that this was not easy and was significantly harder than they experienced during training.

31. Water ingress into some passenger survival suits was most likely the result of poorly fitting neck or wrist seals, or access zips not being fully closed.

32. Both liferafts were successfully deployed by the co-pilot using deployment handles fitted to the underside of the helicopter fuselage. He was only aware of the additional handles as a result of an informal conversation with a pilot who had instructed in the Norwegian sector.

33. The handles used were non-standard for UK helicopters and had been fitted when the helicopter was operated on the Norwegian register.

34. The Flight Manual supplement describing the additional liferaft deployment handles had not been updated to reflect the helicopter's change of registration.

35. The co-pilot was unable to manoeuvre the second liferaft to recover passengers from the water due to the sea current.

Search and Rescue (SAR)

36. ATC contacted the Sumburgh RFFS approximately six minutes after the helicopter's final radio transmissions acknowledging the clearance to land; transmissions from the helicopter's ELT received during this period were not recognised at first by the Sumburgh tower controller.

37. Within one minute of notification, the airport fire vehicles and rescue boat reported manned.

38. There was a short delay in the coastguard being notified by the designated police control centre; however, this did not affect the outcome of the rescue.

39. There was a significant delay to the launch of the airport Fast Rescue Craft because of the tide state and location of the slipway; this did not affect the outcome of the rescue.

40. The survivors were all recovered by winch to SAR helicopters and flown to a casualty reception centre at Sumburgh Airport.

Safety Recommendations and actions

Safety Recommendations made previously in Special Bulletin S7/2013 published on 18 October 2013:

Safety Recommendation 2013-021

It is recommended that the operator of Sumburgh Airport, Highlands & Islands Airports Limited, provides a water rescue capability, suitable for all tidal conditions, for the area of sea to the west of Sumburgh, appropriate to the hazard and risk, for times when the weather conditions and sea state are conducive to such rescue operations.

Safety Recommendation 2013-022

It is recommended that the Civil Aviation Authority review the risks associated with the current water rescue provision for the area of sea to the west of Sumburgh Airport and take appropriate action.

The following new Safety Recommendations are made in this report:

Safety Recommendation 2016-001

It is recommended that the European Aviation Safety Agency introduces a requirement for instrument rated pilots to receive initial and recurrent training in instrument scan techniques specific to the type of aircraft being operated.

Safety Recommendation 2016-002

It is recommended that the European Aviation Safety Agency reviews the existing research into pilot instrument scan techniques, particularly with respect to glass cockpit displays, with a view to addressing shortcomings identified in current instrument scan training methods.

Safety Recommendation 2016-003

It is recommended that the Civil Aviation Authority reviews the methods used by UK North Sea helicopter operators for confirming compliance with their Standard Operating Procedures (SOPs), to ensure they are effective.

Safety Recommendation 2016-004

It is recommended that the Civil Aviation Authority reviews the Standard Operating Procedures of helicopter operators supporting the UK offshore oil and gas industry, to ensure their procedures for conducting Non-Precision Approaches are sufficiently defined.

Safety Recommendation 2016-005

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29) to align them with the Certification Specifications and Acceptable Means of Compliance for Large Aeroplanes (CS 25), with regard to the provision of operational information in Flight Manuals.

Safety Recommendation 2016-006

It is recommended that the European Aviation Safety Agency requires manufacturers of Large Rotorcraft to develop Flight Crew Operating Manuals for public transport types already in service.

Recommendation 2016-007

It is recommended that the Civil Aviation Authority expedites the requirement for companies operating helicopters in support of the UK offshore oil and gas industry to establish a Helicopter Flight Data Monitoring (HFDM) programme.

Safety Recommendation 2016-008

It is recommended that the European Aviation Safety Agency considers establishing a European Operators Flight Data Monitoring forum for helicopter operators to promote and support the development of Helicopter Flight Data Monitoring programmes.

Safety Recommendation 2016-009

It is recommended that the European Aviation Safety Agency collaborates with National Aviation Authorities and helicopter operators to develop and publish guidance material on detection logic for Helicopter Flight Data Monitoring programmes.

Safety Recommendation 2016-010

It is recommended that the Civil Aviation Authority, in co-operation with UK offshore helicopter operators, initiates a review of existing Helicopter Flight Data Monitoring programmes to ensure that operating procedures applicable to approaches are compared with those actually achieved during everyday line flights.

Safety Recommendation 2016-011

It is recommended that the Civil Aviation Authority expedites the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

Safety Recommendation 2016-012

It is recommended that the Civil Aviation Authority supports the ongoing development of Helicopter Terrain Awareness Warning Systems, following the publication of the Helicopter Safety Research Management Committee report into improving warning envelopes and alerts.

Safety Recommendation 2016-013

It is recommended that the European Aviation Safety Agency requires the installation of Helicopter Terrain Awareness Warning Systems to all helicopters, used in offshore Commercial Air Transport operations, with a Maximum Certificated Take-off Mass (MCTOM) of more than 3,175 kg, or a Maximum Operational Passenger Seating Configuration (MOPSC) of more than nine, manufactured before 31 December 2018.

Safety Recommendation 2016-014

It is recommended that the European Aviation Safety Agency introduces a requirement for the installation of cockpit image recorders, in aircraft required to be equipped with Flight Data and Cockpit Voice Recorders, to capture flight crew actions within the cockpit environment.

Safety Recommendation 2016-015

It is recommended that the European Aviation Safety Agency introduces a requirement to install image recorders, capable of monitoring the cabin environment, in aircraft required to be equipped with Flight Data Recorder and Cockpit Voice Recorders.

Safety Recommendation 2016-016

It is recommended that the European Aviation Safety Agency instigates a research programme to provide realistic data to better support regulations relating to evacuation and survivability of occupants in commercial helicopters operating offshore. This programme should better quantify the characteristics of helicopter underwater evacuation and include conditions representative of actual offshore operations and passenger demographics.

Safety Recommendation 2016-017

It is recommended that, where technically feasible, the regulatory changes introduced by the European Aviation Safety Agency Rulemaking Task RMT.120 are applied retrospectively by the EASA to helicopters currently used in offshore operations.

Safety Recommendation 2016-018

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for rotorcraft (CS 27 and 29) to require the installation of systems for the automatic arming and activation of flotation equipment. The amended requirements should also be applied retrospectively to helicopters currently used in offshore operations.

Safety Recommendation 2016-019

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to require the provision of a side-floating capability for a helicopter in the event of impact with water or capsize after ditching. This should also be applied retrospectively to helicopters currently used in offshore operations.

Safety Recommendation 2016-020

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for offshore operation, to ensure that any approved cabin seating layouts are designed such that, in an emergency (assuming all the exits are available), each exit need only be used by a maximum of two passengers seated directly adjacent to it.

Safety Recommendation 2016-021

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for commercial offshore operations, to include minimum size limitations for all removable exits, to allow for the successful egress of a 95th percentile-sized offshore worker wearing the maximum recommended level of survival clothing and equipment.

Safety Recommendation 2016-022

It is recommended that the European Aviation Safety Agency amends the Certification Specifications for Large Rotorcraft (CS 29), certified for use in commercial offshore operations, to require a common standard for emergency exit opening mechanisms, such that that the exit may be removed readily using one hand and in a continuous movement.

Safety Recommendation 2016-023

It is recommended that the European Aviation Safety Agency amends the operational requirements for commercial offshore helicopters to require the provision of compressed air emergency breathing systems for all passengers and crew.

Safety Recommendation 2016-024

It is recommended that the European Aviation Safety Agency (EASA) amends the operational requirements for commercial offshore helicopter operations, to require operators to demonstrate that all passengers and crew travelling offshore on their helicopters have undertaken helicopter underwater escape training at an approved training facility, to a minimum standard defined by the EASA.

Safety Recommendation 2016-025

It is recommended that the European Aviation Safety Agency amends the design requirements for helicopters to ensure that where liferafts are required to be fitted, they can be deployed readily from a fuselage floating in any attitude.

Safety Recommendation 2016-026

It is recommended that the European Aviation Safety Agency requires that, for existing helicopters used in offshore operations, a means of deploying each liferaft is available above the waterline, whether the helicopter is floating upright or inverted.

Summary of Safety Actions

CAA Safety actions

The CAA published CAP 1145, Civil Aviation Authority – Safety review of offshore public transport helicopter operations in support of the exploitation of oil and gas. In this document the following actions are of relevance to the G-WNSB accident:

A4 The CAA will work with the helicopter operators via the newly established Helicopter Flight Data Monitoring (FDM) User Group to obtain further objective information on operational issues from the FDM programme.

A7 With effect from 1 June 2014, the CAA will require helicopter operators to amend their operational procedures to ensure that Emergency Flotation Systems are armed for all over-water departures and arrivals.

A8 With effect from 1 June 2014, the CAA will prohibit the occupation of passenger seats not adjacent to push-out window emergency exits during offshore helicopter operations, except in response to an offshore emergency, unless the consequences of capsize are mitigated by at least one of the following:

a) all passengers on offshore flights wearing Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time;

b) fitment of the side-floating helicopter scheme in order to remove the time pressure to escape.

A9 With effect from 1 April 2015, the CAA will prohibit helicopter operators from carrying passengers on offshore flights, except in response to an offshore emergency, whose body size, including required safety and survival equipment, is incompatible with push-out window emergency exit size.

A10 With effect from 1 April 2016, the CAA will prohibit helicopter operators from conducting offshore helicopter operations, except in response to an offshore emergency, unless all occupants wear Emergency Breathing Systems that meet Category 'A' of the specification detailed in CAP 1034 in order to increase underwater survival time. This restriction will not apply when the helicopter is equipped with the side-floating helicopter scheme.

In the case of **Action A10** the UK Oil and Gas Industry have introduced a new CAA approved Category A Compressed Air Emergency Breathing System (CAEBS). From **1 September 2014**, all UK passengers travelling by helicopter to and from an offshore installation, who are not seated next to an emergency exit will be required to wear this device. From **1 January 2015, ALL** UK passengers on all UK helicopter flights to and from an offshore installation will be required to wear this device.

Safety actions by the operator

The operator took action to review and revise its standard operating procedures and promulgated them to its flight crews in July 2014.

Key elements of the changes for the Super Puma fleet were:

All instrument approaches to be flown 4-axes coupled. If 4-axes mode is not available then 3-axes with IAS mode is required.

A specified, pre-briefed, nominated fixed airspeed to be used for onshore approaches below 1,000 aal.

Changes to the stabilised approach definitions and criteria.

When climbing or descending in 3 axis/2 cue[3] without the collective coupled, crews shall couple airspeed, not vertical speed, to the pitch axis.

Safety actions by the manufacturer

In December 2014, in a presentation given at the EASA Rotorcraft Symposium 2014, Airbus Helicopters reported on an initiative that was launched in September 2013, the Airbus Helicopters Safety Partnership. This was an '*initiative bringing together Airbus Helicopters' efforts to implement and improve safety practices and standards in close cooperation with oil and gas operators, authorities and industry stakeholders*'.

In November 2015, the helicopter manufacturer advised the AAIB that:

'*the FCOM 225 for oil and gas operations has been released by AH and AH has committed to release FCOM for all new AH helicopters flying in oil and gas operations. It will be done at least for the H175 and the H160. For the 332L2, a FOBN (Flight Operational Briefing Note) related mainly to the optimized use of the AFCS is planned by AH.*'

Other safety actions

The safety issue highlighted in AAIB Special Bulletin S1/2014, published on 23 January 2014, concerned the content of the pre-flight safety briefing video. UK operators in the North Sea took safety action to amend the pre-flight safety briefing video for passengers to include information on the automatic air supply feature.

In response to Safety Recommendation 2013-021, Highlands & Islands Airports Limited took action to modify the Runway 09 slipway to allow a water rescue capability to be provided in all tidal conditions, subject to weather conditions.

Footnote

[3] According to helicopter type.

AAIB Field Investigation Reports

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

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

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

ACCIDENT

Aircraft Type and Registration:	Agusta Bell 206B Jet Ranger III, G-OMDR
No & Type of Engines:	1 Allison 250-C20B turboshaft engine
Year of Manufacture:	1981 (Serial no: 8610)
Date & Time (UTC):	27 June 2014 at 1553 hrs
Location:	Near Gamston Airport, Nottinghamshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to main rotor transmission driveshaft couplings, isolation mount, transmission stop mount, swashplate support, tachometer generator and freewheeling unit
Commander's Licence:	Private Pilot's Licence (Helicopters)
Commander's Age:	44 years
Commander's Flying Experience:	850 hours (of which 500 were on type) Last 90 days - 32 hours Last 28 days - 12.5 hours
Information Source:	AAIB Field Investigation

Synopsis

The helicopter was attempting to transit an area of forecast poor weather and inadvertently climbed into cloud, where control was lost. During the loss of control, significant damage occurred to the gearbox isolation mount, rendering the helicopter un-airworthy. This damage was not discovered until two further sectors had been completed. The pilot was then advised that the helicopter was safe to fly to the owner's maintenance facility and two further sectors were completed, before the helicopter was withdrawn from service. Subsequent inspections revealed numerous items of additional damage that were not immediately apparent. The extent of the damage meant that this occurrence met the definition for an accident. It was reported in February 2015.

