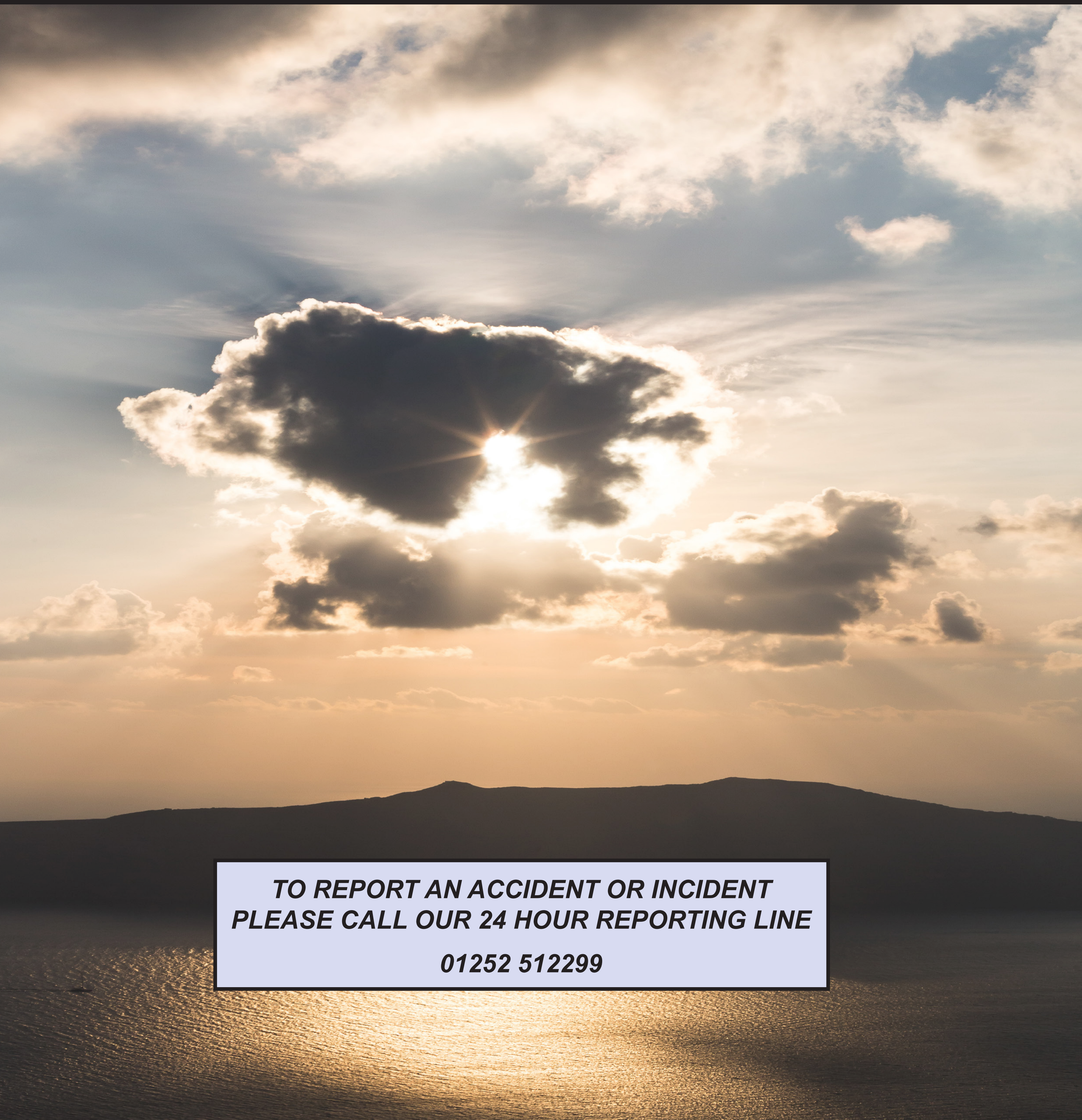
AAIB
Air Accidents Investigation Branch

AAIB Bulletin 9/2016



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01252 512299

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

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

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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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(ALL TIMES IN THIS BULLETIN ARE UTC)

AAIB Field Investigation Reports

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

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

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

SERIOUS INCIDENT

Aircraft Type and Registration:	BAe ATP, G-BUUR
No & Type of Engines:	2 Pratt & Whitney Canada PW126 turboprop engines
Year of Manufacture:	1990 (Serial no: 2024)
Date & Time (UTC):	26 January 2016 at 1950 hrs
Location:	On approach to Guernsey Airport
Type of Flight:	Commercial Air Transport (Cargo)
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	60 years
Commander's Flying Experience:	6,843 hours (of which 1,512 were on type) Last 90 days - 74 hours Last 28 days - 23 hours
Information Source:	AAIB Field Investigation

Synopsis

The crew reported that the autopilot would not disengage during the approach for a night landing at Guernsey in a strong crosswind. A manually flown go-around was initiated from low altitude and the newly-qualified co-pilot, who was Pilot Flying (PF), reported the aircraft then exhibited a strong pitch-up tendency. The commander also sensed excessive pitch-up and pushed forward on his control column to assist. Thereafter the crew were alerted to activation of the Standby Control System (SCS) with the left and right elevators operating in split control.

During the go-around, the elevator control system problems distracted the crew so they did not follow the standard go-around procedure resulting in late retraction of the gear and flaps. After levelling, the pilots realised the autopilot was not engaged and immediately re-engaged it. The appropriate drill for SCS engagement was then actioned and they diverted to Jersey.

On completion of the flight, the crew reported the problems encountered to the operator and their engineers began system checks. It was not understood by the crew or those working on the aircraft that the event was a reportable serious incident and consequently, the Cockpit Voice Recording (CVR) of the event was not preserved and certain autopilot components were removed from the aircraft prior to the AAIB being notified on the evening of 27 January 2016.

Recorded flight data indicated the autopilot disengaged during the approach to Guernsey and examination of the aircraft revealed no technical defects that would have caused the incident. As the CVR was unavailable, it was not possible to ascertain if an audio autopilot disengagement alert was generated. Some human factors were identified which may have contributed to the incident. The operator has made changes to its training policies and its guidance concerning post-incident or accident response.

History of the flight

The aircraft departed Jersey at 1940 hrs for a night cargo flight to Guernsey. The co-pilot, who was PF, had completed the operator's BAe ATP training course the previous month and this was his first commercial aircraft type. The forecast was for a strong southerly wind affecting both islands, with a possibility of severe turbulence and windshear. The PF believed he had experienced similar weather during training and was content to handle the aircraft in these conditions. Before departing for this short flight he briefed the commander, who was Pilot Not Flying (PNF), about the expected approach to Guernsey's Runway 27. He mentioned the required routing in the event of a missed approach but did not discuss the actions required of each pilot in the event of a go-around.

Following a normal take-off, autopilot system 2 (AP2) was engaged at approximately 1,000 ft aal and the aircraft was levelled at 2,000 ft amsl. No significant turbulence was experienced and Runway 27 was in view when the aircraft established on an ILS approach with AP2 still engaged. The visibility was good, the surface temperature was 11ºC, the reported surface wind was from 200º at 20 kt and the crosswind was within the operator's advisory limits (see *Crew guidance*). At 1,000 ft agl, the PNF stated the aircraft was stable; with the gear extended and flaps set to 20º. The estimated landing weight was 18,369 kg, so the calculated threshold speed (V_{AT}) was 103 kt. The approach speed would have been 113 kt (V_{AT}+10) but the crew added a 5 kt buffer and aimed to fly at 118 kt because of the gusty conditions and the forecast of possible windshear.

Approaching the decision altitude (200 ft aal), the PF attempted to disengage the autopilot, by pressing the red disengage switch on his control wheel, but he did not hear the expected audio disengagement alert. Unaware of this, the PNF suggested the autopilot be disengaged, as he was keen the PF had enough time before landing to become used to handling the aircraft in the windy conditions. The PF pressed the disengage switch once more but still neither pilot heard the disengagement alert. The decision altitude was then announced by the PNF and acknowledged by the PF, who pressed the autopilot disengage switch again. He also tried to make small control column inputs but he thought the controls felt extremely stiff.

Both pilots believed the autopilot was still engaged, as neither of them had heard the disengagement alert and the PNF was aware, in his peripheral vision, of the PF "frantically pressing" the disengage switch. The PNF asked what was happening and the PF told him "it won't disconnect", so the PNF pressed the disengage switch and the pitch trim switch on his control column, as either action should disengage the autopilot. He also recalled pressing the AP switch[1] on the autopilot controller, but still no disengagement alert was

Footnote

[1] See *Autopilot selection and engagement.* The AP switch's function is to engage the autopilot if pressed for 0.75 seconds. This switch does not have a disengagement function.

heard. He could not recall checking the auto-flight mode annunciations on his Primary Flight Display (PFD). The PF thought he remembered seeing the relevant AP annunciator on his PFD at some stage after his first attempt to disengage the system.

The PNF asked the PF if he had control and the PF said he was not sure. The PF later stated that he tried moving the control column again, both laterally and fore and aft but it felt very stiff, "as if the autopilot was in". Both pilots were aware of the aircraft deviating above the glideslope and the PF recalled trying to pitch the nose down and possibly reducing power as well. Shortly after this the PNF instructed the PF to go-around, because he was unsure if sufficient control was available to land the aircraft in the crosswind conditions and he now assessed the approach to be unstable. He recalled making this decision when the aircraft was close to the runway.

The PF advanced the power levers and pressed the go-around button on the right power lever using his left hand. This should have caused the autopilot to disengage and the flight director bars on the PFD to move. He was not aware that either of these changes happened, so he pressed the go-around button a second time, but still sensed no response. However, he was now applying rearwards force on the control column with his right hand and the aircraft began to pitch nose-up. His recollection was that the controls felt stiff but he did not have to exert an unusual amount of force at this stage. He called for go-around power, for FLAP 15 and for HDG and PSA mode selections (see *Autopilot and flight director modes*).

The PNF concentrated on adjusting the power levers to the go-around setting and moving the flap lever. He could not recall looking at the flight director bars on the PFD or selecting HDG and PSA modes[2]. Neither pilot was sure if they employed IAS mode while climbing, but both of them did remember seeing a large decelerative speed trend on their PFD airspeed tapes during the go-around. Once the power had increased, the PF was aware of a strong pitch-up tendency and he responded with an unusually large amount of forward force on his control column.

The PNF also recalled the aircraft pitching up more than expected, possibly as much as 15-20º but he did not see this on the instruments. He instinctively assisted the PF by pressing forward on the left control column using the palms of his hands. He then heard the caution annunciation and was aware of a caution light on the Central Warning Panel (CWP).

The PF saw the STANDBY CONTROLS caution on the CWP. The pitch control forces now seemed lighter than normal and were similar to those he had experienced in the simulator when practising flight with split elevator control.