History of the flight

On Friday, 27 June 2014, the pilot departed from a private site near Beaconsfield to attend a business meeting near Bicester. At Bicester, he refuelled the helicopter to full fuel and departed at 1504 hrs, intending to fly to Breighton Airfield in Yorkshire, to refuel again. His ultimate destination was a private site near Scarborough, where the helicopter was to remain for two days, until Sunday, 29 June 2014.

The pilot recalled that the weather was very good at the departure point, although he was aware that the weather would deteriorate further north due to a weather front. However, he did not consider there would be cloud low enough to affect his flight.

The pilot intended to cruise at a height of about 1,000 ft agl and a speed of 100 kt IAS. As he approached East Midlands Airport, the cloud base was 2,000 to 3,000 ft agl. However, he began to encounter one or two octas of cloud at about 400 to 500 ft agl but recalled being in clear air between the layers of cloud, with good sight of the surface.

To the north of East Midlands Airport, the weather deteriorated more rapidly than had been expected. The pilot's iPad GPS navigation application showed Gamston Airport a few miles away to the north-west but the sky appeared brighter to the east, suggesting better weather. He was considering whether to divert to Gamston or route further to the east when he entered cloud.

The pilot attempted to regain visual conditions by slowing the helicopter towards 60 kt and conducting a 180° turn. He believed he successfully completed the 180° turn but, as he was still in cloud, he lowered the collective lever and commenced a descent. He then noticed that the airspeed was decreasing rapidly and that the IAS needle was decreasing below the 0 kt mark. There was also high vibration and he believed he was experiencing the symptoms of being in a vortex ring state (VRS): descending rapidly, with low airspeed, power applied and uncommanded yaw changes.

Consequently, the pilot moved the cyclic stick forward, in an attempt to increase airspeed and recover from VRS. After an undetermined period of time, the helicopter seemed to start to recover from the VRS but the attitude indicator then rolled to almost 90° of bank, possibly to the right, and the pilot felt that the helicopter was not responding to control inputs.

The helicopter then recovered towards a more normal attitude, before the pilot thought he was in VRS, once more, and had little control of the helicopter. He selected forward cyclic again and attempted to transmit a MAYDAY call, though he was later unsure he had achieved this; no such call was received by ATC. The helicopter descended into clear air below cloud and the pilot was able to recover the helicopter to normal flight and carry out a precautionary landing at Gamston Airport.

Events following the loss of control

After landing at Gamston, the pilot reported that he conducted a thorough inspection of the helicopter, without using a checklist, and did not find any damage. He paid particular attention to the drag pin, located on the underside of the gearbox, as he believed that to be the most critical indicator of excessive movement of the transmission (see Figure 1). He did not consider the drag pin to be damaged and thought that the helicopter had operated normally after the loss of control. He, therefore, conducted some hovering at Gamston to check for any unusual vibrations and, finding none, decided to continue to Breighton.

Figure 1

Transmission stop mount assembly (not accident aircraft)

On arrival at Breighton the pilot changed his plans and, having embarked a passenger, departed without shutting down or refuelling. He then proceeded to Scarborough, arriving at 1745 hrs.

During the weekend (28/29 June 2014) the pilot discussed the event with the helicopter owner's duty engineer, by telephone. Based on his information, the duty engineer was not willing to approve the helicopter for further flight. He advised the pilot to contact the maintenance manager, who would be available after the weekend.

On the morning of Monday, 30 June 2014, the pilot spoke to the maintenance manager, by telephone, to seek advice before flying the helicopter again. He described the loss of control event and advised the maintenance manager that he had continued to fly the helicopter to his destination, after his precautionary landing at Gamston Airport, and that the helicopter was "flying OK, with temperatures and pressures all OK". The maintenance manager asked the pilot to check and photograph certain areas of the helicopter, in addition to carrying out a normal daily 'A' check. These additional inspection items included the top surface of the isolation mount, which the pilot did not normally check.

Amongst the photographs the pilot sent by email were images of the transmission drag pin and stop mount, and the main transmission driveshaft, forward coupling and isolation mount. The maintenance manager examined the photographs and, when looking at the stop mount support plate (see Figure 2), he did not see any damage or cracked paint on the domed heads of the attachment rivets. Furthermore, he did not see any disturbance of the sealant between the stop mount support and the fuselage upper deck. He observed that the drag pin attachment hardware appeared undamaged, as did the drag pin itself, apart from some loss of paint on the side of the pin. This, in his experience, was not an abnormal condition. He did not notice the absence of the stop mount plate, which had detached.

Figure 2

Pilot's photograph of damage to transmission drag pin and stop mount assembly

When looking at the driveshaft area (see Figure 3), the maintenance manager observed that the dots on the red temperature indicator stickers, on the forward driveshaft coupling, were white, indicating that the coupling had not been overheated excessively. He noted a gouge in the isolator mount top plate, which was similar in his experience to previous B206 heavy landing events, but he did not ask the pilot to measure the gouge depth and did not refer to the AMM for allowable damage limits. The pilot advised the maintenance manager that the mast was "free to move left and right" and photographs taken by the pilot showed no visible contact marks on the main rotor pitch links or the mast cowling. The maintenance manager verbally approved the helicopter to fly back to Biggin Hill Airport for further examination at the owner's maintenance facility, and no defects were recorded in the helicopter's technical log either before or after these flights.

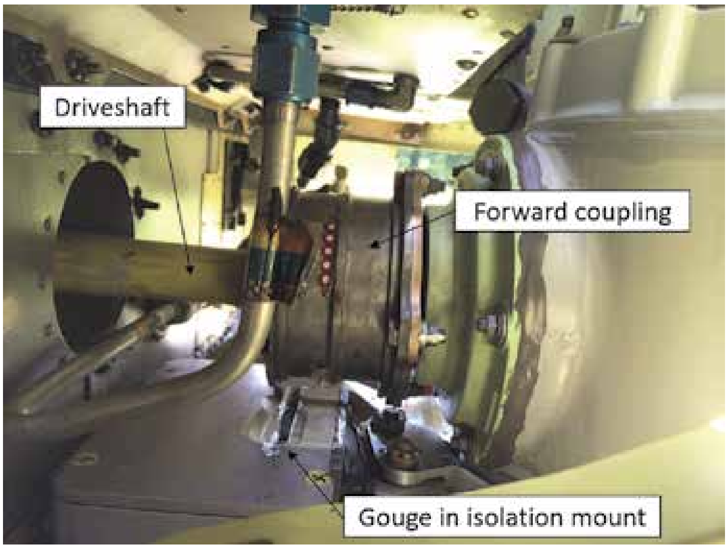

Figure 3

Pilot's photograph of damage to isolation mount

The pilot then flew the helicopter to Breighton Airfield, to refuel, and on to Biggin Hill Airport, where it was taken out of service.

The AAIB was advised of the accident in February 2015. No Mandatory Occurrence Report (MOR) had been filed.

Aircraft description

The AB (Agusta Bell) 206B is a single-engine helicopter of conventional layout and is only certified for VFR flight. It has teetering two-bladed main and tail rotors, driven by an Allison 250-C20B gas turbine engine mounted on the fuselage roof behind the main rotor transmission. The engine delivers power to the main rotor transmission via a freewheeling assembly and a transmission driveshaft that features flexible couplings at both ends. Temperature indication labels are adhesively bonded to each driveshaft coupling. Each label contains five dots that change colour from white to black to indicate whether the coupling has exceeded certain temperature limits during operation. Each coupling should feature two yellow #6000-3 ‘low-temperature’ stickers, with dots that turn black at 330°F, and two red #6000-1 ‘high-temperature’ stickers, with dots that turn black at 370°F.

The main rotor transmission is attached to the fuselage by two pylon support links. Transmission vibrations are attenuated by an elastomeric vibration isolation mount that is bolted to the fuselage roof and attached by a lug to the bottom of the transmission housing. During normal operation there is approximately 12 mm of vertical clearance between the forward driveshaft coupling and the isolation mount top plate. If the main rotor transmission is excessively displaced, such as can occur during heavy landings or with extreme cyclic control inputs, the forward driveshaft coupling can strike the top plate, creating a gouge in the plate’s surface.

A tachometer generator unit, that generates an electrical signal proportional to the main rotor rpm, is attached to a hydraulic pump assembly, which is mounted to the rear of the main transmission housing.

The bottom of the transmission housing features a vertical steel drag pin that projects through an opening in a stop mount assembly (see Figure 1). The stop mount assembly consists of a stop mount plate that is attached to a stop mount support by eight rivets. These rivets are intended to fail in shear and the stop mount plate to detach from the support plate when heavy contact with the drag pin occurs during extreme movement of the main rotor transmission.

Damage description

The gear teeth of both the forward and aft main driveshaft couplings were found to be damaged beyond allowable limits, due to chipping of the gear tooth material. The freewheeling unit’s attachment flange, which is bolted to the main driveshaft rear coupling, was deformed beyond allowable limits.

The isolation mount top plate was gouged through its entire thickness and the internal elastomeric damper material had mostly dis-bonded due to overload, rendering the isolator incapable of providing significant vibration damping.

The main driveshaft rear coupling had two temperature indication stickers fitted, which were both of the red 'high-temperature' type, and both of these had white dots showing that the rear coupling's temperature had not exceeded 370°F.

The main driveshaft forward coupling had four temperature indication stickers fitted. Two were red 'high-temperature' stickers and two were yellow 'low-temperature' stickers, of incorrect part number #6000-2, which are designed to turn black at 270°F[1]. The red stickers both had white dots and the yellow stickers both had black dots, indicating that the forward coupling's temperature had exceeded a temperature of 270°F but had remained below 370°F.

The transmission drag pin had made heavy lateral contact with the stop mount plate and the rivets attaching the stop mount plate to the support plate had failed in shear, releasing the stop mount plate which was found lying loose beneath the support plate. The drag pin's paint finish had been abraded, revealing the bare metal surface beneath.

The degree of transmission movement was sufficient to permit the transmission tachometer generator to be damaged due to mechanical contact with a cyclic control tube support bracket, although the unit was still functional. The internal bore of the swashplate support had been scored by the main rotor mast, indicating that the mast had flexed significantly.

Inspection criteria listed in the Aircraft Maintenance Manual (AMM)

Chapter 63-00-00 *'Main Rotor Drive System'* of the helicopter's AMM contains a detailed *'Pylon Whirl Inspection'* which must be carried out if the following criteria are reported:

> *PYLON WHIRL INSPECTION*
>
> *NOTE*
>
> *Perform pylon whirl inspection following pilot report or evidence of abnormal landing, excessive slope landing, operation in severe turbulence, low rotor RPM during flight (power ON or OFF), rapid and extreme cyclic input, excessive spike knock[2] or main driveshaft contact with isolation mount.*

The pylon whirl inspection consists of a detailed three-page flow-chart of component and rotor system inspections, many of which require substantial disassembly of the rotor system.

One of the required checks is to inspect the isolation mount for any contact with the main rotor driveshaft coupling and, if the isolation mount is damaged beyond permitted limits, to overhaul the main driveshaft. The Bell 206 Component Repair and Overhaul Manual

Footnote

1 The requirement to apply #6000-1 and #6000-3 temperature indicating stickers to the driveshaft couplings was promulgated in Agusta Mandatory Technical Bulletin 206-219, dated 24 October 1995.

2 *'Spike knock'* refers to contact of the transmission drag pin with the stop mount assembly.

states that the maximum allowable depth of damage to the isolation mount top cover plate is 0.080” (2.0 mm). The top cover plate thickness is 5.2 mm.

The assessment of damage to an aircraft is outside the privileges of pilot maintenance, as defined by EASA Part M[3]. Therefore, determination of continued airworthiness, based on AMM allowable damage limits, is a task that must be certified by an EASA Part 66 licensed aircraft engineer.

Chapter 63-11-01 of the AMM, entitled *‘Main Driveshaft’,* contains information for interpretation of the temperature indication stickers on the main driveshaft couplings. A combination of black dots on the yellow ‘low temperature’ stickers and white dots on the red ‘high temperature’ stickers is stated to have a probable cause of *‘Elevated temperature’*. The remedial actions required for this condition are stated as:

> *Elevated coupling temperature is indicated. Determine probable cause of elevated temperature indication and take corrective action before continued operation. Accomplish checks in steps a. and b. If probable cause is not revealed from steps a. and b., perform steps c. and d. Replace affected TEMP-PLATE[4].*
>
> *a. Check driveshaft coupling for any signs of grease leakage. If leakage is detected, the coupling must be serviced before returning to service.*
>
> *b. Review current operating conditions to determine probable cause of elevated coupling temperature. Make appropriate adjustment to correct condition.*
>
> *c. Inspect engine and transmission pylon mounts for condition.*
>
> *d. Verify engine-to-transmission alignment.*

Meteorology

Pilot planning

The pilot could not recall exactly what he had done on the morning of 27 June 2014 but stated that he would normally obtain an overview of the weather from various BBC services before using the Met Office website to gain specific airfield forecasts and actual weather for his route.

The Met Office

The UK Met Office provided details of the forecast weather that had been available before the pilot departed from Beaconsfield, and an aftercast for the same day.

The forecast Metform F215 (see Figure 4), issued at 0317 hrs on 27 June 2014 and valid between 0800 hrs and 1700 hrs, showed an occluded front located across the pilot’s planned route. In the overall area of the front (Area B), the visibility was forecast to be generally 15 km, with about 50% of the area having 7 km visibility in moderate rain or showers of rain.

Footnote

[3] EASA Part M, Section A, Subpart H, M.A.803 Pilot-owner authorisation.
[4] *‘TEMP-PLATE’* is an alternative name for the temperature indication stickers.

Near the front, up to 25% of the area would have 2 km visibility in mist and drizzle, with hill fog covering between 25% and 50% of the area.

A trough (Area C) was located to the south of the front and moving north more quickly than the front. Near the trough, the visibility was forecast to be 7 km in showers of rain, with between 25% and 50% of the area having 2 km visibility in heavy showers of rain and heavy thunderstorms and rain. Up to 25% of the area was forecast to have hill fog, with visibility below 200 metres.

In relation to cloud, 25% to 50% of Area B was forecast to have scattered or broken stratus, with the base between 400 ft and 1,000 ft amsl and tops at 1,500 ft amsl. Above that, between 1,500 ft and 3,000 ft amsl, scattered or broken cumulus or stratocumulus, incorporating moderate icing and moderate turbulence, was forecast.

The updated chart issued at 0900 hrs, indicating the forecast positions of the fronts at 1800 hrs, showed a narrowing of the gap between the trough and the occluded front.

Met Office reported that the actual conditions on 27 June 2014 were consistent with the forecast.

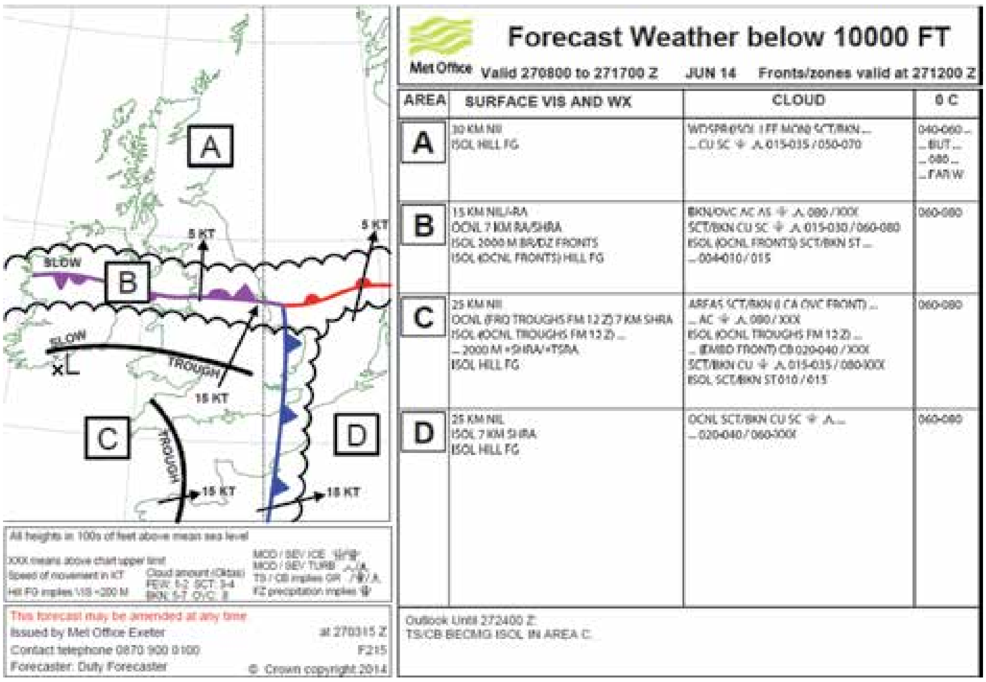

Figure 4

F215 valid for flights between 0800 hrs and 1700 hrs on 27 June 2014

Pilot

The pilot held an EASA Private Pilot's Licence (Helicopters) (PPL(H)), with a valid Bell 206 Jet Ranger type rating. He had held a UK PPL(H) since 2001 and his Bell 206 Jet Ranger type rating had initially been issued in 2002.

The PPL(H) training syllabus includes '*Basic Instrument Awareness*', in case a pilot inadvertently encounters poor visibility or cloud. The pilot had received no additional training in flying on instruments.

Recorded data

The pilot was using an iPad navigation application during the four flights on the day of the event and the two return flights three days later. The application recorded tracks for all these flights (see Figure 5).

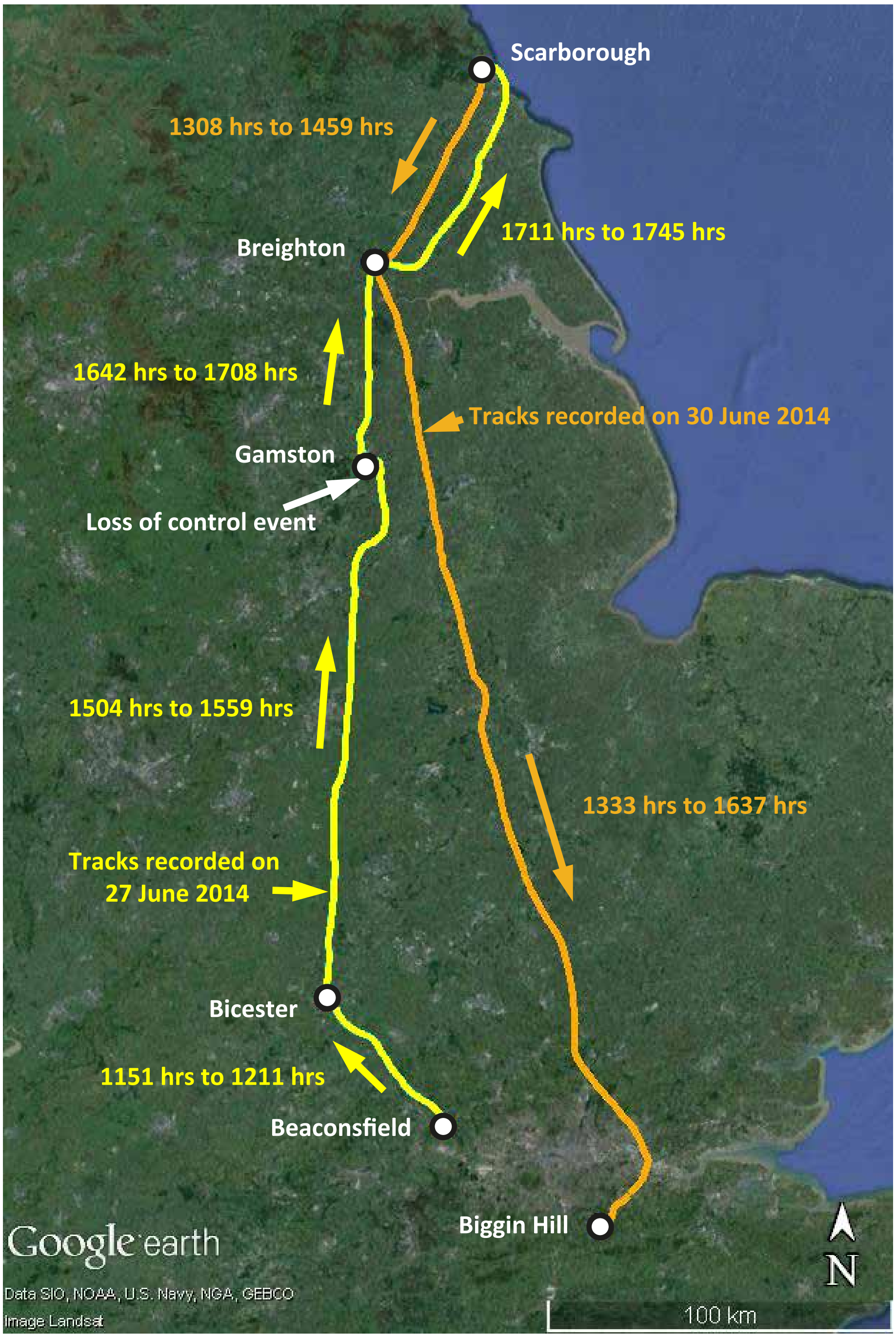

Figure 5

Tracks recorded on the iPad for 27 June 2014 and 30 June 2014

The flight from Bicester (see Figure 6) started at 1504 hrs on 27 June 2014. The helicopter initially tracked north at a height of approximately 1,000 ft agl. At 1533 hrs, it descended to approximately 600 ft agl, before descending further to approximately 400 ft agl. After this, the helicopter climbed to a height of approximately 2,000 ft agl over a four-minute period.

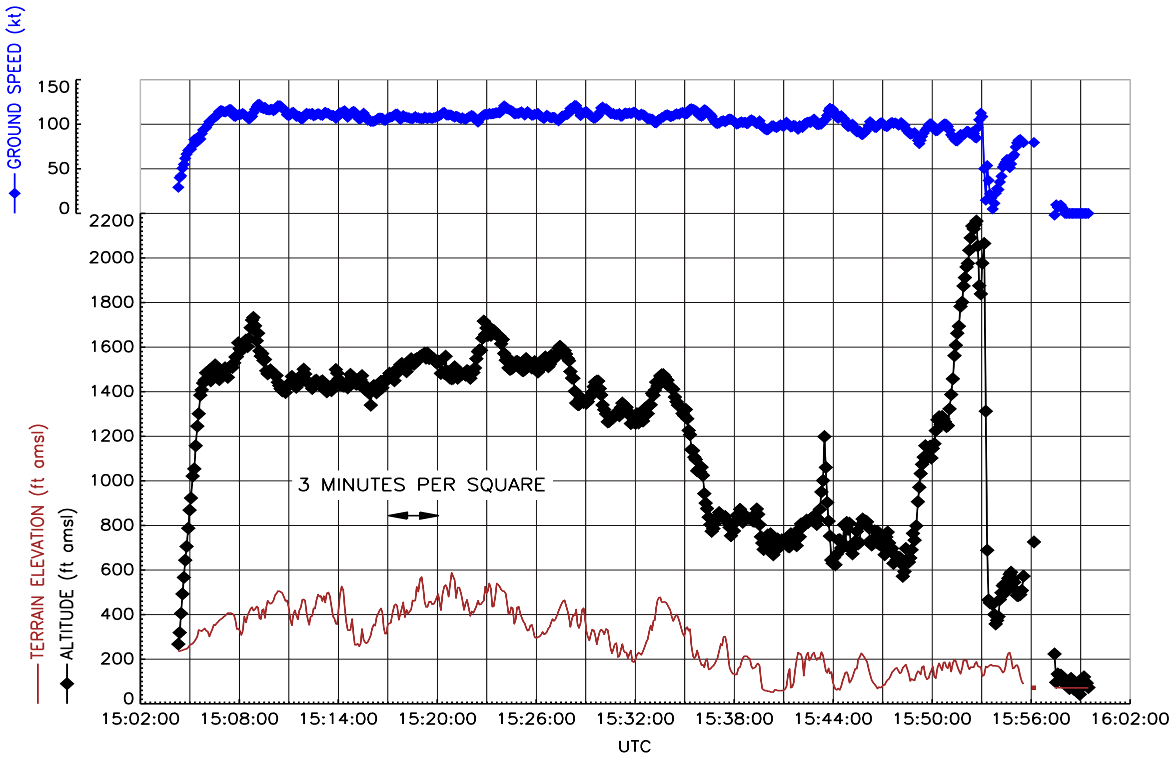

Figure 6

Flight from Bicester to Gamston

On reaching this height, the helicopter began a turn to the left, achieving a track change of 90° in approximately 20 seconds, and a descent was initiated (see Figure 7). As the data becomes less reliable under dynamic situations, it could not be used to accurately assess the dynamic manoeuvres that followed.

The highest rate of descent indicated by the data was 6,000 ft/min but this is unlikely to be accurate. The data indicated that the helicopter then flew level at a height of approximately 300 ft agl but with a reducing ground speed. The helicopter then descended further, the speed increased and the helicopter then climbed again. After control was regained, the aircraft proceeded to Gamston Airport.