The crew later stated they felt the go-around now began to "normalise" and they retracted the flaps and levelled at 2,000 ft amsl, in response to ATC instructions. They then noticed an elevator SPLIT indicator on the overhead console. Both pilots now realised the autopilot was no longer engaged. They did not recall discussing the autopilot problem or its annunciations at this time and successfully re-engaged AP2.

Footnote

2 See ***Organisational information*** **-** *Go-arounds.*

The drill in the Quick Reference Handbook (QRH) titled '*Standby Controls Warning (CWP)*' was actioned, during which the crew engaged AP1 for a short time, before re-engaging AP2. After completing the drill, AP2 was briefly disengaged again and then re-engaged.

The autopilot now disengaged and re-engaged normally and both pilots heard the audio autopilot disengagement alert clearly. They decided to divert to Jersey, where the runway is longer[3] and where the operator has a maintenance base. Owing to the unusual circumstances, with the elevators split, the commander elected to reverse the crew roles and, with the co-pilot's agreement, he became the PF for the approach to Jersey. The autopilot was switched from AP2 to AP1, without difficulty.

During the approach to Jersey the commander disengaged the autopilot earlier than normal. At approximately 600 ft aal the Enhanced Ground Proximity Warning System (EGPWS) annunciated a 'TERRAIN' audio alert but the crew disregarded this as they were visual with the runway, the approach was stable and because, according to the commander, "terrain warnings are not uncommon at Jersey and Guernsey".

After landing the crew noticed the elevator ENGAGED caption was illuminated on the overhead panel. They did not recall seeing this during the flight. The commander told the engineering staff what had happened and made an entry in the Technical Log. This stated the autopilot failed to disconnect on approach and that the elevators split and the standby controls engaged during the go-around.

The following day (27 January 2016) the commander forwarded an incident report to the operator and that evening the AAIB was notified. In the intervening period, the aircraft was electrically powered and the Cockpit Voice Recorder (CVR) recording of the incident flight was overwritten during maintenance activity.

Recorded information

Cockpit Voice Recorder

The aircraft was fitted with a CVR which was successfully downloaded. However, the 30 minute recording was of poor quality; a 400 Hz tone was continually audible and prevented comprehension of the whole recording, but it was evident that the recording did not cover the event. Instead, it recorded a period of on-ground troubleshooting during which the event was discussed and, at times, the aural autopilot disengagement alert could be heard to function.

Data Recorders

G-BUUR was also fitted with a 25-hour Flight Data Recorder (FDR) and a Quick Access Recorder (QAR), both of which were successfully downloaded. The data on the QAR replicated the data on the FDR so the QAR data, which was available first to the investigating team, was used.

Footnote

[3] The LDA of Runway 27 at Guernsey is 1,463 m and the LDA of Runway 27 at Jersey is 1,554 m. The QRH drill states the aircraft should be landed at the nearest suitable airfield and does not specify any adjustment to the required landing distance.

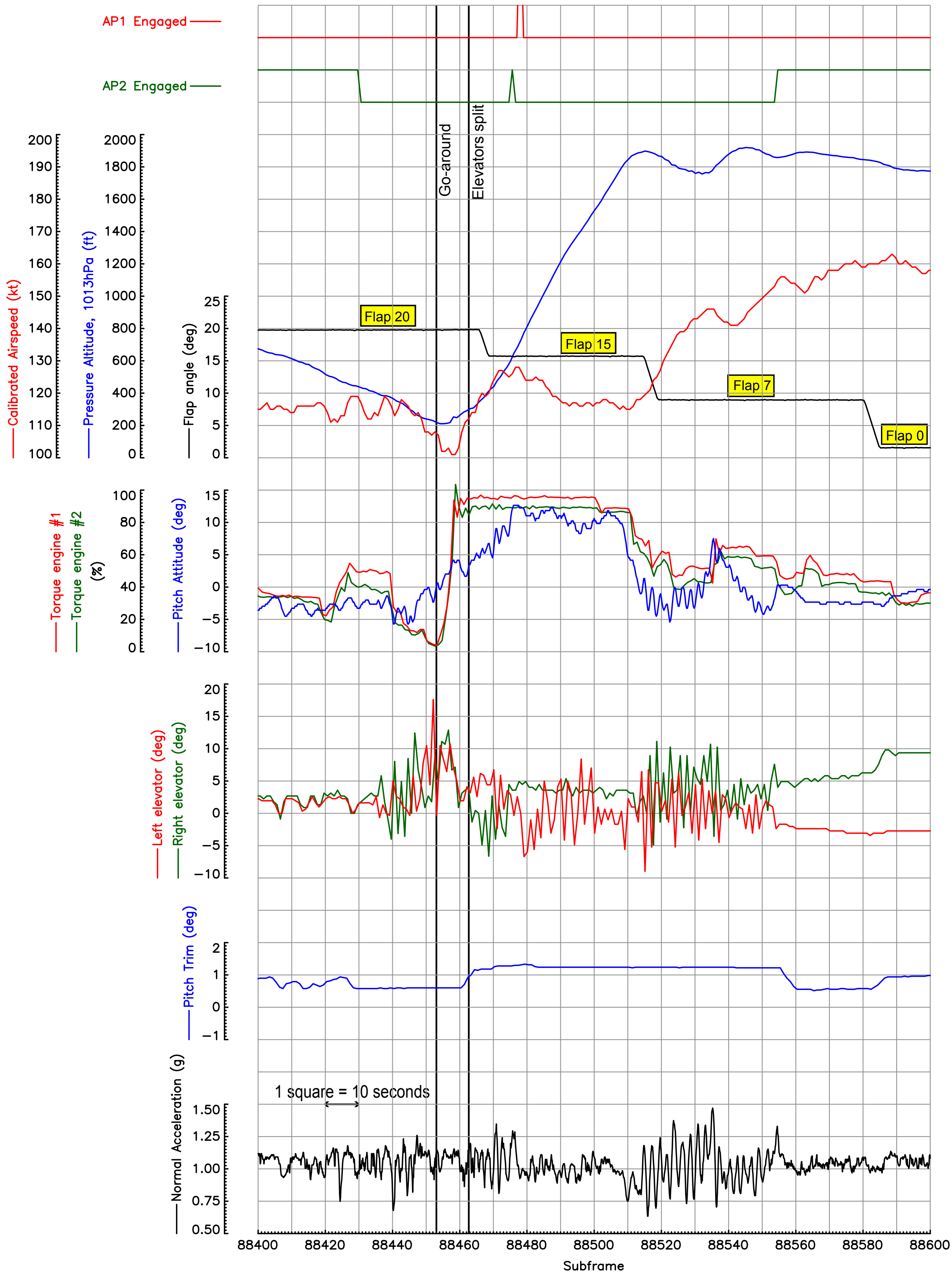

Figure 1

QAR data showing the approach and go-around at Guernsey

The QAR data has been divided into 3 phases; *the approach to autopilot disengagement*, *the go-around* and *the level-off to final autopilot re-engagement*. These phases are described under their respective headings below.

The approach to autopilot disengagement

The data showed that AP2 was engaged as the aircraft descended through 685 ft pressure altitude[4], equivalent to 470 ft above aerodrome level (aal)[5], 20º of flap was selected and the aircraft's pitch attitude, although varying, averaged -3º. The aircraft's airspeed was generally steady, with only minor fluctuations, around 115 kt[6] and engine torques were well matched at 34%. However, 19 seconds later, a reduction in torque to 22% on engine No 1 and to 20% on engine No 2 occurred as the aircraft passed through 550 ft pressure altitude (335 ft aal). At the same time the aircraft's airspeed reduced to 111 kt and an application of power was then made. This was slightly asymmetric in nature with engine No 1 leading engine No 2, torque values settled at 50% for engine No 1 and approximately 40% for engine No 2. The aircraft's airspeed increased to 119 kt. At this point, the aircraft was descending through 435 ft pressure altitude (220 ft aal[7]) and the data showed that AP2 disengaged. Prior to AP2 disengaging, the left and right elevators moved together in unison and the pitch trim was observed to modulate[8].

The go-around

After disengagement of AP2, for a period of 10 seconds, the aircraft's airspeed continued to vary between 112 kt and 119 kt but engine torques fluctuated by no more than 3%. The aircraft's pitch attitude was approximately -2º. Engine torques then reduced over 4 seconds to 15%, the initial reduction coincident with a change in pitch attitude of the aircraft to -5.7º, but thereafter pitch attitude settled at around -5º. The aircraft's airspeed, which had reduced to 113 kt, recovered back to 119 kt. Following autopilot disengagement, the activity on the elevators increased but because both elevators were sampled at different points in time and, due to a low sample rate, the precise position of the elevators, especially in relation to each other, could not be deduced. However, the trend of both elevators began to show a nose-up demand. The aircraft's pitch attitude changed, from -5º to +2º over 6 seconds, and during this time both engine torques decreased to 4%, whilst the aircraft's airspeed decayed to 102 kt. A minimum pressure altitude of 211 ft, approximately equivalent to the elevation of Guernsey's runway, was recorded before a rapid increase of torque, over 3 seconds, from 4% to a value of 95% for engine No 1 and 90% for engine No 2. The power settled at these values as the aircraft passed 250 ft pressure altitude (370 ft amsl). At 300 ft pressure altitude (420 ft amsl), a nose-down demand on both elevators was recorded and a nose-up

Footnote

4 Using 1013 hPa as the pressure reference.

5 The METAR for Guernsey at 1950 hrs UTC gave the regional pressure setting as 1017 hPa, meaning altitudes measured with reference to 1013 hPa required correction by +4 hPa, or +120 ft, to read above mean sea level. Taking into account the elevation of Guernsey (336 ft), as listed in the UK's Integrated Aeronautical Information Package, all aal heights were calculated by taking the 1013 hPa pressure altitude values, adding 120 ft and then subtracting 336 ft.

6 The target approach speed was 118 kt (see *History of the flight*).

7 Decision height for the approach was 200 ft aal.

8 When the autopilot is engaged it controls the pitch trim but, when it is not engaged, the pilots can adjust the pitch trim, either electrically or manually.

deflection in pitch trim then occurred. The elevator surface deflections now changed in character, with different absolute values for both elevators recorded even during periods of elevator inactivity, consistent with the elevators having split. At 355 ft pressure altitude (475 ft amsl) the flaps were retracted to 15º, the aircraft's airspeed settled at between 125 kt and 130 kt and the pitch attitude reached the maximum recorded of 12.6º. Around this point, AP2 and then AP1 both momentarily showed as engaged. The aircraft reached 1,500 ft pressure altitude (1,620 ft amsl) 24 seconds later with the pitch attitude in the climb being between 8 and 12º and the airspeed averaging 118 kt.

The level-off to final autopilot re-engagement

Both engines now reduced to 87% torque, the pitch attitude reduced to +4º, which was accompanied by a further power change on both engines to around 70% torque. After the aircraft reached 1,900 ft pressure altitude (2,020 ft amsl), with an airspeed of 120 kt, the flaps were retracted to 7º. Further reductions in engine power were then made to 48% torque on engine No 1 and 40% torque on engine No 2 and the aircraft descended back to 1,750 ft pressure altitude (1,870 ft amsl) with a pitch attitude of -2.5º. The aircraft's pitch attitude was then increased to +7º, along with a power increase to approximately 60% torque, the aircraft climbed to 1,920 ft pressure altitude (2,040 ft amsl) with the flightpath becoming more stable although the aircraft continued to accelerate. During this whole period of time, the QAR data showed significant elevator activity, but this then settled with the re-engagement of AP2, and at the same time the pitch trim surface moved nose-down. Over the next 20 seconds, the aircraft levelled at 1,775 ft pressure altitude (1,895 ft amsl) the airspeed settled at 160 kt and the flaps retracted to 0º.

Aircraft description

The British Aerospace[9] Advanced Turbo Prop (ATP) was derived from the Hawker Siddeley 748. The aircraft is a low-wing turboprop transport with a conventional tail configuration and two Pratt and Whitney PW126 engines, mounted above the wings, driving six bladed propellers (Figure 2). The aircraft was produced in passenger and cargo configurations.

Figure 2

British Aerospace ATP G-BUUR

Footnote

[9] BAE Systems (Operations) Ltd is the design Type Certificate holder.

System descriptions

Autopilot

Automatic flight control is provided by two independent autopilots, flight directors and SCS. Each autopilot system has its own computer / amplifier. Only one autopilot can be engaged at any time.

Autopilot selection and engagement

An autopilot controller, common to both systems, is located on the console between the two pilots. It provides control of the autopilot functions and selection of system 1 or 2 (Figure 3). Operating the system selection switch will alternately select either system 1 or system 2 with each successive operation. The selected system is displayed above the selection switch. The autopilot is engaged by depressing the AP switch for a minimum period of 0.75 seconds. The autopilot will engage provided a safety circuit does not detect any errors and successful engagement will be indicated on the autopilot controller by a cyan AP caption on the autopilot controller.

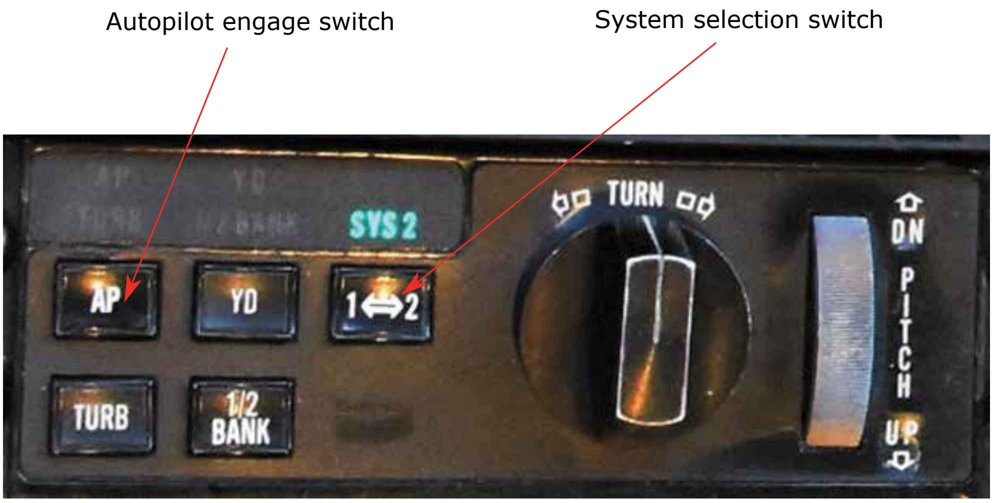

Figure 3
Autopilot controller

Autopilot and flight director modes

There are two identical mode selectors, one for each system. Each selector has two rows of switches and two rows of annunciator lamps to indicate armed and engaged modes. These modes are also annunciated on the PFDs, to either side of the autopilot annunciator. The mode selectors can be used independently to provide inputs to the flight directors and autopilots. During a coupled ILS approach the lateral engaged mode is APP (localiser captured) and the vertical mode is GS (Glideslope captured). GA (Go-Around) mode is a flight director only mode that is initiated when the go-around button is pressed and which demands wings level and 6º pitch-up on the PFDs. HDG is a lateral mode that directs the aircraft to follow the heading index as selected on the PNDs. The PSA (Pre-Selected Altitude) mode is used to capture a pre-selected barometric altitude and can be used in conjunction with another vertical mode, such as IAS (Indicated Airspeed) which maintains the airspeed indicated at the time the mode is engaged. Following the selection of GA mode the flight directors will demand wings level until the lateral mode is changed (eg HDG mode engaged) and 6º pitch-up will be demanded until the vertical mode is changed (eg IAS mode engaged).

Autopilot status on Primary Flight Display

The autopilot engaged annunciation (AP1 or AP2) is presented above the roll scale datum position on each PFD. If the system 1 autopilot is engaged, AP1 is coloured green on the commander's PFD and white on the co-pilot's PFD. When the system 2 autopilot is engaged, the co-pilot's indication is coloured green and the commander's PFD indication is coloured white. Lateral and vertical navigation modes, as selected or armed on the mode selector, are displayed to the left and right, respectively, of the autopilot engagement status (Figure 4).

Figure 4

Autopilot and mode indications on PFD
(Note photo taken of a PFD under test conditions and not in flight)

Autopilot manual disengagement

When the autopilot is manually disengaged the AP annunciation on the autopilot controller and the AP1 / AP2 annunciations on the PFDs are extinguished. To confirm disengagement a one second audio 'cavalry charge' alert is passed to the pilots' headsets and the cockpit loudspeaker.

The autopilot can be disengaged by pressing the red instinctive autopilot disengage switch on either of the pilots' control wheels. The autopilot will normally autotrim the elevators using the trim servomotor but, if necessary, electric trim switches on the pilots' control wheels can be used to adjust pitch trim manually. Activation of either switch will disengage the autopilot first (Figure 5).

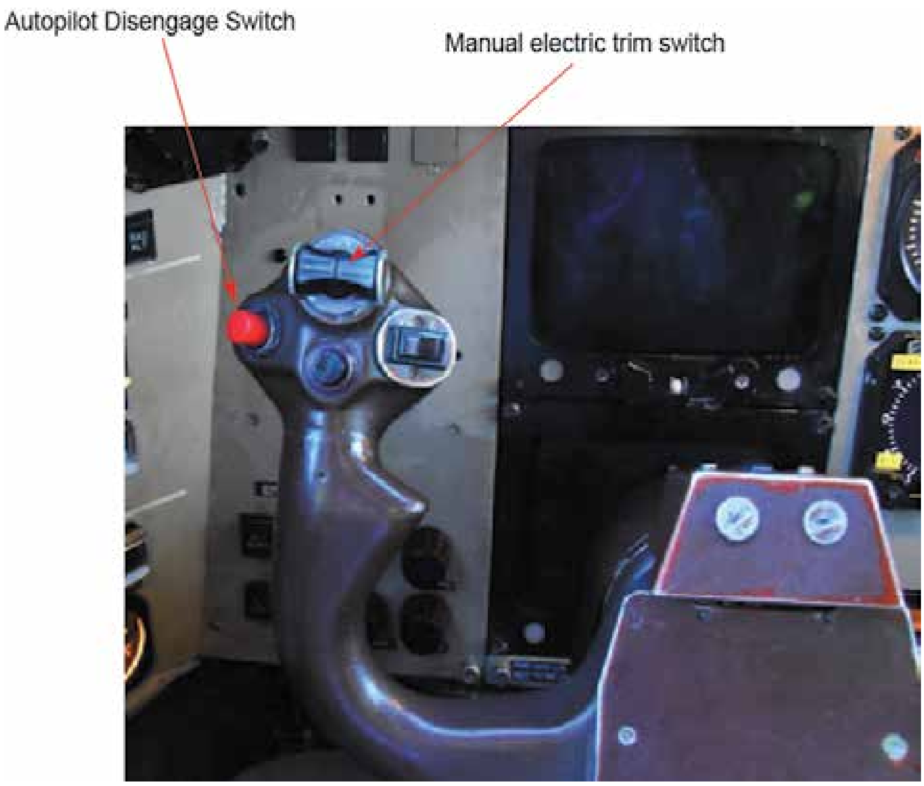

Figure 5
Autopilot and manual trim switches

Elevator primary flying controls

The elevators are operated directly from the control columns through a system of cables, rods and levers (Figure 6). These pass under the floor, down the left side of the fuselage then via push / pull rods and bell cranks to the control surfaces. A solenoid-operated elevator release unit is fitted between the two elevators. Under normal circumstances the release unit functions as a fixed length control rod but when the solenoid is energised the unit allows the elevators to operate independently. The elevator release unit cannot be reset in flight.

Under normal operating conditions the two control columns are interconnected by a torque tube and detent mechanism. The detent mechanism consists of a spring-loaded roller on the right control column and a cam on the torque tube. Spring pressure between the roller and cam ensures that the control columns remain aligned during normal operation but provides a means of breaking the interconnection in the event of a jam; this requires a differential of 100 lb between the control columns. If necessary, the pilots can physically separate the control columns at the detent unit by pulling a force relief handle in the cockpit. The force relief handle cannot be reset in flight.

A servomotor in the right tailplane drives the elevators in response to autopilot demands. The servomotor has a common gearbox driven by two independent motors; one associated with each of the autopilot systems. An electromagnetic clutch is energised when the autopilot is engaged and a slipping clutch at the servomotor output allows the autopilot to be overpowered if the force applied at the control column exceeds 50 lb. Overpowering the autopilot will not automatically disengage it.