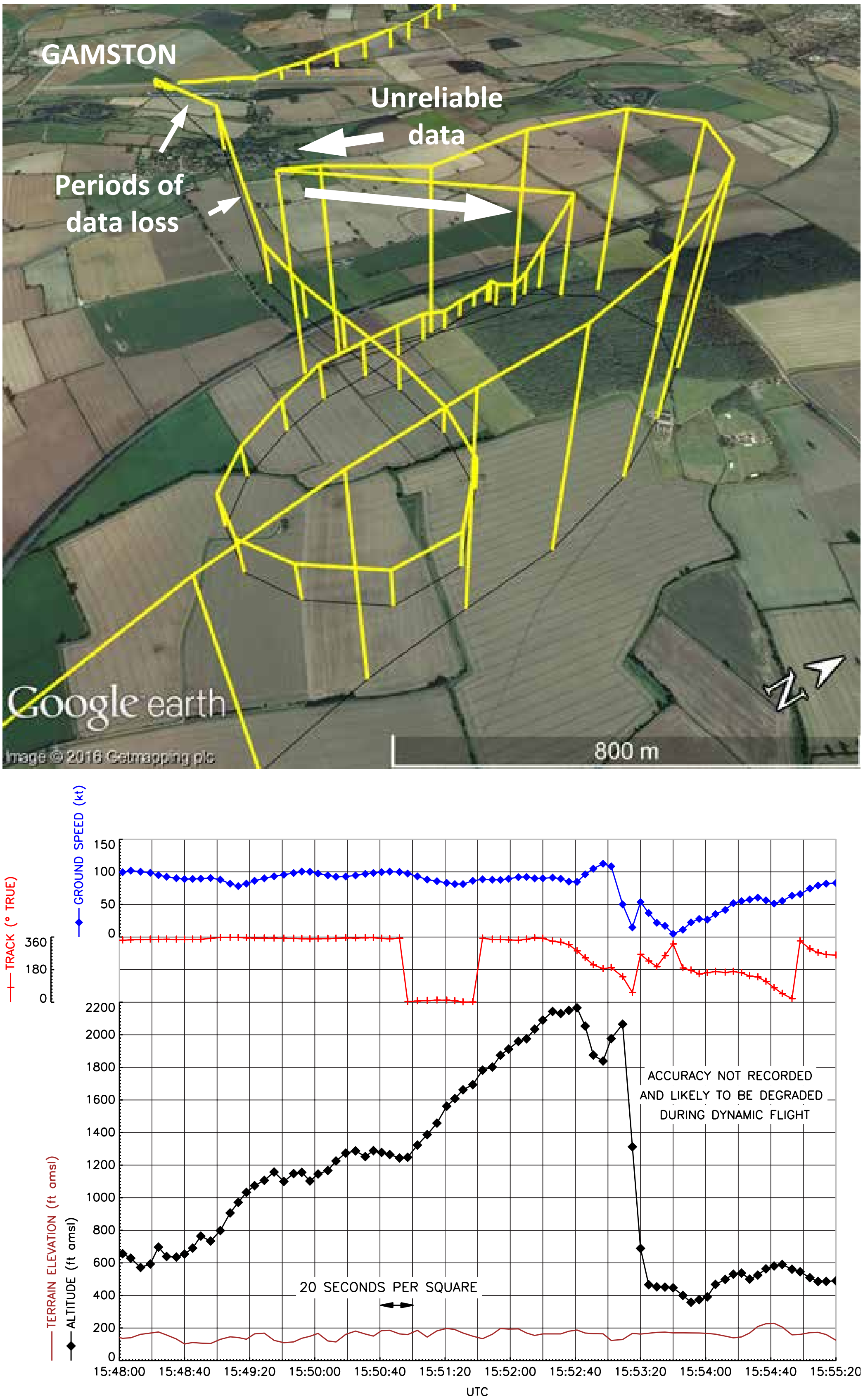

Figure 7

Loss of control

Aircraft accident and serious incident reporting

The Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996 defines an accident as an occurrence associated with the operation of an aircraft during which:

> *'A person suffers a fatal or serious injury*
>
> *or*
>
> *The aircraft sustains damage or structural failure that would normally require major repair or replacement of the affected component.'*

Where an accident …. occurs:

> *'The relevant person shall give notice by the quickest means of communication available.'*

Civil Air Publication (CAP) 382 Mandatory Occurrence Reporting (MOR) scheme

The Mandatory Occurrence Reporting (MOR) scheme is run by the CAA with guidance material published in CAP 382. Reports should be dispatched to the CAA within 96 hours of the occurrence of a reportable event.

Pertinent sections of the scheme include: *Categories of Aircraft Under the Scheme,* which states:

> *'The ANO specifies the aircraft covered by the MOR Scheme as:….*
>
> - *any turbine-powered aircraft which has a certificate of airworthiness issued by the CAA.'*

And the Categories of Persons Required to Report, which include:

> *'The operator and the commander of a turbine powered aircraft which has a certificate of airworthiness issued by the CAA….*
>
> *A person who carries on the business of maintaining or modifying a turbine powered aircraft, which has a certificate of airworthiness issued by the CAA…'*

Appendix B of CAP 382 provides examples of occurrences which must be reported. For the operation of aircraft, it includes:

> *'1.1 (f) Loss of Control, regardless of cause.*
> *1.2 (g) An event leading to the declaration of an emergency.'*

For engineering-related occurrences, it includes:

> *'2.3.1 (b) Damage or defect of main rotor gearbox/attachment which could lead to in-flight separation of the rotor assembly and / or malfunctions of rotor control.'*

Published safety advice

The CAA Safety Sense Leaflet 1, '*Good Airmanship',* advises pilots to:

> *'Get an aviation weather forecast, heed what it says and make a carefully reasoned GO/NO–GO decision. Do not let 'Get-there/home-itis' affect your judgement and do not worry about 'disappointing' your passenger(s). Establish clearly in your mind the current en-route conditions, the forecast and the 'escape route' to good weather. Plan an alternative route if you intend to fly over high ground where cloud is likely to lower and thicken'*

The CAA Safety Sense Leaflet 17, '*Helicopter Airmanship',* advises pilots that:

> *'Return or land early if the weather deteriorates. Maintain a safe altitude.'*

Flight Manual pre-flight inspection

The AB206B '*Flight manual section II normal procedures: preflight check'* directs the pilot to inspect (amongst other items):

> *'Isolation Mount : Condition.*
>
> *Drag Pin : Security and evidence of contact with static stop plate.*
>
> *Main Driveshaft forward and rear couplings: Condition and grease leakage. Check paint stripe(s) for evidence of overheating indicated by brown colour.'*

The isolation mount is inspected from both the left and the right side of the helicopter.

Safety action

> The reference to *'paint stripe(s)'* on the driveshaft couplings refers to the configuration of the couplings prior to embodiment of Agusta Mandatory Technical Bulletin 206-219, which replaced the paint stripes with *'TEMP-PLATE'* temperature indication stickers. The manufacturer has amended the AB206B flight manual to correct this anomaly.

Analysis

Flight planning

The hazard presented by the combination of a trough and an occluded front that lay laterally across the planned route, with the latter extending beyond the coastline, was not identified prior to the flight. The forecast combination of low cloud, poor visibility, heavy thunderstorms and showers of rain indicated that there was limited prospect of the flight being completed in VMC.

The flight

After the pilot departed from Bicester, he flew some 80 nm without reported incident. Nearing Gamston Airport, he began to encounter the degraded visual conditions associated with the trough and occluded front. While considering whether to route to the east or divert to Gamston, he entered cloud. The helicopter had climbed steadily over a period of almost four minutes until it entered the base of the cloud, depriving the pilot of visual references.

The PPL(H) syllabus requires pilots to be trained in basic instrument flying techniques. This does not permit planned flight into instrument conditions but provides knowledge on what to do following inadvertent entry into cloud. The pilot successfully completed an approximately level 90° level turn on entering cloud. The helicopter remained in cloud, the pilot had no visual references and control was lost.

The pilot's description and the recorded data show that a variety of extreme manoeuvres occurred during the temporary loss of control, resulting in the helicopter sustaining significant damage.

Continued flight following the loss of control

Given the extent of the damage to the helicopter's main rotor drive system, it is most probable that the damage occurred during the loss of control event. Consequently, the helicopter operated four sectors in an un-airworthy condition before the full extent of the damage was discovered at the owner's maintenance facility.

The first opportunity to detect the damage would probably have been during the pilot's pre-departure inspection at Gamston Airport. The pilot stated that he found no damage to the helicopter but added that the isolation mount was not part of his normal inspection routine. His inspection had focussed on the condition of the drag pin, which he considered as a critical identifier of serviceability. Inspection of the condition of the isolation mount and stop mount plate is contained within the AB206B flight manual section detailing the normal pre-flight exterior checks.

A second opportunity to detect the damage occurred when the maintenance manager reviewed the pilot's photographs of the helicopter. These showed the missing stop mount plate and the gouge in the isolation mount. The maintenance manager stated that his decision to approve the helicopter for the return flight was influenced by the pilot's positive report of how the helicopter had performed on the sectors following the loss of control event, and also by the fact that the driveshaft couplings had not been excessively overheated. It is possible that these factors promoted confirmation bias[5] when he reviewed the photographs of the damaged isolation mount, which was similar to, but more severe than, previous examples he had seen. He did not detect the absence of the stop mount plate that was missing in one of the pilot's photographs, as his attention was drawn to

Footnote

[5] Confirmation bias is the tendency to interpret new evidence as confirmation of one's existing beliefs or theories.

other features in the photograph which supported his belief that the helicopter was not seriously damaged.

The maintenance manual requires a pylon whirl inspection to be carried out if the isolation mount damage limits are exceeded or the pilot reports extreme cyclic inputs. Had the maintenance manual been consulted, it is improbable that the helicopter would have been approved for continued flight.

Reporting

The pilot was unaware that the MOR scheme applied to private pilots and that this event should also have been reported to the AAIB as soon as the extent of the damage was evident. The regulations and other guidance for both accident investigation and the MOR scheme are available on the AAIB and CAA websites, respectively, to assist pilots and others in determining whether an event is reportable.

Conclusion

The flight was planned to route through an area of deteriorating weather and conducted in a helicopter cleared for VFR flight only. The helicopter entered cloud and the pilot temporarily lost control. Serious damage occurred during the recovery to normal flight which rendered the helicopter un-airworthy. However, this was not detected until two subsequent flights had been completed. When the damage was identified, it was assessed incorrectly as acceptable and two further flights were completed before the helicopter was withdrawn from service and the full extent of the damage was discovered. The occurrence was reported eight months later.

ACCIDENT

Aircraft Type and Registration:	Ikarus C42 FB80, G-CEDR
No & Type of Engines:	1 Rotax 912-UL piston engine
Year of Manufacture:	2006 (Serial no: 0606-6833)
Date & Time (UTC):	7 April 2015 at 1020 hrs
Location:	Newtownards Airport, Northern Ireland
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:	National Private Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	89 hours (of which 23 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	AAIB Field Investigation

Synopsis

The pilot was practising circuits. About fifty minutes into the flight, just after an increase in power during a touch-and-go landing, the aircraft was seen to enter a climbing left turn at low height. As it continued to climb, the angle of bank was observed to increase steadily until the nose dropped and the aircraft descended, striking the grass surface to the left of the runway in a steep nose-down attitude. The pilot was fatally injured. There was evidence to indicate that the accident could have been due to incapacitation.

History of the flight

It was understood that the pilot's intention was to practise visual circuits. As he prepared the aircraft for flight in the hangar, he spoke to another pilot who later described him as being in a "good, cheerful mood and appearing to be in good health". The latter pilot then watched as the aircraft taxied out and took off from Runway 22, at about 0930 hrs. The aircraft remained in the circuit and, sometime later, the runway in use was changed to Runway 04 due to a change in the wind direction. All visual circuits at Newtownards are flown to the east, ie to the right, when using Runway 04.

About fifty minutes into the flight, having just touched down on a touch-and-go, witnesses heard the aircraft's engine increase to what sounded like full power. The aircraft was then seen to roll left, at low height, soon after becoming airborne. As it continued to climb, the angle of bank was observed to increase steadily until, at a height of 80 to 100 ft, the nose dropped and the aircraft descended, striking the grass surface to the left of the runway in a steep nose-down attitude.

Numerous people ran or drove to the aircraft and a local ambulance arrived on the scene shortly afterwards. The pilot was given first aid before being transported to the local hospital but did not survive his injuries.

At the time of the accident, the weather was CAVOK, the temperature was 13°C and the wind was from 040° at less than 5 kt.

Pilot's experience

The pilot began learning to fly microlights in 2008 and passed his General Skills Test (GST) in May 2009.