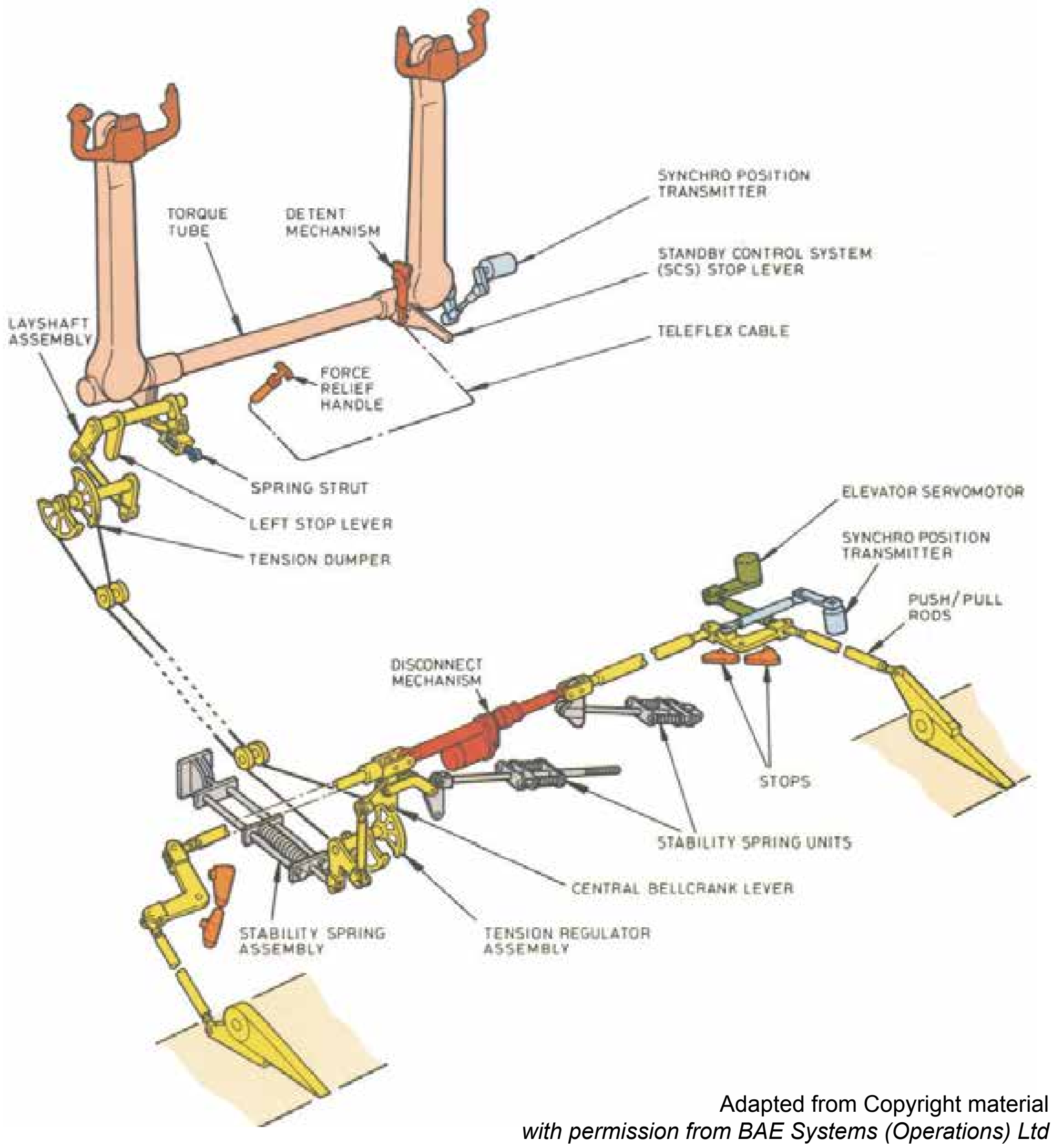

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Figure 6

Elevator flying controls

Elevator Standby Control System (SCS)

The Standby Control System (SCS) is designed to ensure safe, continued operation in the event of either control cable severance or a jam in the control system.

The SCS control circuitry resides within the autopilot computers. It operates independently of the autopilot and continuously monitors the position of the flying controls. The autopilot has priority over the SCS.

Control cable severance

If the elevator control cable breaks, the direct (mechanical) connection between the control columns and the elevators will be lost.

The output of a synchro transmitter (position sensor) that is connected to the right control column is continuously compared against the output of a synchro transmitter that monitors the right elevator control surface. If the difference between the two outputs exceeds 25%, and the autopilot is not engaged, SCS will engage. The elevators will be electrically driven, via the elevator servomotor, to a position where there is no difference between the two synchro transmitters. Both pilots will retain control of the elevators via their respective control column.

Elevator jam

If there is a jam in the elevator system, the pilots will experience a resistance to movement at the control columns.

When the pilots exert a force exceeding 100 lb they will overcome the detent mechanism and the control column that is not on the jammed side will 'break out'. Overcoming the detent mechanism energises a solenoid on the elevator release unit, thereby separating the elevators. An amber STANDBY CONTROLS caption illuminates on the CWP, an audible warning will be heard and the attention getters flash. The amber elevator release unit SPLIT caption illuminates on the STANDBY CONTROLS panel on the overhead panel in the flight deck.

Continued operation of the elevators is dependent on the location of the jam. If the jam is forward of the elevator release unit and the difference between the two synchro transmitters exceeds 25%, the SCS will engage and the right elevator will be controlled by the right control column through the elevator servomotor. The amber ENGAGED caption will illuminate on the overhead panel (Figure 7).

Figure 7

STANDBY CONTROLS panel

If the jam is aft of the release unit, the left elevator will respond normally to primary control system inputs. If the control column detent mechanism has operated, the pilots should establish the forces required to operate the elevators and, if necessary, the force relief handle should be operated to separate the control columns.

Autopilot fails to disengage

If the autopilot does not disengage when selected, the servomotor can be overpowered by the pilot applying a force in excess of 50 lb. The autopilot will continue to try and fly the aircraft but the pilot's inputs will overcome the slipping clutch. If the aircraft is being controlled from the left seat, this situation will continue until the autopilot is disengaged. If the aircraft is being controlled from the right seat, the same conditions will exist unless the pilot applies a force in excess of 100 lb, which will overcome the control column detent, thereby operating the elevator release unit. An amber STANDBY CONTROLS caption will illuminate on the CWP and the SPLIT caption will illuminate on the STANDBY CONTROLS panel. The right elevator will remain under autopilot control until the autopilot is disengaged. The left elevator can be driven by the left control column and the right control column, provided the detent mechanism is not overcome.

If the autopilot were to subsequently disengage, the right elevator would cease to be driven and its position would be dependent on the airflow over the control surface. This situation will continue until the difference between the two synchro transmitters exceeds 25%, at which point the SCS will engage and the right elevator will be controlled by the right control column through the elevator servomotor. The amber ENGAGED caption will illuminate on the overhead panel.

If the force relief handle has not been pulled, both control columns will be held together by the detent mechanism which allows the cables and autopilot SCS to drive both elevators.

Enhanced Ground Proximity Warning System (EGPWS)

The EGPWS fitted to the aircraft provides look-ahead terrain awareness warning and display functions. System warnings are provided by red PULL UP, amber TERR and white GLIDE SLOPE annunciators above the PFDs. Aural alerts are passed to the pilots' headsets and a flight deck loudspeaker.

The EGPWS incorporates the basic GPWS modes 1 to 4, producing aural warnings of possible terrain conflict. Mode 5 monitors for excessive deviation below the ILS glideslope and mode 6 provides aural altitude alerts as a function of radio altitude and decision height.

Mode 2B is active when the flaps are in the landing configuration or during an ILS approach with less than two dots deviation on the glideslope and localiser. When the warning envelope is penetrated and the landing gear is in the down position, a mode 2B warning generates a repeated aural "TERRAIN, TERRAIN" alert and red PULL UP captions are illuminated until the warning envelope is exited.

Maintenance and aircraft history

The aircraft was manufactured in 1990 and had accrued 21,554 hours and 23,181 cycles. It was originally configured for passenger transportation but was converted for cargo operations in 2006.

According to the operator, the aircraft did not have a recent history of autopilot or flying control problems.

Aircraft examination

Prior to AAIB notification

Prior to the AAIB being notified of the occurrence, the operator initiated its own investigation and downloaded the QAR. A functional check of the autopilot disengage logic and electrical continuity checks that required disconnection of the autopilot computers were performed. No failures were identified.

The autopilot controller and elevator servomotor were removed and replacement units were installed. The units that were removed had been quarantined locally pending further investigation.

Investigation under AAIB control

Visual examination of the elevators, horizontal stabilisers and rear fuselage showed no abnormalities. The floor and appropriate panels were removed to allow access to the elevator flying control system. There was no evidence of damage or restriction. The SCS synchro transmitters and associated wiring were checked and no faults were identified.

Functional testing of the autopilot disengage logic, elevator SCS and control column detent identified no failures. The incident autopilot controller and elevator servomotor were refitted and the tests were successfully repeated.

The aircraft was released to the operator. Since then and up to the end of April 2016, it had completed an additional 79 flying hours and 110 cycles without recurrence.

Component testing

The following components were removed from the aircraft and sent to an approved overhaul facility for testing and strip examination as appropriate.

- Autopilot computer No 1 (Serial Number 242)
- Autopilot computer No 2 (Serial Number 121)
- Autopilot controller (Serial Number 195)
- Audio summing amplifier (Serial Number 1542)
- No 1 static inverter (Serial Number F503)
- Elevator servomotor (Serial Number 449)

- Right control column pitch position synchro (Serial Number AL903)
- Elevator trim servomotor (Serial Number 130)
- Tone Generator (Serial Number 99)

Extensive testing identified no failures that were associated with the reported occurrence.

Weight and balance

The aircraft's dry operating mass was 13,721 kg and it departed Jersey with a recorded cargo load of 2,157 kg and with 2,750 kg of fuel. The calculated takeoff mass was 18,628 kg and the calculated landing mass at Guernsey was 18,369 kg; both weights were significantly less than the regulated figures recorded on the load sheet. A load plan, signed by a member of the loading team, stated the cargo was loaded in accordance with the load sheet. The Centre of Gravity (CG) was calculated to be well within the allowable range for both takeoff and landing. During the takeoff the PF reported that control forces felt normal, with no indication that the CG was different from that calculated.

Organisational information

Crew guidance

The Operator's Manual (OM) advises that the maximum demonstrated crosswind for ATP landings is 34 kt. The operator recommends a crosswind limit of 25 kt when landing on wet runways with a width of 40 m or more and good braking action. The operator did not specify a crosswind landing limit for newly qualified pilots.

A section of the OM Part B relating to flight director and autopilot selection procedures states, '*When selecting a mode or autopilot on the selected mode shall be crosschecked on PFD by both pilots.*' Thus both pilots are to check their PFD when a flight guidance mode is selected or when the autopilot is engaged, but autopilot disengagement is not mentioned.

The Part A to the OM lists the commander's responsibilities, one of which is to ensure the immediate deactivation of flight recorders in the event of an incident or accident that is subject to mandatory reporting. However, the Part A contained no guidance to crews regarding the reporting of accidents, serious incidents or the mandatory occurrence reporting scheme. This information had previously been in the Part A but had been moved to the operator's Management System Manual. No specific guidance was offered in the OM on how the FDR or CVR should be deactivated.

Go-arounds

The OM lists several items '*which may be considered*' for inclusion in an approach briefing and one of these is '*Review the go-around procedure'.* The Standard Operating Procedure (SOP) for the go-around procedure is:

'If the PF, PNF, ATC or the EGPWS calls for a go-around the PF will call "go-around". He/she shall then simultaneously:

- *Press either or both go-around buttons on the power levers*
- *Advance the power levers close to the rated torque setting*
- *Rotate the aircraft to maintain speed VAT +10*

When pressing the go-around button(s) the autopilot will disengage and flight director mode GA will engage, demanding 6° nose up attitude and the heading at go-around selection. As soon as practicable, HDG and PSA shall be inserted and confirmed. When the correct speed (VAT +10) is achieved, it is recommended to engage IAS mode.

The PF shall, after having set the approximate power, call "set power – flaps 15" (flap 20 landing).The PNF shall set power and call "power set" retract the flaps to 15 degrees and make the appropriate call outs. As soon as positive rate of climb is achieved, the PNF shall call "positive rate" and gear up selection shall be made.

…Upon reaching 400 feet AAL, and providing that speed is above V2 flap 7°, retract the flaps to 7°.Continue as a normal take off in regards to acceleration, configuration and speed…'

EGPWS

The OM includes instruction for pilots to adjust the aircraft's flight path positively and immediately in response to all EGPWS alerts and warnings. The commander is permitted to modify the response only in day, VMC conditions when it is immediately obvious the terrain does not pose a danger. All alerts and warnings are to be reported to the operator.

The operator was aware of nuisance alerts and warnings being generated by the ATP on approach to certain airports, including Jersey and Guernsey. Trials by the operator, in collaboration with the aircraft manufacturer, indicated that on Runway 26 at Jersey there was a tendency for a nuisance 'TERRAIN' alert to be generated if the aircraft deviated very slightly below the glideslope at a certain position on approach. An email was sent to pilots in July 2015 which asked them to have the autopilot engaged during ILS approaches at Guernsey and Jersey. This procedure was not incorporated in the OM, because it was only intended as a short-term trial to assist in identifying spurious alerts, but the duration of the trial was not specified. The OM Part C stated an EGPWS '*callout*' was possible on approach to the eastern runway at Jersey but made no mention of the Runway 26 approach. The commander stated he regarded nuisance 'TERRAIN' alerts as being normal at Guernsey and Jersey and that the operator was aware.

Crew comments

The commander considered that, by the time he appreciated the difficulty the co-pilot was having trying to disengage the autopilot, it was not appropriate for him to take control and check if the aircraft could be flown normally from the left seat. His reasoning was that the aircraft was close to the ground and there was a strong crosswind, so it was more appropriate to go around and then re-assess the control problem.

During discussions after the event, neither pilot thought they had been trying to move the elevator in opposing directions when the control split occurred. The PF's recollection was the STANDBY CONTROLS caution illuminated at approximately 600 ft amsl.

Both pilots reported they had been distracted from following the standard go-around procedure and the gear was raised later than normal. They were unsure exactly when the gear was raised because their focus had been on achieving a safe flight path. The PF was sure he made no pitch trim inputs during the initial part of the go-around and neither pilot recalled trying to change the autopilot status while the aircraft was climbing.

BEA go-around study

Un-anticipated go-arounds with all engines operating have previously led to numerous serious incidents and accidents. In August 2013 the French Bureau d'Enquetes et d'Analyses (BEA) published a '*Study on Aeroplane State Awareness during Go Around*' ie a study of situations in which there was a loss of control of the flight path at some stage during a go-around. It concluded that such events could be due to one or more of a list of factors, including:

> ' • *Time pressure and a high workload.*
> • *The inadequate monitoring of primary flight parameters during go-arounds, especially with a startle effect*[10]*.*
> • *The difficulty in applying Crew Resource Management (CRM) principles in a startle effect situation.*
> • *Inadequate monitoring by the PNF.*
> • *The low number of go-arounds with all engines operating performed by crews, both in flight and in the simulator.*
> • *Inadequate fidelity on flight simulators.*
> • *The non-detection of the position of nose-up trim by the crew during go-arounds.*
> • *Aircrew learning teamwork on unrepresentative aeroplanes before a first CS 25 TR*[11]*.*

Footnote

[10] The sudden onset of critical events can create a '*startle*' or '*surprise*' effect which can cause cognitive impairment for up to 30 seconds.

[11] 'first CS 25 TR' refers to a pilot's first type rating on a Certification Standard 25 aeroplane ie a large aeroplane on which all or most of the go-around training required is achieved in a simulator.

- *Somatogravic illusions[12] related to excessive thrust on aeroplanes. The lack of evaluation of visual scan during the go-around.*
- *The channelized attention of a crew member.*
- *The difficulty of reading and understanding Flight Mode Annunciator (FMA) modes.*
- *Excessive time spent by the PNF on manipulating the Flight Control Unit/ Main Control Panel.'*

Human factors

Pre-flight rest

The co-pilot was off duty on 23 January 2016 (3 days before the incident) while the commander operated a night flight on 22/23 January which ended at 0415 hrs on 23 January. Both pilots were off duty on 24 January with rest days on 25 January. They reported for duty at Coventry Airport, their crew base, at 0230 hrs on 26 January before positioning by ground transport to Luton Airport. At 0525 hrs they departed Luton in G-BUUR for a cargo flight and arrived at Guernsey at 0640 hrs, where they remained for 30 minutes before leaving for Jersey. They landed at 0730 hrs and went to a hotel where they were rostered to commence their rest period at 0750 hrs. However, there were no rooms available and they had to transfer to an alternative hotel. They did not arrive at the second hotel until 0900 hrs or perhaps later; the pilots' recollections of the timing differed. The operator was not informed of the delayed start to the rest period.

At 1845 hrs, after spending a maximum of 9 hours 15 minutes at the hotel, the pilots reported for duty at Jersey Airport. The operator's flight time limitation scheme specified that the crew required a minimum rest period of 11 hours and that the hotel room allocated to each crew member had to be available for occupation for a minimum of 10 hours.

The co-pilot stated he achieved over six hours sleep but the commander estimated that he only slept for four or five hours due to noise. However, neither of the pilots believed they were fatigued or tired at the start of the duty.

Commander's experience

The commander had logged 1,300 hours as an ATP co-pilot and had considerable experience instructing in light aircraft when he began his command training in March 2015. Following the simulator element of this training course, it was stated that he had been overly reliant on his PNF in pressurised situations.

Since completion of command training, the commander had logged a further 207 hours on-type and had carried out recurrent training in the simulator in September 2015. The

Footnote

12 When an aircraft accelerates during a go-around, hairs in the utricle of the vestibular system bend backwards, creating the same sensation as when the head tilts back. The acceleration force is therefore perceived by the brain as a strong pitch-up sensation and is known as a somatogravic illusion.

simulator instructor's report indicated the commander demonstrated good Crew Resource Management (CRM) skills during this training detail.

Co-pilot's experience

The co-pilot had 380 hours flying experience before this flight, including 74 hours on the ATP. This was his first commercial aircraft type and the first type he had flown using Electronic Flight Instrument System (EFIS) screens. He could not recall having been taught to check for autopilot disengagement on the PFD during his training, which was completed the previous month. The operator's records state he progressed well through training and demonstrated good qualities as PF and as PNF. He was complimented for his ability to think ahead and also for his crosswind landing technique.

CRM

The operator provided CRM training to its pilots in accordance with EASA specifications. The commander completed an approved course of CRM training during his command course, 9 months prior to the flight, and further CRM training and a skills assessment as part of his recurrent simulator training in September 2015. The co-pilot received CRM training during his initial type conversion in the latter part of 2015.

CRM involves non-technical skills, such as communication, problem solving, decision making and workload management. When unusual circumstances are encountered, effective CRM training should ensure the crew, particularly the PF and PNF (monitoring pilot), share information efficiently and succinctly and co-ordinate their actions.

This operator advocates the mnemonic '*DODAR*' as a template for pilots to use when managing stressful events. The first '*D*' is for Diagnosis; the use of all available senses and resources to understand the symptoms of a problem. The '*O*' is for Options; consider if more than one option is available, what the consequence of each is and what time is available. The second '*D*' is for Decision, this being mutually agreed after considering the options and risks. The '*A*' is for Allocate; with crew members allocated tasks based on the decision made and other agencies, such as ATC, informed of any assistance required. Finally the '*R*' is for Review; has the event changed, does the diagnosis require updating? The aim is to re-evaluate the situation continuously and manage the time available efficiently.

Sensory awareness

Visual inputs tend to take precedence over aural inputs when the brain is working at high capacity leading to inattentional deafness. Consequently a person may hear a sound but the aural input does not register and the person is unaware of it[13]. Most aircraft alerts

Footnote

[13] Evidence of inattentional deafness by pilots in a high workload environment is offered by Dehais, Frédéric and Causse, Mickael and Vachon, François and Regis, Nicolas and Menant, Eric and Tremblay, Sébastien in their paper '*Failure to Detect Critical Auditory Alerts in the Cockpit: Evidence for Inattentional Deafness',* published 2014 in The Journal of the Human Factors and Ergonomics Society, vol. 56 (n° 4). pp. 631-644. ISSN 0018-7208. The paper can be accessed via the following link: http://oatao.univ-toulouse.fr/11613/1/Dehais_11613.pdf

and warnings are presented aurally and visually but sole reliance on an aural input as confirmation of an action or change of status may cause it to be missed during periods of high workload.

Subsequent research

Three weeks after the incident the co-pilot practised go-around manoeuvres in the ATP training simulator with the operator's fleet manager. The simulator was configured for landing with the autopilot engaged and the co-pilot attempted to move the control column. He experienced feedback forces which he likened to those he felt on G-BUUR before the go-around. He then initiated several go-arounds by pulling back on the control column to overcome the autopilot, without pressing the go-around button, which would have disengaged the autopilot. He needed to use both hands on the control column to pitch the nose up and the STANDBY CONTROLS caution on the CWP and the elevator SPLIT indicator on the overhead panel illuminated before the aircraft began to climb.

After rotation the co-pilot sometimes had to overcome a pitch-up tendency by pushing forwards. On some occasions the pitch-up force exerted by the simulator seemed as strong as that experienced in G-BUUR and the assistance of the other pilot was required to resist this force. While overcoming the autopilot, the green AP2 annunciator remained lit on the co-pilot's PFD until the autopilot was deliberately disengaged during the climb. When the autopilot was disengaged, the SCS ENGAGED indicator on the overhead panel illuminated (as well as the SPLIT indication).

The crew tried to follow the standard go-around procedure in each practice, using HDG and PSA modes before the IAS vertical mode was engaged, after selecting FLAP 15. A video recording of one go-around showed the engaged vertical mode change to IAS, when the IAS switch was pressed, and a nose-up attitude of 13-15º was evident while the airspeed was maintained at VAT+10.

In these simulator trials, because the autopilot was kept engaged, it subsequently had to be disengaged but on the incident flight the pilots reported that they did not have to disengage the autopilot before re-engaging it. It therefore should be noted that the simulator trials by the operator differ from the incident flight. The co-pilot reported during the simulator trials that he had to overcome differing amounts of pitch-up after power was set. This could be a consequence of engaging the IAS mode while the autopilot was being over-powered. If IAS mode was engaged while accelerating, the autopilot would make a pitch-up input to try to maintain the speed at mode engagement. However, if the IAS mode was engaged at a stable speed (eg VAT+10) the autopilot would not input such a pitch-up demand.

Go-around handling

It is SOP for go-arounds in the ATP to be flown with the autopilot disengaged. The operator's fleet manager stated the aircraft does not tend to pitch nose-up during go-arounds, either with a single engine or with both engines operating. A nose-up attitude of 10º or greater is needed to achieve a stable airspeed during a two-engine go-around, even for an aircraft at maximum mass.