After passing his GST, he underwent conversion training on the CT2K and C42 microlights with the same instructor, although there is no regulatory requirement to do so. The instructor also completed the pilot's subsequent biennial instructor flights. He described the pilot as "a good, safe and meticulous pilot who took flying seriously". He added that the pilot had requested conversion training on the microlights, to improve his competency before flying them solo. The instructor had demonstrated flapless circuits and was content for the pilot to practise them.

Flight trial

A flight trial was carried out in a similarly powered Ikarus C42 by a test pilot, and was observed by the AAIB. Its purpose was to assess the aircraft's handling qualities, particularly with respect to touch-and-go landings, with and without flap. The V_{APP} for these is 55 kt and 65 kt, respectively, with the aircraft touching down about 5 kt slower.

The stall characteristics were also assessed. There was subtle pre-stall buffet and, at the stall, the aircraft was controllable in roll with the control column, and there was no tendency to drop either wing. The stall speeds were:

Configuration	Power	V_s KIAS	Stall warning
Clean	Idle	38	44
One Flap	Idle	36	40
Full Flap	Idle	32	36

The C42 was assessed as possessing strong lateral stability. This meant that the aircraft had a marked tendency to roll away from any sideslip. Applying left rudder generated sideslip to the right resulted in the right wing generating extra lift and the aircraft rolling to the left. Small amounts of sideslip were able to generate a noticeable rolling moment. This could overpower a rolling moment generated by a small amount of aileron. The test pilot commented that it would be possible to have a situation where a small amount of applied rudder could overpower the effectiveness of a small amount of aileron.

The test pilot concluded that the 80 hp C42 aircraft was a “very benign” aircraft with “good” handling qualities and stall characteristics. Takeoffs and landings were easy to perform and flapless landings were no more difficult to fly than full flap landings. Applying full power after a flapless touch-and-go landing required minimal pilot control input to stabilise the aircraft in a 60 KIAS climb. Open loop[1], a mild neutral phugoid[2] developed but this could easily be damped. Overall, it was not possible to replicate a combination of power and control inputs likely to cause the aircraft to behave as witnessed in the accident.

Medical and pathological information

The pilot held a CAA Medical Declaration[3], with no ‘special limitations’, countersigned by his General Practitioner (GP) on 22 October 2013. It was valid for five years, until 22 October 2018. The GP did not know of any condition, prior to the accident, which would have given him cause to suspend the pilot’s medical declaration.

A post-mortem examination of the pilot was carried out by a State pathologist for Northern Ireland. He stated that the pilot died as a result of chest injuries. The findings were reviewed by a Royal Air Force (RAF) consultant aviation pathologist. The RAF pathologist commented that the pilot had a considerably enlarged heart for an adult male of the pilot’s height and weight. He added that:

> *‘…*[symptoms related to the heart] *could potentially have produced a degree of distraction or incapacitation which could have led to the final fatal manoeuvre; there is no definite pathological evidence to indicate that they had done so, but equally lack of such evidence does not preclude the possibility.…if a medical event has occurred it is likely it would have been sudden rather than insidious in its onset.’*

Toxicology tests showed no evidence of alcohol or drugs.

Engineering

Aircraft description

The Ikarus C42 is a two-seat, high-wing microlight aircraft. The fuselage consists of a tubular structure covered by non-load bearing composite fairings and panels. The wings are constructed of two tubular spars which support the wing ribs. The wings and flying control surfaces are covered in a Kevlar/Mylar material. The aircraft is equipped with a single control column, mounted between the two seats. Both occupants are restrained by a four-point harness which is designed to withstand a 9g forward deceleration[4]. Engine power is controlled by folding throttle levers mounted between the legs of the occupants. The flaps

Footnote

1 Open loop means not interfering in the feedback process from the flying controls. This was achieved by relaxing the touch on the control column so as not to restrict its movement following the touch-and-go.

2 A phugoid is a long-period oscillation of the pitch axis, where the aircraft perpetually hunts about an attitude and trimmed speed.

3 CAA Form SRG (Safety Regulation Group) 1204.

4 EASA Certification Specifications for Very Light Aircraft Amendment 1, 5 March 2009, CS-VLA 23 & CS-VLA 561.

are operated by the use of a centrally mounted, overhead lever. G-CEDR was fitted with an 80 hp Rotax 912 engine, driving a three-bladed propeller. The engines carburettors had been fitted with engine coolant carburettor heaters to minimise the possibility of carburettor icing.

Initial examination

The aircraft came to rest approximately 100 m from the left edge of Runway 04. The limited ground markings indicated that the aircraft had been on a heading of approximately 360°M and had struck the ground in a steep nose-down attitude before falling backwards, coming to rest upright.

The impact had caused significant damage to the forward fuselage. The engine mounts had failed and the engine had been pushed rearwards and upwards, disrupting the forward section of the cockpit. Examination of the pilot's seat harness confirmed that remains of both lap straps were secured to their mounting points, the straps having been cut by the airfield fire service after the accident. The pilot's shoulder harness was not attached to the aircraft. The fitting which secured it to the aircraft had failed at the point where it attached to the aircraft structure, releasing the harness. The flap handle was in the UP position and the fuel selector was ON. It was not possible to determine the pre-impact position of the throttle or carburettor heat control.

Both wing leading edges exhibited impact damage. The left wing leading spar had failed approximately one metre from the wing root and the left wing had been pushed rearwards during the impact. This had resulted in the failure of the wing mounting structure and the right wing rotating forward.

Two of the propeller blades had dug into the ground during the impact sequence and failed close to the propeller hub (see Figure 1). The third blade remained attached to the hub but had split along the leading edge. The forward face of this blade had broken into two sections and had separated from the rest of the blade. These sections were located approximately 10 m to the right of the wreckage.

An inspection of the runway surface showed no evidence of recent propeller strike marks. Prior to removal of the aircraft, the continuity of all the flying control circuits was confirmed and approximately 45 litres of fuel was recovered from the fuel tank.

Aircraft maintenance

Examination of the aircraft's maintenance records confirmed that it had been maintained in accordance with regulatory requirements and that there had been no reported issues regarding the performance of the aircraft prior to the accident. The records showed that 12 days prior to the accident the propeller blades had been replaced with new units, supplied by the propeller manufacturer.

Figure 1
Propeller blades embedded in the ground

Detailed examination

Inspection did not identify any evidence of a pre-existing defect or restriction in the aircraft flying control circuits.

Damage to the engine and carburettors prevented any operational testing of these units being carried out. The carburettors were stripped and no evidence of any pre-accident defects was found within either unit. Quantities of fuel were recovered from both carburettor bowls, and the engine fuel filter was free from contamination and restriction and contained fuel. Disassembly of the engine showed no evidence of a pre-existing defect which would have prevented normal operation. Damage was observed on the inner face of the reduction gearbox rear case, which had been caused by the propeller drive gear being pushed against the casing, while rotating.

Tests carried out on the fuel recovered from the aircraft confirmed that it was free from contamination and met the required specification for MOGAS.

Detailed examination of the remains of the propeller confirmed that the two propeller blades which had broken close to the propeller hub had been the first two blades to strike the ground during the impact sequence and had failed in overload. The forward face of the third blade, which had split along its leading edge during the impact, had failed due to bending and torsional overload. No pre-existing structural abnormalities were found within the blades and no evidence was found that the blades had struck the runway surface prior to the accident.

Optical examination of the shoulder harness attachment fitting confirmed that it had failed in tensile overload. No evidence of fatigue or a metallurgical defect was found in the fitting.

The shoulder harness fitting from the aircraft's other seat was removed and its load carrying capability was tested. The tests confirmed that the shoulder harness fitting was capable of carrying loads in excess of its design requirements.

Recorded data

Radar

Radar recordings from the surveillance and en route radar heads at Belfast International Airport were made available to the investigation.

Only the en route radar was able to observe radar returns in the vicinity of Newtownards at the time G-CEDR was airborne. However, these radar returns were intermittent and G-CEDR could not be positively identified.

Photographic evidence

A member of the public, walking along a path on the eastern edge of the airfield, had taken photographs of G-CEDR during the accident flight. Three of these were of particular interest. The first showed the aircraft proceeding along the runway after its last landing. The second showed the aircraft airborne and in a climbing turn to the left. The final photograph showed that the aircraft had turned through approximately 180° and had rolled between 70° and 90° to the left. Examination of the second and third photographs confirmed that the flaps were in the UP position and that the rudder remained central. The second photograph showed that the ailerons were deflected to correct the left roll.

CCTV

During the investigation, a CCTV camera, with its field of view covering part of the runaway, was downloaded. The downloaded footage showed G-CEDR taxiing prior to the accident flight and on two other occasions when the aircraft was flying. The first of these was for a period of four seconds, which showed the aircraft airborne in a shallow climb. The second occasion, recorded nine minutes and four seconds later, showed the aircraft in view for five seconds. In this recording, the aircraft initially appeared close to or on the runway surface and it was then seen to pitch nose-up and start to climb. The aircraft began to roll to the left immediately after it pitched up, and continued to climb, roll and turn to the left until it passed out of the camera's field of view.

Detailed examination of the recordings, taking into account the camera's position and field of view, allowed an estimation of the aircraft's speed and height to be calculated. On the first occasion, the aircraft had a groundspeed of approximately 61 kt and climbed from approximately 20 ft agl to approximately 40 ft agl. During the second recording, the initial ground speed of the aircraft was calculated as 61 kt, which decreased to approximately 54 kt prior to the aircraft leaving the camera's field of view. The initial nose-up pitch attitude of the aircraft was calculated as 7.5°. This appeared to be maintained throughout the recording, during which the aircraft reached a height of approximately 40 ft.

Analysis

Conduct of the flight

When the pilot arrived at the airfield he appeared to be in good health and to carry out the normal pre-flight preparations and checks. His takeoff and subsequent circuits also appeared to be normal, until the last touch-and-go landing.

In the second CCTV recording, the aircraft had a groundspeed of approximately 61 kt and climbed from approximately 20 ft agl to approximately 40 ft agl. During the third CCTV recording, just prior to the accident, the initial groundspeed of the aircraft was calculated as 61 kt, which decreased to approximately 54 kt prior to the aircraft leaving the camera's field of view. The nose-up pitch of the aircraft, calculated to be 7.5°, appeared to be maintained throughout the recording. Given that the wind was from 040° at less than 5 kt, the IAS would have been up to 5 kt greater than the calculated groundspeeds. Therefore, with the aircraft's clean stall speed being about 38 KIAS, its minimum speed would have been approximately 20 kt above the stall speed when last recorded by the CCTV.

The third CCTV recording also showed the aircraft beginning to roll to the left immediately after the initial pitch-up. Given that there was no evidence of a pre-existing defect or restriction in the aircraft's flying control circuits, it is likely that this roll was a result of an input on the flying controls. Had the pilot been applying some pressure to the left rudder pedal, this would have generated sideslip to the right, the secondary effect of which would have been a rolling moment to the left. However, it could not be determined if this roll to the left was the result of an intentional input by the pilot or not. Since the circuit direction on Runway 04 was to the right and there was no evidence that he had not followed the expected flightpath on previous circuits, is was considered more likely that it was unintentional.

One of the subsequent still photographs showed the aircraft's ailerons deflected to induce a roll to the right. This would have opposed the roll to the left. However, as the left roll continued, the amount or extent of this control input was not enough to curtail the manoeuvre. While it is likely that the control inputs required to make the aircraft climb and induce a correcting roll to the right were made by the pilot intentionally, how much control he exerted could not be determined.

As the aircraft continued to climb and roll, its speed would have decreased. The evidence indicated that the aircraft subsequently developed a steep nose-down attitude, before striking the ground.

Engineering

The damage to the airframe, together with the ground marks at the accident site, were consistent with the aircraft striking the ground in a steep nose-down attitude, with the aircraft rotating to the left.

No evidence was found of a pre-impact restriction or defect within the aircraft's flying control circuits. Nor was there evidence of any defect which would have prevented the engine from operating normally. Fuel, which met the required specification, was present, in quantity, throughout the aircraft's fuel system. Although an estimation of the engine's power at impact could not be made, the damage to the propeller and the ground marks it produced were consistent with the engine operating at relatively high power as it struck the ground.

Testing of the unoccupied seat shoulder harness attachment fitting demonstrated that it exceeded the certification requirements. Given that the pilot's shoulder harness fitting failed in tensile overload, and that no abnormalities were identified during its examination, it is reasonable to conclude that the fitting failed after being subjected to loads which exceeded its design criteria.

The pilot

The consultant aviation pathologist commented that:

> '…[symptoms related to the heart] *could potentially have produced a degree of distraction or incapacitation which could have led to the final fatal manoeuvre; there is no definite pathological evidence to indicate that they had done so, but equally lack of such evidence does not preclude the possibility.'*

Conclusion

In the absence of any conclusive evidence, the investigation considered that the accident occurred due to the pilot not intervening sufficiently to correct the increasing roll to the left after the last touch-and-go landing. There was evidence to indicate that this could have been due to incapacitation.