The manufacturer concurred with these observations but noted that application of power can create some pitch-up tendency. During certification testing this equated to a control column force of less than 40 lb in the most extreme case.

Other relevant ATP incidents

27 May 1991. The commander of an ATP, G-BTPJ, stated that in the early stages of an approach the autopilot failed to disengage using any of the usual means. The crew eventually disengaged the system by pulling the autopilot circuit breaker. A fault was later found on the co-pilot's electric trim switch and there is no record of the problem recurring. No recorded flight data remains available.

Reporting of serious incidents

The UK Civil Aviation (Investigation of Air Accidents and Incidents) Regulations 1996 state that when an accident or serious incident occurs in the UK, or to a UK registered aircraft, the commander is responsible for informing the AAIB. If the commander is killed or incapacitated the operator becomes responsible for notification, although operators sometimes assume such responsibility once they are advised of a relevant accident or serious incident.

A serious incident is defined by the Regulations as '*involving circumstances indicating that an accident nearly occurred.*' Greater clarity is added by EU Commission Regulation No 996/2010 which provides a list of examples of serious incidents and this includes '*occurrences which could have caused difficulties controlling the aircraft'.*

EU Commission Regulation No 965/2012 (Air Operations Regulations section CAT.GEN.MPA.105 'Responsibilities of the commander' section 10) states that the commander shall:

> *(10) ensure that flight recorders:*
>
> *(i) are not disabled or switched off during flight; and*
>
> *(ii) in the event of an accident or an incident that is subject to mandatory reporting:*
>
> *(A) are not intentionally erased;*
>
> *(B) are deactivated immediately after the flight is completed; and*
>
> *(C) are reactivated only with the agreement of the investigating authority;*

Analysis

Extensive examination and functional testing of the aircraft systems and components identified no technical failure that could be associated to the reported events during the incident flight. The available data indicated the autopilot disengaged on command during the approach. However, the crew report that the autopilot remained engaged. The lack of a cockpit voice recording of the event has meant it was not possible to verify if the autopilot disengagement alert sounded.

Prior to go-around

The approach to Guernsey was at night in a strong crosswind, with turbulence and possible windshear reported. This would have made the approach and landing potentially challenging and would have increased the cognitive workload, especially for a newly trained pilot. However, the reported wind was within the applicable limits, the co-pilot was confident of his own ability and had coped well with similar conditions during training.

In view of the conditions and his own experience level, the co-pilot decided to disengage the autopilot approaching decision altitude. He could see the runway when he pressed the disengagement switch, so was likely to be using both external and internal cues during the latter part of the approach. The flight data shows airspeed changes and power adjustments being made just above decision altitude. It is likely the speed changed due to the windy conditions and the co-pilot responded by making power changes. This suggests his workload was high when he pressed the switch to disengage the autopilot.

His primary indication of autopilot disengagement would be an audible alert, but he did not hear this and so believed the autopilot was still engaged. It is possible the alert did sound but was not registered by either crew member because of the high workload. Neither pilot looked to the PFD for confirmation of autopilot status. The operator, in its OM and during training, does not prescribe referring to the PFD to verify the autopilot has disengaged. The co-pilot pressed the disengage switch again, before trying to move the controls and felt resistance, as if the autopilot was still engaged.

The flight data indicates the autopilot disengaged at 220 ft aal, at about the point at which the co-pilot reports first pressing the autopilot disengagement switch. With the autopilot disengaged the co-pilot should not have experienced unusual resistance when he tried to move the control column. It cannot be entirely excluded that there was some intermittent fault within the autopilot system that resulted in the pilot experiencing resistance to his inputs, but subsequent tests have not revealed any defect with the system or with the flight controls.

The commander did not recall hearing the autopilot disengagement alert. The aircraft was below decision altitude before he realised the co-pilot was having difficulty disengaging the autopilot. When the commander attempted to disengage the autopilot, from his control column, he did not take control to check if the aircraft could be flown normally from his position. He later stated that, with the aircraft close to the ground and a strong crosswind, it was more appropriate to go around and then re-assess the control problem.

The target approach speed was 118 kt but below decision altitude it decayed steadily in response to a power reduction, while the pitch attitude increased from approximately -5º to +2º. The pilots recalled the aircraft deviating above the glidepath and the co-pilot thought he tried to lower the nose in response. The flight data indicates the airspeed decayed to 102 kt prior to initiation of the go-around. The pilots were not aware of the speed reduction at this stage, possibly because they were both looking out and distracted by the autopilot issue.

Go-around initiation

The aircraft was close to the runway when the commander called for the go-around. Approximately 25 seconds had elapsed since the initial attempt to disengage the autopilot. The co-pilot stated he pressed the go-around button, which is a further means of disengaging the autopilot, but still no disengagement alert was heard[14] and apparently the flight director bars did not command a pitch-up as they should have done. The commander did not recall looking at the flight director bars or at the auto-flight modes and these indications are not recorded. The go-around button later functioned normally so there is no verification of a malfunction. It is possible the flight director bars did move but the aircraft's proximity to the ground and the confusing situation distracted the pilots from absorbing all the data presented on their PFDs.

The co-pilot was able to initiate the pitch-up using one hand, although he considered the controls to be stiffer than he would have expected if the autopilot was disengaged. The pilots later remembered a large decelerating speed trend and this may have been displayed on the PFD as the aircraft started to pitch up before it responded to the power increase. The data shows the power was increased quickly and the pitch attitude increased to a little less than 5º by the time power was set. This is close to the 6º the flight director should have commanded and yet the commander had the impression of a pitch attitude of 15-20º. This might have been a somatogravic illusion as the aircraft was accelerating quickly and the effect may have been particularly alarming because of the observed low speed indications. In view of this and because the co-pilot was apparently struggling, the commander pushed on the control column.

A nose-up attitude of 15º can be normal during a two-engine operating go-around. This is substantially greater than that required for a single engine go-around, which is the manoeuvre the crew were more familiar practising in the simulator.

The co-pilot's recollection was that once power was set he had to overcome a strong pitch-up force. The ATP does not normally exhibit a strong pitch-up tendency during go-arounds (see *Go-around handling*) and the CG was within the normal range. The force experienced might be partly attributable to the dynamic changes to engine power, pitch attitude and airspeed which occurred while the pitch trim remained stationary. Alternatively it may be the strong force was felt after the pitch trim moved nose-up (see *Recorded information*). The co-pilot does not recall making such a selection but it is possible he inadvertently pressed the electric pitch trim switch and then had to push forward to overcome the resulting pitch-up force.

The nose-up pitch trim input would have increased control column loading so, when the co-pilot pushed forwards on the right column, he may have had to exert more than 100 lb force, causing the detent mechanism to operate and the elevators to split. It is also possible the pilots applied opposing forces to their control columns for a short time and this caused the columns to separate and the elevators to split. This does not conform to the pilots'

Footnote

[14] The disengagement alert should only have sounded at this point if the autopilot had not disengaged earlier and then responded normally when the go-around button was pressed.

recollections but they were experiencing a high workload and a potentially disorientating situation. The BEA study underlines the difficulties associated with monitoring an unexpected go-around due to startle effect and particularly the challenges faced by the monitoring pilot, who is trying to manipulate gear, engine controls and flap controls while monitoring the instruments and PF's actions. These difficulties were compounded during this event by the suspected flight control problem.

Another possibility that may have led to the elevator split mechanism initiating would be if the co-pilot was having to oppose an input from some part of the autopilot system. The flight data does record brief, unexplained, engagement and disengagement of each autopilot channel in turn during the climb. However, subsequent examination of the aircraft has not revealed any technical defects that would have caused the autopilot to oppose the crew's inputs.

Approximately 40 seconds after levelling at 2,000 ft amsl, AP2 was re-engaged, without any discussion of the potential complications this might cause. There was no acknowledgement that it must have disengaged during the go-around or that it might not disengage again. After a further 25 seconds the last stage of flaps were retracted.

Response to abnormal situation

The go-around was successful but did not follow standard practice. The likely reason for this was the distracting effect of the control problems encountered but the lack of a detailed go-around brief may have contributed to the actions taken. The BEA study was initiated as a result of problems encountered during all-engine operating go-arounds and this event highlights some of the factors mentioned in the BEA conclusion. Crews should prepare as well as they can to cope with such factors and pre-briefing of individual actions during a go-around is one preparation which can aid this process.

The DODAR philosophy does not appear to have been followed after the go-around. This may have assisted the crew with their diagnosis and further options before re-engaging the autopilot. They did complete the QRH drill and agreed on the decision to divert but continued to use the autopilot, although they then disconnected it at an early stage of the approach to Jersey. When stress levels are high, there is a natural desire to make things as normal as possible as quickly as possible and in this case the outcome was successful. However, the potential threats from re-introducing a faulty system were not considered before AP2 was re-engaged.

Fatigue

The operator's flight time limitation scheme specified that the crew required a minimum rest period of 11 hours and that the hotel room allocated to each crew member had to be available for occupation for a minimum of 10 hours. Owing to problems with the hotel rooms they only spent a maximum of 9 hours 15 minutes at the hotel. Neither crew member thought they were fatigued either before or during the flight, but fatigue can be a contributory factor that might lead to individual underperformance.

In this case the rest period was shorter than required by the operator and the commander's rest was disturbed by daytime noises in the hotel.

Terrain alert

The crew were aware the EGPWS on the ATP sometimes generated nuisance 'TERRAIN' alerts, especially at Guernsey and Jersey and decided to continue this night approach as they were visual with the runway, stable and confident they had good terrain separation. The operator requires crews to make immediate, positive manoeuvres in response to any EGPWS alerts or warnings at night but also promulgates certain places where nuisance alerts may be expected. The possibility of nuisance 'TERRAIN' alerts being triggered on final approach to Runway 26 at Jersey was known about but was not mentioned in the OM. Alerting and warning systems can be ineffective when false alarms become the norm.

Serious incident response

Operators are required to provide sufficient training and guidance to ensure serious incidents are correctly recognised and reported by their staff and the correct actions taken to notify and preserve evidence. If it is suspected that the occurrence is a serious incident then the recorders should be isolated and engineering work delayed until the AAIB has been notified. In this serious incident the CVR was overwritten and critical evidence concerning the flight was lost, despite an instruction in the OM Part A for flight recorders to be de-activated following any reportable incident. Engineering work prevented the AAIB from being able to analyse the systems in the state they were in at the end of the flight.

Inclusion of the list of examples of serious incidents from EU 996/2010 in an OM can help employees understand what may constitute a serious incident. This operator had moved guidance concerning accidents and incidents from its OM Part A to the Management Safety Manual, and this might be one reason there was a delay reporting the event.

Safety actions

This serious incident occurred when the operator was in the process of transferring all ATP aircraft and crews to a related company, with an air operator's certificate from another European country. Several Safety Actions were taken by the operator;

- An internal review was carried out and the pilots received further training.
- Changes were made to ATP procedures before the fleet transfer was completed. This included a requirement to check autopilot disengagement switches before each flight.
- The entry for Jersey in the OM Part C was amended to include note of the potential for spurious EGPWS alerts in certain circumstances.
- The procedures required after accidents or incidents are now detailed in the OM Part A.
- Pilots and engineers have been given guidance on deactivation of flight recorders and CVRs.
- Changes were made to pilot training procedures and certain wind limitations for newly qualified pilots have been reduced.

Conclusion

Extensive examination and functional testing of the aircraft systems and components identified no failures that were associated with the reported occurrence. The available data indicated the autopilot disengaged on command although the pilots believed otherwise. As the operator had not isolated the recorders following the incident, a cockpit voice recording of the event was not available. It was therefore not possible to ascertain if the autopilot disengagement alert sounded at the moment the FDR recorded autopilot disengagement during the approach.

During the resultant go-around, the co-pilot recalled having to overcome a strong pitch-up force after power was set, which he then struggled to overcome. The data indicated the aircraft was trimmed nose-up after power was set, so this may have been the cause of the pitch-up force and the co-pilot's opposition to this force may have led to the elevator control split. It is also possible the pilots briefly made opposing inputs on the control column and this caused the elevator split and activation of the SCS.

However, it was not possible to exclude the possibility that there was an intermittent fault within the autopilot system that then caused the system to oppose the co-pilot's inputs and lead to the control split. The recorded data shows two brief recordings of autopilot engagement during the event which the investigation could not explain.

Once the elevators had split the pilots completed the go-around but deviated from SOPs while struggling with a stressful and disorientating situation. They re-engaged the autopilot without discussing any potential threats from this action and they did not use CRM principles designed to help deal with problem solving and decision making. The operator has since reviewed and updated its training of crews as a result of the findings from this incident.

ACCIDENT

Aircraft Type and Registration:	Piper PA-34-220T Seneca V, OK-OKD	
No & Type of Engines:	2 Continental Motors TSIO-360 piston engines	
Year of Manufacture:	2001	
Date & Time (UTC):	17 August 2015 at 1832 hrs	
Location:	Newquay Airport, Cornwall	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - 1 (Fatal)	Passengers - N/A
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	68 years	
Commander's Flying Experience:	1,300+ hours (estimated, of which 16+ were on type) Last 90 days - 16+ hours Last 28 days - 16+ hours	
Information Source:	AAIB Field Investigation	

Synopsis

The pilot was landing at Newquay Airport at the end of a three-sector flight from Pribram Airport, near Prague, Czech Republic. The aircraft bounced on landing and a go-around was initiated. At some stage during the touchdown, the right engine propeller blades contacted the runway. After lifting off, the aircraft started a low level climbing turn to the right, which continued towards a downwind heading. The aircraft was then seen to yaw to the right and enter a steep descent, before impacting the ground.

History of the flight

Background

The pilot arranged to purchase the aircraft from a company based at Pribram Airport (LPKM), near Prague, Czech Republic. The purchase arrangements included familiarisation training on the aircraft, if required, and the option of a safety pilot for the flight to the United Kingdom (UK).

The pilot travelled to the Czech Republic on 11 August 2015 and started flying OK-OKD, with an instructor, on 12 August 2015. He had planned to return to the UK on Friday 14 August but there was a delay in the completion of the necessary documentation for the transfer of the aircraft ownership and the instructor also considered that the familiarisation training was not complete.

Between 12 and 16 August, the pilot completed ten hours of familiarisation training, including three hours in the local circuit and several landings at other airfields. During the course of instruction, the sequence of actions trained for a two-engine go-around was: set full power, speed 90 kt, initiate climb, retract the flap to 25°, then, when a positive climb had been achieved, select the landing gear UP, select flap to 10°, then flap 0° and set climb power.

Additional familiarisation training was available but the pilot was keen to return to the UK as soon as possible. Consequently, it was arranged that the aircraft would depart Pribram on 17 August, with the intention of flying to Biggin Hill Airport (EGKB), in the UK. The pilot and the instructor then planned to stay the night in London, before flying on to Newquay Airport, Cornwall (the pilot's home airfield), the next day.

Flight to the UK

The pilot and his instructor departed Pribram Airport at 0755 hrs on 17 August 2015, initially flying to Prague Airport (LPKR). The aircraft arrived there at 0840 hrs and was refuelled. Customs clearance was obtained and it departed for Biggin Hill Airport at 0950 hrs. The weather conditions were not suitable for VFR flight, so both sectors were flown IFR. As the aircraft neared the UK, the weather conditions improved and a straight-in ILS approach was carried out to Runway 21, at Biggin Hill. The aircraft landed at 1329 hrs.

After landing the pilot and instructor discussed the serviceability of the autopilot. For about the last 30 minutes of the flight from Prague, the autopilot's heading mode had not maintained the selected heading, although the navigation mode had worked normally. The instructor suggested that the problem might be fixed by removing all power from the autopilot and then restoring it.

The instructor offered to accompany the pilot for the rest of the flight to Newquay, either that same afternoon or on the following day. However, the pilot declined the offer and indicated that he would plan to stay overnight in London and continue the next day, either with a local UK based instructor or on his own. The instructor recommended to the pilot that he should fly with a safety pilot for a number of hours until he had become more familiar with the aircraft. The instructor returned to the Czech Republic that evening.

After the instructor departed, the pilot entered the Airport terminal area to buy a cup of coffee and obtain assistance printing out a flight plan from his tablet computer. The assistant at the reception desk stated that the pilot mentioned he was very tired and asked for help with the coffee machine.

The pilot also arranged for the aircraft to be refuelled, uplifting 322 litres (85 USG) of Avgas 100LL.

Flight to Newquay

The aircraft departed for Newquay at 1634 hrs. It flew south-east towards the coast and then turned west. A plot of the nine waypoints on the planned route, together with the aircraft's recorded track, are shown in Figure 1.

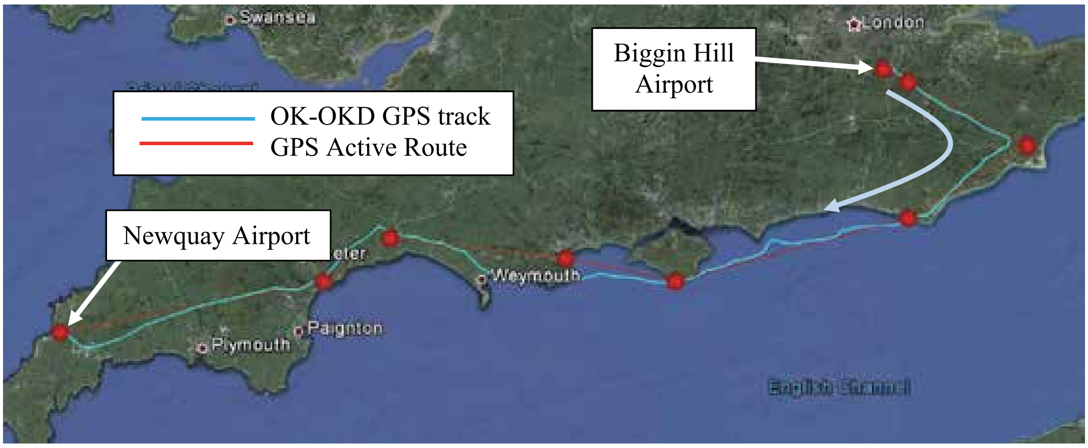

Figure 1

OK-OKD recorded GPS track

At 1815 hrs, the pilot contacted Newquay ATC (Approach). He was issued with a transponder code and advised that the aerodrome QNH was 1018 hPa. He confirmed that he had received ATIS information Y (Runway 30 in use) and requested a visual approach, commenting "ITS BEEN A LONG DAY". The next contact was at 1826 hrs, as the aircraft was tracking west, when ATC enquired whether the pilot had the airfield in sight. He replied "NOT JUST AT THE MOMENT – ER THE SUNS RIGHT IN MY EYES". ATC advised the pilot he was approaching the runway extended centreline at about 8 nm and suggested a turn to the right. He was advised that the runway lights were on. Two minutes later, the pilot confirmed that he had the lights in sight and he was instructed to transfer to the ATC Tower frequency. Having established contact with the ATC Tower Controller, he was issued with a clearance to land and advised that the surface wind was from 350° at 7 kt.

From his vantage point in the ATC Tower Visual Control Room (VCR), the Controller watched the aircraft land. He later stated that it touched down just after the runway touchdown zone and bounced. He then saw the left wing lift and the aircraft turn towards the right side of the runway. Thinking that it was going to run off the runway onto the grass, he activated the crash alarm. The aircraft then become airborne again and he heard the pilot transmit "GOING ROUND" in a calm voice.

The aircraft tracked towards the ATC Tower in a climbing turn to the right. The controller estimated that it had climbed to a height of about 150 ft, and was still turning to the right, when he saw a distinct yaw to the right, the nose drop to a near vertical attitude and the aircraft descend rapidly. It then disappeared out of sight behind a building.

As the crash alarm had already been activated, the Controller made contact with the airfield RFFS and directed them towards the aircraft. He advised them that there was one person on board but subsequently revised this to an unknown number of persons on board. He then telephoned Biggin Hill ATC to confirm how many occupants were in the aircraft. Being a private, domestic flight, there was no requirement for the pilot to notify ATC of the number of persons on board.

The RFFS arrived at the scene quickly and extinguished a small fire. They determined that the pilot had not survived the impact and checked the cabin to confirm that he was alone.

Witness information

A witness located south of the runway reported that his attention was drawn to the aircraft by an unusual noise, as it went around. He described a "loud clattering", somewhat similar to an "unsilenced exhaust" on a car. He saw the aircraft flying towards the ATC Tower, while turning right. As the turn continued, the angle of bank increased until the left wing was almost vertical. Then he saw the nose dropping and realised the aircraft would crash. Subsequently, he saw smoke rising from the accident site and drifting to the right (south-east).

A witness in a vehicle, also on the south side of the runway, saw the aircraft make a couple of small "hops" on landing and then described seeing a "huge leap" and the aircraft bounce from one wheel to another. He heard the engine noise increase and saw the aircraft climb away from the ground in a turn to the right. He watched as the aircraft entered a steeply banked turn to the right and described seeing the nose turn towards the ground, before the aircraft entered a steep descent.

Meteorological information

The weather conditions for the flight from Biggin Hill to Newquay were suitable for VFR flight and the Newquay ATIS information, issued at 1820 hrs, reported: surface wind from 360° at 6 kt, visibility greater than 10 km, few clouds at 4,000 ft, temperature 16°C, QNH 1018 hPa, Runway 30 active. The weather forecasts for southern England for the next day were good and would also have been suitable for VFR flight.

Sunset at Newquay Airport was in the west-north-west at 2038 hrs. At the time the pilot made his approach, the sun was low in the sky and about 15° to the left of the runway heading.