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.

INCIDENT

Aircraft Type and Registration:	ATR 72-212 A, EI-REM	
No & Type of Engines:	2 Pratt & Whitney PW127F turboprop engines	
Year of Manufacture:	2007 (Serial no: 760)	
Date & Time (UTC):	22 December 2015 at 1553 hrs	
Location:	Ronaldsway, (Isle of Man) Airport	
Type of Flight:	Commercial Air Transport (Passenger)	
Persons on Board:	Crew - 4	Passengers - 66
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Light abrasion damage to tail bumper	
Commander's Licence:	Airline Transport Pilot's Licence	
Commander's Age:	46 years	
Commander's Flying Experience:	9,332 hours (of which 7,741 were on type) Last 90 days - 130 hours Last 28 days - 67 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The co-pilot, who was undergoing line training under supervision, mishandled the flare slightly and the tail bumper, on the underside of the rear fuselage, made light contact with the runway. The aircraft was inspected and no maintenance action was necessary for it to continue in service.

History of the flight

The aircraft was operating a scheduled passenger service from Birmingham to the Isle of Man when the incident occurred. The co-pilot, who was the handling pilot for the flight, was undergoing line training under the supervision of a Line Training Captain.

The captain reported that the aircraft made a stable approach in good flight conditions, but that the co-pilot flared the aircraft slightly too early for landing and selected a slightly higher pitch attitude than required. The aircraft flew level just above the runway before starting to sink. There was a light skip as the main wheels touched down, and the captain made a steadying input on the control column to guard against the co-pilot making a large forward control input which would risk touching down again on the nose landing gear first. The aircraft touched down firmly on the main landing gear and the rest of the landing run appeared normal to the flight crew.

As the aircraft touched down, an observer adjacent to the runway saw sparks from under the rear fuselage. He passed this information on to ATC who alerted the flight crew. The tail bumper on the lower rear fuselage was found to have suffered light abrasion damage. The damage was limited in its extent, such that no maintenance action was required for the aircraft to continue in service.

SERIOUS INCIDENT

Aircraft Type and Registration:	BAe Avro RJ85, EI-RJH
No & Type of Engines:	4 Lycoming LF507 1F turbofan engines
Year of Manufacture:	1999 (Serial no: E2345)
Date & Time (UTC):	12 November 2015 at 1525 hrs
Location:	Belfast International Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 80
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	10,250 hours (of which 9,700 were on type) Last 90 days - 221 hours Last 28 days - 80 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and incident paperwork submitted by the aircraft operator

Synopsis

The flight crew were unable to land at their destination, Dublin, due to high winds. They initiated a diversion to Belfast International, but their approach there was delayed due to an area of poor weather affecting the airport. Once this cleared, the aircraft was able to land at Belfast, although it did so with less that the required Final Reserve fuel remaining.

History of the flight

The incident occurred during a scheduled passenger flight from Paris Charles de Gaulle to Dublin. During pre-flight preparations, the flight crew noted that Dublin was forecast to be subject to strong south to south-westerly winds gusting to 45 kt at the expected time of arrival. Belfast International Airport was available as an alternate airport, although it was forecasting similar wind strengths to Dublin. The forecast for Manchester Airport gave winds gusting to 25 kt. Both Dublin and Belfast were forecast to be subject to temporary reductions in visibility to 5,000 m during rain showers. Manchester was expecting similar showery conditions, but only later in the day and after the planned flight. Shannon Airport, 96 nm west-south-west of Dublin was forecasting similar conditions to Dublin.

In view of the expected conditions, the aircraft commander ordered sufficient fuel loaded to allow for an approach at Dublin followed by diversion to Manchester, plus an additional 25 minutes flying time. This was in addition to the required 'Final Reserve' fuel which equated to a further 30 minutes flying time. The aircraft departed stand at Charles de Gaulle at 1220 hrs and took off at 1246 hrs.

Actual airfield weather reports obtained en-route showed a surface wind at Dublin from 220° at 23 kt, gusting to 35 kt with Runway 16 in use. Reports from both Manchester and Belfast showed that either was suitable for a potential diversion if a landing at Dublin was not possible. As the aircraft neared Dublin, the flight crew were instructed to delay their approach as the wind was gusting to 47 kt, placing it beyond the maximum cross-wind limit on either Runway 16 or 28. While holding, the crew established that the wind at Belfast International was from 190° at 22 kt, with good visibility.

The wind strength eased at Dublin for a time and the aircraft commenced an approach. However, the approach had to be discontinued when the wind strengthened again and a number of aircraft ahead were unable to land. The flight crew initiated a diversion to Belfast, having checked that the weather there was acceptable and that the fuel on board exceeded that required for the diversion.

As the aircraft was being vectored for an ILS approach to Runway 25 at Belfast, the flight crew were informed that an area of poor weather was affecting the airport, with low visibility and wind gusts to 40 kt. The poor weather could be seen by the flight crew on their weather radar. Although it appeared to be moving rapidly, the crew were unable to commence an approach until it had cleared the airport, so made a 'PAN-PAN' call to alert ATC to their reducing fuel state. The crew were also expecting a 'low fuel' alert on the flight deck, so consulted the appropriate checklist in anticipation.

With ATC assistance to avoid the poor weather, the aircraft flew to the south-west of the airport. With the poor weather clearing the area and the wind abating, ATC offered Runway 17 for landing which the flight crew accepted, having earlier checked that the landing distance would be suitable. About this time it became apparent that the aircraft might land with less than the Final Reserve fuel of 849 kg, so the flight crew transmitted a 'MAYDAY' call. The aircraft subsequently flew a short-pattern radar circuit to an ILS on Runway 17, touching down at 1548 hrs with 650 kg of fuel remaining.

Contributory factors

The aircraft commander reported that several factors influenced the sequence of events. While more fuel could have been loaded in Paris, he gave consideration to the aircraft's weight for landing, particularly as windshear conditions were possible. The commander initiated the diversion with fuel for an extra 10 minutes flying time above the minimum required. Although an earlier decision to divert would have meant more fuel available in case of further delays, this had to be weighed against the likelihood of a safe landing at Dublin, which appeared possible for a time when the wind eased.

Manchester was available as a diversion, had better weather conditions and had been allowed for in the fuel uplift. However, Belfast appeared to offer a better alternative at the time, required less fuel, and had two runways available in case of significant wind shifts.

Comment

This incident is an example of the decisions flight crews may have to face in rapidly changing weather conditions. If conditions for landing are well below the requirements, the decision about whether and when to divert is straightforward. However, when conditions appear marginal for landing, the commander will naturally have to weigh the likelihood of making a safe approach and landing at the original destination (which will consume fuel that would otherwise be available for diversion, whether the aircraft is able to land or not) with the many variables involved in diverting at short notice to another airport that may be some distance away.

INCIDENT

Aircraft Type and Registration:	Cessna Citation CJ2, D-ISJP
No & Type of Engines:	2 Williams FJ44-3A-24 turbofan engines
Year of Manufacture:	2001
Date & Time (UTC):	27 March 2015 at 1440 hrs
Location:	Warton Aerodrome, Preston, Lancashire
Type of Flight:	Commercial Air Transport
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	12,000 hours (of which 5,500 were on type) Last 90 days - 80 hours Last 28 days - 40 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot, information supplied by the aircraft operator, ATC reports and a Defence Air Safety Occurrence Report

Synopsis

The flight crew were positioning for a visual approach to Runway 28 at Blackpool Airport (EGNH) but lined up with Runway 25 at Warton Aerodrome (EGNO), 5.5 nm to the south-east. The aircraft descended to an altitude of 1,000 ft amsl, levelled and flew overhead the runway at Warton, before being repositioned for a landing on Runway 28 at Blackpool. There were several opportunities to identify and correct the misunderstanding.

History of the flight

The aircraft was on a positioning flight from Bournemouth to Blackpool, with only the two flight crew on board. The weather conditions in the Blackpool area were clear: the actual meteorological reports from Warton and Blackpool both indicated visibility of more than 10 km, surface winds from the south-west at 8 kt, with a few clouds above 3,000 ft. The co-pilot, who was pilot flying (PF), carried out an approach briefing in which he advised the commander of the location of Warton Aerodrome, nearby, and the risk of confusing it with Blackpool.

The aircraft approached the Blackpool area from the south at FL50. At 1441 hrs, the crew made first contact with Blackpool ATC and were advised to 'STANDBY'. A minute later the following transmissions took place:

TIME	STATION	TRANSMISSION
1442	ATC	DELTA INDIA SIERRA JULIET PAPA BLACKPOOL APPROACH INFORMATION X RAY CURRENT QNH ONE ZERO ONE NINE PROCEDURAL SERVICE NEXT CALL APPROACHING THE BRAVO PAPA LIMA
	Aircraft	YES COPY
	ATC	DELTA JULIET PAPA PROCEDURAL SERVICE NEXT CALL APPROACHING THE BRAVO PAPA LIMA
	Aircraft	ER YES OF COURSE

The aircraft started a right turn, initially towards the 'BPL', an NDB located at the airfield. However, the turn continued until the aircraft was on an easterly track (Figure 1), heading directly towards the POL VOR (33 nm east of BPL). At 1443 hrs, Blackpool ATC requested the range of the aircraft from the BPL, the reply was "THIRTY EIGHT MILES INBOUND PAPA OSCAR LIMA". This was acknowledged by ATC.

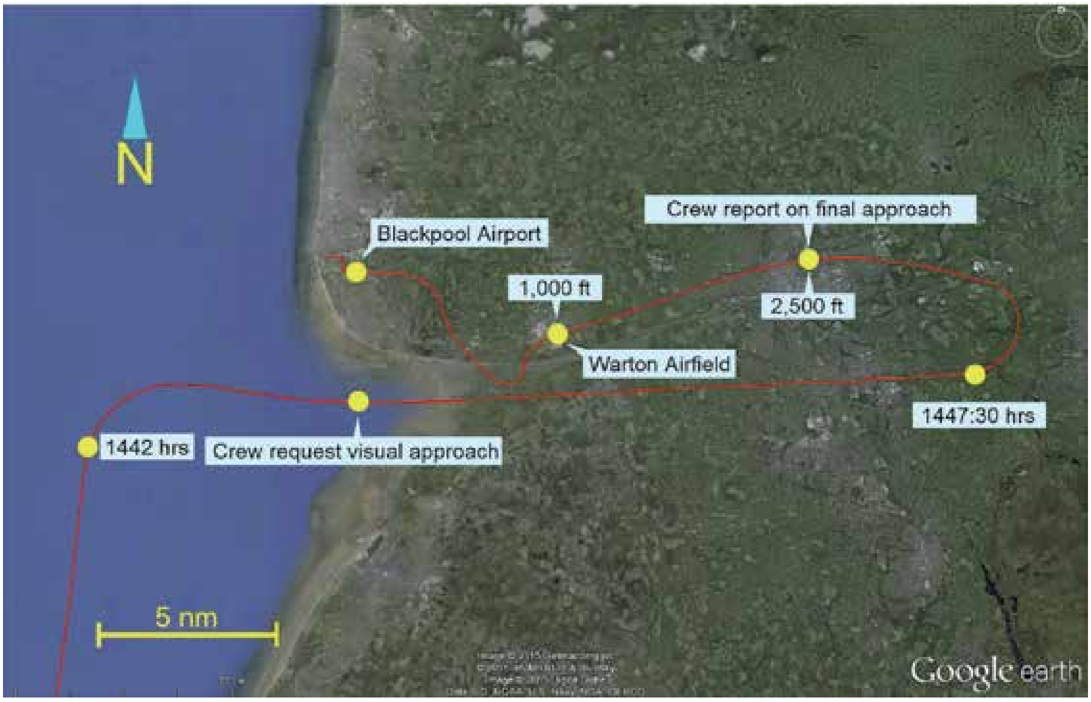

Figure 1

Radar track of approach to Blackpool Airport (altitudes amsl)

At 1444 hrs, the commander contacted ATC, reported the field in sight and requested a visual approach - the aircraft was 3.3 nm south of Blackpool and 4.5 nm west-south-west of Warton. The aircraft was cleared to continue towards the BPL and to report when approaching the beacon. The commander replied "THAT WILL BE FINE".

At 1446 hrs, Warton ATC contacted Blackpool ATC by telephone to advise them of the position of D-ISJP, south-east of Warton, heading east. The controllers agreed that the aircraft had probably misidentified the airport. Warton ATC offered to accept the aircraft for radar vectoring, if required. The Blackpool controller replied that he would take up the offer if the need arose. Blackpool ATC then contacted D-ISJP to query its position. The commander confirmed that the aircraft was south-east of Warton and reported that he was visual with both airfields. The co-pilot, in his report, noted that he had advised the commander that he was not visual with either airfield.

Blackpool ATC co-ordinated with Warton ATC for the aircraft to turn towards Blackpool and then cleared D-ISJP for a visual approach to Runway 28, to report on final approach not below an altitude of 2,000 ft. The clearance was acknowledged. The controller also cautioned the crew about the location of Warton Aerodrome, 6 nm to the south-east of Blackpool. There was no reply from the aircraft.

The commander then disconnected the autopilot, took control and flew the aircraft manually. The aircraft turned left and tracked to the west, towards Blackpool. At 1449 hrs, Blackpool ATC asked D-ISJP to report when established on final approach. The commander replied, reporting that they were on final approach for Runway 28 at 12.5 nm. The following transmissions then took place:

TIME	STATION	TRANSMISSION
1449	ATC	DELTA JULIET PAPA ROGER CONTINUE APPROACH AND ER NEXT REPORT ON A FIVE MILE FINAL
	Aircraft	NEXT REPORT FIVE MILE FINAL DELTA JULIET PAPA
	ATC	DELTA JULIET PAPA INITIALLY MAINTAIN NOT BELOW ALTITUDE ONE THOUSAND SEVEN HUNDRED FEET
	Aircraft	AND INITIALLY NOT ABOVE ONE THOUSAND SEVEN HUNDRED FEET DELTA JULIET PAPA

The aircraft then turned 30° to the left, directly towards Runway 25 at Warton and the commander handed control back to the co-pilot. At 1451 hrs, with the aircraft 2.5 nm to the east of Warton, Blackpool ATC requested its range. The commander reported they were at 7 miles. Meanwhile, an Embraer 145 was backtracking Runway 25 at Warton. The next transmissions were:

1452	ATC	DELTA JULIET PAPA ROGER CONTINUE APPROACH YOU ARE NUMBER TWO AND A NUMBER ONE IS A CHEROKEE ON A TOUCH AND GO AHEAD IF YOU CAN TAKE MINIMUM CLEAN SPEED FOR THE REST OF THE APPROACH PLEASE
	Aircraft	YO WE HAVE THE TRAFFIC ON THE FIELD

Warton ATC telephoned Blackpool ATC to advise them that D-ISJP was 1.5 nm from Runway 25 at Warton, descending on final approach. Blackpool ATC contacted D-ISJP and asked for confirmation that the crew were still in visual contact with Warton. The commander responded that they were over Warton. A clearance to land on Runway 28 at Blackpool was issued and acknowledged.

The co-pilot, having realised that they were lined up with the wrong runway, carried out a go-around, during which the commander initiated a turn to the left. The co-pilot resumed control and, in response to a query from Blackpool ATC, advised that visual contact with Blackpool had been lost. Blackpool ATC instructed the aircraft to turn right on to a track of 280° and to climb to 2,000 ft. The crew then completed a visual approach and landed on Runway 28 at Blackpool.

Recorded data

Radar information was available from three radar heads. The radar at St Annes, which is located less than 1 nm to the south-east of Blackpool Airport, provided a complete record of the approach and landing (Figure 1). Ground based recordings of RTF communications between ATC and the aircraft, and telephone conversations between controllers at Blackpool and Warton airfields, were also available.

Flight crew information

The commander had recorded a total of 12,000 flying hours, of which 5,500 were on type. The co-pilot had a total of 250 flying hours, of which 50 hours were on type. This flight was a line training sector, with the commander responsible for making the radio transmissions. Both pilots provided reports to the investigation.

Airport information

Runways

The main runway at Blackpool Airport is Runway 28/10. It is 1,869 m in length, 46 m wide and is equipped with approach lighting. The main runway at Warton is Runway 25/07. It is 2,422 m in length, 46 m wide and is also equipped with approach lighting. There have been several instances of misidentification of the two airfields by inbound aircraft.

Air Traffic Control

Warton Aerodrome Traffic Zone (ATZ) is a circle of 2.5 nm radius, centred on the main runway, with an upper limit of 2,000 ft. It is notified as permanently active. Permission to enter the ATZ must be obtained from Warton ATC, when available, or from Blackpool ATC. Otherwise, traffic must remain clear. Additionally, there is a Military Aerodrome Traffic Zone (MATZ) of non-standard dimensions at Warton. Warton air traffic services operate on weekdays only: at the time of the incident radar services were operational. MATZ crossing for traffic inbound to Blackpool is co-ordinated by Blackpool ATC. Blackpool ATC operates a procedural service and radar is not available. At the time of the incident, the Blackpool combined approach/tower radio frequency was busy, with several traffic movements in the vicinity of the airport.

Analysis

The co-pilot was under training and there was also a large experience gradient between the two pilots. The co-pilot identified there was a potential for misidentification of the two airfields in his approach briefing but, even so, the aircraft made an approach to the wrong airfield. At a late stage, the co-pilot recognised the error and initiated a go-around.

Warton ATC were notified of the aircraft by Blackpool ATC when it was co-ordinated through the western section of the MATZ. The confusion started to arise on the first radio contact between the aircraft and Blackpool ATC. The aircraft was cleared to the BPL but the commander did not read back the clearance. The controller repeated the clearance but again it was not read back. Blackpool ATC then requested the range of the aircraft from the BPL but the response was read back with reference to POL, a VOR located 33 nm to the east of Blackpool Airport. The incorrect readback was not corrected and, unknown to the controller, the aircraft turned east, directly towards POL. This suggested that the crew believed they had been cleared towards POL.

The commander reported the field in sight and was asked to continue towards the BPL. His readback did not include the instruction to continue towards the BPL, an omission that was not challenged. Thus, a second opportunity to resolve the misunderstanding was missed and the aircraft continued tracking in the direction of the POL.

Two minutes later, Warton ATC, who had radar contact with the aircraft, became concerned about its position and contacted Blackpool ATC. Warton ATC offered to provide a radar service for the aircraft but Blackpool ATC did not use this option. Thus, a further opportunity to resolve the situation was missed.

When the commander confirmed he was visual with both airfields, Blackpool ATC issued a clearance for a visual approach. The controller again cautioned the crew about the position of Warton, to the south-east of Blackpool. The commander then disconnected the autopilot, took control and flew the aircraft manually.

The aircraft turned to the left and initially tracked towards Blackpool but then turned further left towards Warton. Blackpool ATC contacted the aircraft, asking for its range and advised the crew of traffic at Blackpool, on a touch-and-go. At the same time, an aircraft was backtracking Runway 25 at Warton, which may have confirmed to the crew that they were looking at the correct runway.

Warton telephoned Blackpool once more, to inform them that D-ISJP had misidentified the airfield. The co-pilot, meanwhile, realised that the aircraft was at the wrong airfield and carried out a go-around. He also, temporarily, took over the radio transmissions and responded to an enquiry from Blackpool ATC. The aircraft was then re-directed towards Blackpool and the situation was resolved.

Conclusions

The recorded radio transmissions from this incident demonstrate how a lack of standard radio telephony discipline can contribute to developing a misunderstanding. It arose first, perhaps, because there is some similarity between the sound of "BRAVO PAPA LIMA" and "PAPA OSCAR LIMA", but, once begun, it was exacerbated by incomplete readbacks and the reduced situational awareness of the crew. Both ATC units were aware that the aircraft was going in the wrong direction but accepted the commander's assurances.

ACCIDENT

Aircraft Type and Registration:	EC135 T1, G-NWPS
No & Type of Engines:	2 Turbomeca Arrius 2B1A turboshaft engines
Year of Manufacture:	1998 (Serial no: 63)
Date & Time (UTC):	25 November 2015 at 0929 hrs
Location:	Bilsdale, North Yorkshire
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to fenestron tail rotor; duct surface lacerated, hub cover destroyed and foreign object damage to fenestron blades
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	3,482 hours (of which 133 were on type) Last 90 days - 54 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

While landing at an unmarked site adjacent to a television mast, the helicopter's downwash disturbed a metal object which caused damage when it was ingested into the fenestron tail rotor. The pilot felt a jolt, together with vibration through the tail rotor pedals, but retained control and landed normally.

History of the flight

The pilot flew a standard helipad arrival to a clear area adjacent to a television mast, in good visibility and a light westerly wind. The mast operating company had recommended the chosen area, which was unmarked, and the pilot assessed it as suitable. He descended the helicopter to hover height, before hover-taxiing forward approximately 10 metres towards an area with a firm surface. He had not seen any debris or rubbish earlier in the approach but now noticed some pieces of debris, to his front and right, being picked-up and blown away by the helicopter's downwash. However, he did not perceive these as threatening.

While hover-taxiing, the pilot felt a jolt in the yaw axis, then sensed vibration through the tail rotor pedals. He had not seen any debris moving towards the helicopter, so thought the tail might have struck something. He retained normal control, so, after checking both passengers were all right, he continued forward and landed. The vibration in the pedals remained until the helicopter had been shut down and the rotors were stopped.

Damage

It was discovered that the fenestron unit on the tail of the helicopter had been significantly damaged. The hub cover had detached and was found distorted and lacerated (Figure 1). Also, a damaged piece of metal, measuring approximately 20 cm square, was found nearby. The pilot concluded that this had been sucked into the fenestron duct, hitting the hub cover. The hub then detached and one, or both, of these metal objects appeared to have been ingested by the fenestron fan. The duct surface was deeply cut, the paintwork was badly scraped and the fan blades bore signs of foreign object damage (Figure 2).

Figure 1
Remains of fenestron hub cover

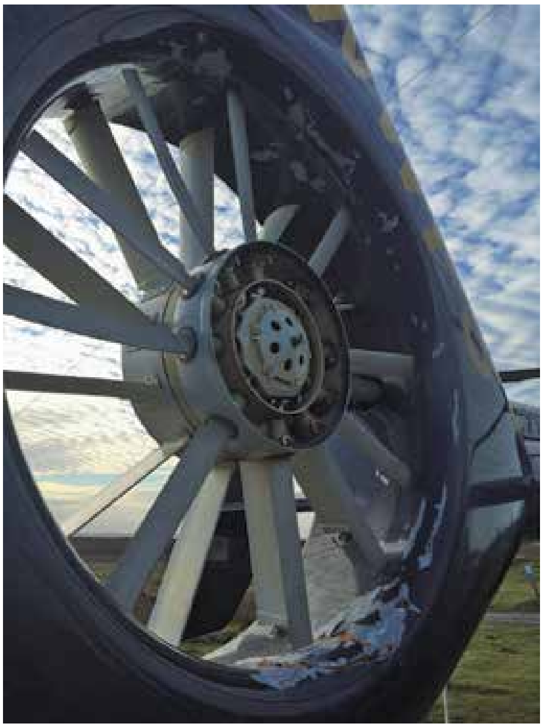

Figure 2
Damaged fenestron duct with hub cover missing

The incident was recorded by a CCTV system. A single piece of debris was shown entering the fenestron duct, causing an apparent puff of smoke, before the tail yawed slightly to the left. It was not possible to identify the origin of the metal debris but it was painted yellow and black on one side and looked like a piece of signage.

Landing site

The company which chartered the helicopter expects landing sites of this sort to be inspected before use but the pilot was unable to ascertain if a check for foreign objects was made before he approached. He saw nobody supervising the site when he landed.

In future, the helicopter operator will ensure, where possible, that sites are checked for loose debris before use.

ACCIDENT

Aircraft Type and Registration:	Piper PA-31-310 Navajo, G-EEJE
No & Type of Engines:	2 Lycoming TIO-540-A2C piston engines
Year of Manufacture:	1972 (Serial no: 31-825)
Date & Time (UTC):	1 January 2016 at 1625 hrs
Location:	Fadmoor Airfield, Yorkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to one propeller blade and lower aft fuselage
Commander's Licence:	Private Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	9,286 hours (of which 500 were on type) Last 90 days - 42 hours Last 28 days - 8 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

When the pilot selected the landing gear DOWN prior to landing, only the nose gear extended. He was unable to deploy the main gear and landed the aircraft with only the nose gear extended. At the time of preparation of this report, no technical reason for the malfunction has been found.

History of the flight

The pilot had flown the aircraft from Sturgate Airfield to Fadmoor in order to uplift some fuel. When he selected the landing gear DOWN whilst in the circuit to land, only the nosewheel green 'DOWN-LOCKED' light illuminated whilst the red gear NOT LOCKED light illuminated and the warning horn sounded continuously. Several attempts were made to recycle the landing gear but the selector lever would not move out of the NEUTRAL position. Attempts to extend using the emergency procedure also failed and the pilot contacted the airfield owner to discuss preparations for a landing with the main gears retracted and the nosewheel extended.

The subsequent emergency landing was successfully executed on the grass runway and minimal damage was incurred. The pilot had feathered both propellers and placed the mixtures in IDLE CUT-OFF prior to touchdown.

Examination of the aircraft

G-EEJE was recovered by lifting the fuselage using a farm vehicle and two slings. It could be seen that the mainwheels were fully retracted and the doors were closed and undamaged. The gear selector was placed in the DOWN position without difficulty and, using the emergency hand pump, it was possible to lower the main gears and achieve downlock as normal. The aircraft was then towed off the runway and parked. Since then, there has been no formal diagnostic work carried out but the aircraft's maintainers, who have considerable experience of the Navajo type, advise that they have never come across the same set of circumstances which seem to feature in this case.

ACCIDENT

Aircraft Type and Registration:	ARV1 Super 2, G-BPMX	
No & Type of Engines:	1 Hewland AE75 piston engine	
Year of Manufacture:	1989 (Serial no: K005)	
Date & Time (UTC):	22 November 2015 at 1240 hrs	
Location:	Lodge Farm, Gainsborough	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Wings and fuselage damaged, engine seized	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	61 years	
Commander's Flying Experience:	204 hours (of which 1 was on type) Last 90 days - 6 hours Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further inquiries by the AAIB	

The pilot reported that the engine stopped suddenly after takeoff when he reduced power to level off at a height of approximately 1,000 feet. The engine could not be restarted and the pilot made a forced landing in a field. The aircraft struck a tree stump and was badly damaged but the pilot was uninjured.

With the agreement of the AAIB and in consultation with the Light Aircraft Association (LAA), the pilot dismantled the engine, revealing evidence of contact between a piston and cylinder; the damage was characteristic of a cold seizure.

Two-stroke engines are susceptible to cold seizures if run at high power before fully warm because the pistons expand faster than the cylinders; cold seizure can also occur if the throttle is rapidly reduced following a period of operation at high power such as after takeoff. Previous occurrences have been reported by the AAIB and NTSB following incidents on G-BTGT (AAIB Bulletin 11/96), N12911 (NTSB Identification CEN11FA433) and N55368 (NTSB Identification LAX04LA228).

The LAA will highlight this occurrence and the susceptibility of two-stroke engines in an article in their *'Light Aviation'* publication.

ACCIDENT

Aircraft Type and Registration:	Auster J1N Alpha, G-AHSS
No & Type of Engines:	1 De Havilland Gipsy Major I piston engine
Year of Manufacture:	1946 (Serial no: 2136)
Date & Time (UTC):	27 June 2015 at 1615 hrs
Location:	Great Massingham Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller, cowlings, exhaust, tail and spring connecting the wheel mount
Commander's Licence:	Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	399 hours (of which 375 were on type) Last 90 days - 8 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

After an approach that was described by the pilot as normal, the aircraft landed into wind on Runway 28 at Great Massingham Airfield, Norfolk. The aircraft then started to drift left and the pilot was unable to prevent it leaving the paved surface and entering long grass by the edge of the runway. The left landing gear came into contact with some large stones, which were not visible to the pilot, and the aircraft abruptly tipped forward with the propeller coming into contact with the ground. When the aircraft fell back onto its landing gear, further damage was caused to the tail and fuselage. The engine had stopped so the pilot made the aircraft safe and vacated it normally.

The pilot thought the initial drift was probably caused by a gust of wind, and that, having relaxed after landing, he felt he was too slow to respond. He considered he should have applied power and gone around as soon as the aircraft began to drift.

ACCIDENT

Aircraft Type and Registration:	Glos-Airtourer Series 115 Airtourer, G-AZRP
No & Type of Engines:	1 Lycoming O-235-C2A piston engine
Year of Manufacture:	1969 (Serial no: A529)
Date & Time (UTC):	19 July 2015 at 1514 hrs
Location:	Tower Farm, Cathedine, Powys
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Substantial
Commander's Licence:	Private Pilot's Licence
Commander's Age:	81 years
Commander's Flying Experience:	911 hours (of which 835 were on type) Last 90 days - 4 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot reported that he completed normal pre-flight checks and departed from Shobdon in CAVOK conditions. Following some sightseeing near Llangorse, he commenced a full-throttle climb towards 2,000 ft. Approaching that altitude, and without any warning or rough running, the engine stopped. Restart checks had no effect. The low height, and the aircraft's relatively poor glide performance, meant that the options available for a forced landing were limited to sloping fields of small acreage. The pilot attempted to execute a forced landing into the most suitable one, but the aircraft stalled from a low height, with the flaps up, into the field before the one he had chosen. The aircraft sustained substantial damage in the impact, and was damaged beyond economic repair. The pilot suffered serious injuries. There was no fire. No cause of the engine failure was identified; 40 litres of fuel was drained from the intact fuel tank after the accident and checks of the spark plugs and magnetos found no faults. In the CAVOK conditions pertaining, flight at a higher altitude, and remaining within gliding range of fields suitable for a forced landing, could have improved the outcome of the engine failure.

ACCIDENT

Aircraft Type and Registration:	MCR-01 Club, G-DGHI	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2004 (Serial no: PFA 301A-14128)	
Date & Time (UTC):	20 September 2015 at 1230 hrs	
Location:	Fridd Farm, Bethersden, Kent	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Extensive to propeller, nosewheel and cowls	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	69 years	
Commander's Flying Experience:	1,076 hours (of which 469 were on type) Last 90 days - 15 hours Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot was conducting a local flight from a farm strip where the aircraft was based. On his return, about 2 nm away from the strip, the engine misfired. The pilot then flew past the strip to assess the wind indicated by the strip's windsocks. As he did so the engine misfired again. The wind was light and variable and he positioned the aircraft for a landing on Runway 14.

The pilot established the aircraft slightly high and slow on the final approach because of large oak trees in the runway undershoot, so that if the engine failed before crossing them he would be able to land beyond them.

The pilot then judged that the aircraft was too high on the approach and initiated a go-around on short final. Soon after achieving full power the engine misfired again and then stopped. The pilot attempted to avoid an area of soft ground. The aircraft landed in the overshoot of the strip on an area of grass before coming to rest in an adjacent field of crops where the nose wheel dug in and the aircraft came to a stop.

The pilot vacated the aircraft uninjured. The aircraft sustained damaged to its propeller, nosewheel and cowls.

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-161 Cadet, G-CEZO
No & Type of Engines:	1 Lycoming O-320-D3G piston engine
Year of Manufacture:	1989 (Serial no: 2841226)
Date & Time (UTC):	19 September 2015 at 1300 hrs
Location:	Fairoaks Airport, Surrey
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Fire damage to engine and engine bay
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	23 years
Commander's Flying Experience:	689 hours (of which 153 were on type) Last 90 days - 165 hours Last 28 days - 46 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

After completing the pre-flight checks the pilot attempted to start the engine. The engine primer pump was not used as the engine was still hot from an earlier flight, but the engine failed to start. The engine was then primed and a second start was attempted which was also unsuccessful. The engine was re-primed and a third start attempted. During this attempt the pilot initially selected the fuel mixture control to IDLE / CUT-OFF, in an attempt to eliminate excess fuel in the carburettor and engine, before moving the mixture control to FULL RICH. Once again the engine failed to start.

After waiting for a few minutes the engine was re-primed and a fourth start attempted. During the start a significant volume of smoke began to emerge from beneath the engine cowlings. The aircraft was evacuated without injury and the AFRS extinguished a fire which was restricted to the engine bay. Inspection of the engine after the event revealed some evidence of oil leaking onto the exhaust from the lower engine cowling. The fire is believed to have been caused by over-fuelling of the engine and the presence of oil on the engine exhaust.

ACCIDENT

Aircraft Type and Registration:	Piper PA-38-112 Tomahawk, G-RVNB	
No & Type of Engines:	1 Lycoming O-235-L2C piston engine	
Year of Manufacture:	1978 (Serial no: 38-79A0260)	
Date & Time (UTC):	2 July 2015 at 1158 hrs	
Location:	Liverpool Airport	
Type of Flight:	Training	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to cowling and right side window	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	34 years	
Commander's Flying Experience:	890 hours (of which 600 were on type) Last 90 days - 120 hours Last 28 days - 50 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries	

The aircraft was on a circuit training flight with a student pilot in the left seat and flying instructor in the right. The instructor was aware of the elevated risk of birdstrike in the summer at Liverpool, and had turned the window heat on, intending to improve the windscreen's resistance to impact. On a flapless final approach to Runway 27, at around 80-90 KIAS and approximately 650 ft aal, the instructor suddenly saw a small flock of grey pigeons against the grey sky to the right of the nose, close by and flying into the aircraft's path. Before he could react, the aircraft struck four or five birds. One bird struck the windscreen, which did not break, but another broke the right side window, causing bruising to the instructor's shoulder. The approach continued to a flapless landing, and the aircraft vacated the runway. Post-flight inspection found birdstrike evidence in the engine bay and on the cowlings and wing. CAA Safety Sense Leaflet 10c - '*Bird Avoidance*', offers a range of advice to pilots to mitigate the hazard posed by birds in flight, including use of windshield heat.

ACCIDENT

Aircraft Type and Registration:	Rans S6-ES, G-CDVF	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2006 (Serial no: PFA 204-14464)	
Date & Time (UTC):	5 July 2015 at 1048 hrs	
Location:	Shifnal Airfield, Shropshire	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Serious)	Passengers - 1 (Serious)
Nature of Damage:	Substantial	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	64 years	
Commander's Flying Experience:	282 hours (of which 70 were on type) Last 90 days - 3 hours Last 28 days - 0 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

The aircraft suffered an uncommanded loss of engine rpm shortly after takeoff. The aircraft struck the ground in a steep nose-down attitude seriously injuring the pilot and the passenger.

History of the flight

The aircraft had undergone a 100 hour inspection eighteen days prior to the accident flight. On the day before the accident flight the pilot had visually checked the aircraft and engine and completed engine ground runs during which it appeared to operate normally.

On the day of the accident flight the pilot, accompanied by a passenger, fuelled the aircraft and completed the pre-flight checks. Four takeoffs, circuits and landings were then flown without incident but the pilot commented, in his report to the AAIB, that that the engine performance "felt sluggish". While preparing for the fifth takeoff the engine began to run roughly and its rpm decreased before recovering. The pilot checked that the engine instrument readings were normal, the fuel selector was ON and that the fuel tank contents were as expected. A magneto drop check was completed after which the pilot carried out two high-power engine runs. As the engine now appeared to be performing normally the pilot decided to carry out another takeoff. Shortly after becoming airborne, between 100 ft and 200 ft agl, there was an uncommanded reduction in engine rpm. The aircraft lost height and struck the ground in a steep nose-down attitude.

After coming to rest a small fire developed which was extinguished by a witness to the accident. The witness removed the passenger from the aircraft. The pilot was removed from the wreckage by the emergency services. Both the pilot and passenger received serious injuries during the accident and the aircraft was destroyed.

Investigation

Shortly after the accident, the wings had been removed from the fuselage and the wreckage had been moved a short distance from the accident site by members of the flying club. The wreckage was subsequently transported to the AAIB for further investigation.

No evidence of pre-accident defects or restrictions in the aircraft's flight or engine control systems was found. Disassembly of the aircraft at the accident site had resulted in the loss of all of the fuel from the aircraft. It was therefore not possible to confirm that the aircraft's fuel met the required specification and was free from contamination. The damage sustained during the accident prevented any operational test of the engine, ignition system or the carburettors.

A partial disassembly of the engine confirmed that there was no evidence of a major mechanical malfunction. The engine's mechanical fuel pump was tested and found to operate normally. The fuel filter was free from contamination and the spark plugs showed no sign of abnormal operation. Both carburettors, which had been fitted with heaters to minimise the formation of carburettor icing, were disassembled. There was no evidence of any pre-impact defect which would have prevented their normal operation.

Analysis

There was no evidence of a pre-existing defect within the engine, its controls or fuel supply which would have prevented the engine from operating normally. As the aircraft had completed four short flights without event, it is considered unlikely that contamination had resulted in the loss of engine rpm. The completion of the previous flights also supports the fact that the engine ignition system had appeared to operate normally; however, the inability to test the system meant that the presence of an intermittent defect within the ignition system could not be eliminated as potential cause for the uncommanded engine rpm reduction.

ACCIDENT

Aircraft Type and Registration:	SLA 80 Executive, G-CEII	
No & Type of Engines:	1 Rotax 912-UL piston engine	
Year of Manufacture:	2007 (Serial no: 10107)	
Date & Time (UTC):	28 January 2016 at 1330 hrs	
Location:	Breighton Aerodrome, 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	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	31 years	
Commander's Flying Experience:	1,541 hours (of which 15 were on type) Last 90 days - 59 hours Last 28 days - 26 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was landing on grass Runway 28 at Breighton Aerodrome; the wind was from 230º at 10 kt. The pilot, who was accompanied by an instructor, reported that "low-level windshear" had resulted in the aircraft touching down heavily before bouncing. The instructor took control and flew a go-around before positioning to land. During the subsequent landing the left main gear collapsed.

Miscellaneous

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

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

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

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

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

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

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

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

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

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

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

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

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

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

http://www.aaib.gov.uk

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

Air Accidents Investigation Branch