Pilot information

The pilot's first licence was a PPL(H), issued in 1991. Then, in 1996, he gained a PPL(A). An IMC (now IR Restricted) rating was added in 1997 and a Multi-engine Piston (MEP) rating in 1998. He renewed his Single-engine Piston (SEP) rating on 14 September 2013 and his IRR(A) rating on 12 December 2014. His MEP rating was renewed on 10 July 2015 and was valid until 31 July 2016.

The pilot had previously owned several other aircraft. In 2001, he took part in the London to Sydney Air Race, flying in his own Piper PA-23 Aztec. In October 2009, he purchased a Piper PA-32R Saratoga, a single-engine aircraft. It appears that he flew this regularly until it was sold in June 2015, although no log book records were found which were dated later than April 2013. For this reason, an accurate assessment of his recent flying history was not possible. It was reported that the pilot was in the habit of using a checklist while flying.

When the instructor at Pribram first flew with the pilot in OK-OKD, he described his performance as “poor”. However, after a couple of hours of instruction, progress was made and the training continued. The instructor considered that, with the limited training time available, achieving consistent landings was a priority. Thus, all the landings practised were conducted using full flap. Two-engine go-arounds were included in the training, using the procedure previously described.

The pilot advised the instructor that, on return to the UK, he would continue a training and familiarisation programme with a local instructor. Although the pilot normally had a slow manner of speech, the instructor observed that he appeared to be tired much of the time.

The instructor described the pilot’s conduct of the flight from the Czech Republic and his approach and landing at Biggin Hill as good - he told the pilot it was his best landing yet. He noted that the pilot generally preferred to fly manually, rather than use the autopilot, and considered that he was sufficiently practised to be able to conduct a solo cross-country flight in good visual weather conditions.

Medical and pathological information

The pilot held a European Union Class 2 medical certificate which was renewed on 31 July 2015 and valid until 29 August 2016. A post-mortem examination was carried out and no evidence of any medical condition that could have contributed to the accident was found.

Aircraft information

Piper Seneca V

The Seneca V is a twin, piston-engine-powered, general aviation aircraft. It is approximately 9 m long, with a wingspan of approximately 12 m. The accident aircraft was manufactured in 2001 and was transferred from the US register to the Czech Republic in 2002, when it was re-registered as OK-OKD. The current Certificate of Airworthiness was issued in 2008 and the Airworthiness Review Certificate was valid until March 2016. The aircraft had accumulated approximately 993 hours since new, prior to the accident flight. It was fitted with six seats, including the pilot’s, and was well equipped for single-pilot IFR flight. The two engines had recently been fully refurbished and were rated at 220 BHP each. They were fitted with three-blade, fully feathering, constant-speed propellers. The engine controls consisted of a throttle, a propeller control lever and a mixture control lever for each engine, located on a quadrant below the central instrument panel. To carry out a baulked landing or go-around manoeuvre, the propeller and mixture controls should be advanced fully forward and the throttles adjusted for full power.

The aircraft has three selectable stages of flap, at 10°, 25° and 40°. The flap select lever is mounted on the instrument panel, immediately to the right of the centre console and throttle quadrant. In order to change the flap setting, the lever has to be pulled out of its detent and moved into the detent for the required setting.

The retractable landing gear is selected using a selector switch on the centre console. It is a wheel-shaped knob located to the left of the throttle quadrant. To operate the switch, it must be pulled out before it is moved to the UP or DOWN position.

The aircraft's fuel capacity is 128 USG (485 litres), with a useable fuel of 122 USG (462 litres).

The power off stall speed, at 1,860 kg (4,100 lbs) with 0° flap, is 66 KIAS. At 30° angle of bank, for the same weight, it increases to 71 KIAS and at 60° angle of bank it increases to 93 KIAS[1].

Procedures

The Pilot's Operating Handbook (POH) includes guidance on operating procedures. A normal takeoff in the Seneca V is performed with 0° flap and the recommended liftoff speed is 79 KIAS. It is recommended that the final approach is flown at 90 KIAS. For a flapless approach a '*higher than normal'* speed is recommended.

In the event of a baulked landing the initial target climb speed is 85 KIAS, adjusted to 83 KIAS for the best angle of climb (V_X) or 88 KIAS for the best rate of climb (V_Y), once the landing gear and flaps have been retracted. The Air Minimum Control Speed (V_{MCA}) (the lowest airspeed at which an aircraft is controllable with one engine operating at takeoff power and the flaps UP) is 66 KIAS. The one-engine-inoperative best rate of climb speed (V_{YSE}) is 88 KIAS.

The POH provides checklists for use during the different phases of flight. There was also a similar, but not identical, checklist in the aircraft. Both checklists contained an '*Approach and Landing*' checklist, a separate '*Normal Landing*' checklist and a '*Go-Around'* checklist. The selection of flaps did not feature in either of the '*Approach and Landing'* checklists but the first item on the '*Normal Landing'* checklist was, in both cases:

Flaps (Below 113 KIAS)......DOWN/FULL

The earlier versions of the Piper Seneca, variants I, II and III, contained a single, combined '*Approach and Landing*' checklist. The manufacturer provided the following explanation for the apparent anomaly of providing two 'Landing' checklists for the Seneca V:

> *'During the history of the Seneca III Piper added a short field performance landing procedure. When the short field landing procedure was added, the checklist line concerning flaps was removed from the approach and landing checklist and added to both the normal landing and short field performance landing checklist.'*

Footnote

1 Power on stall speeds are not available in the Pilot's Operating Handbook.

The manufacturer's and on-board aircraft go-around checklists were similar:

Mixtures.....................FULL RICH
Propellers ....FULL FORWARD
Throttles ....FULL POWER
Control Wheel ....BACK PRESSURE TO OBTAIN POSITIVE CLIMB ATTITUDE at 85 KIAS
Flaps ....RETRACT SLOWLY
Gear ....UP

Handling considerations for multi-engine piston (MEP) aeroplanes

FAA publication Airplane Flying Handbook[2] contains a chapter '*Transition to Multi-engine Airplanes'* which provides extensive guidance on factors associated with the operation of small multi-engine aircraft. The following paragraph concerns go-arounds:

> *'If the go-around was initiated from a low airspeed, the initial pitch up to a climb attitude must be tempered with the necessity of maintaining adequate flying speed throughout the maneuver. Examples of where this applies include go-arounds initiated from the landing roundout or recovery from a bad bounce as well as a go-around initiated due to an inadvertent approach to a stall. The first priority is always to maintain control and obtain adequate flying speed. A few moments of level or near level flight may be required as the airplane accelerates up to climb speed.'*

Accident site

Eight propeller strike marks were identified on the runway, along the centreline and approximately 609 m from the threshold for Runway 30. The marks were approximately 72 cm apart and were shallow in depth. No further ground marks were present, until the point where the aircraft made contact with the ground during the final impact sequence. This was located on an old aircraft dispersal area, adjacent to a disused taxiway and near to a new Maritime and Coastguard Agency hangar, which was under construction. Initially, the aircraft struck the surface of the hardstanding and the fuselage nose, engines and wing leading edges left clear impressions in the tarmac, on a heading of 099°M. There were also deep propeller strike marks leading to each engine impression. The aircraft came to rest approximately 20 m away from the initial impact point on a heading of 114°M, on the grass and in an inverted attitude. Debris from the aircraft was scattered around the area of the main fuselage.

Footnote

2 Airplane Flying Handbook: FAA-H-8083-3A available at http://www.faa.gov/regulations_policies/handbooks_manuals/aircraft/airplane_handbook/media/faa-h-8083-3b.pdf [accessed 14 September 2015]

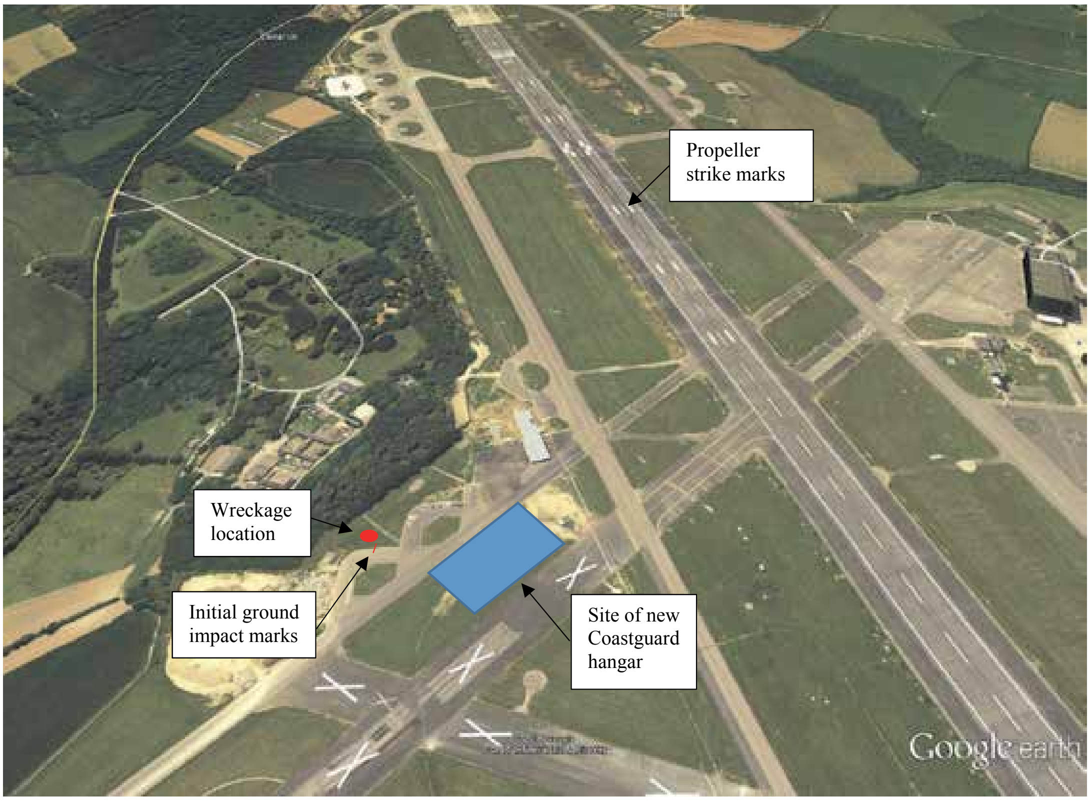

Figure 2

Accident site relative to the runway, looking back down Runway 30 from the direction of the Control Tower

Aircraft wreckage

The aircraft fuselage was significantly disrupted by the impact with the ground. The nose section was completely removed, with small pieces of the structure scattered around the debris field. The cockpit bulkhead was compressed as a result of the impact with the ground. All six propeller blades had been liberated from their hubs, which were also disrupted. The blades were distributed around the accident site but within close proximity to the main fuselage. Both engines had broken from their mounts and only remained attached by wiring and ancillary pipework. The right wingtip leading edge was damaged by the impact with the ground and the left wing tip had been destroyed by a small post-impact fire. The landing gear was down and locked, but the nose gear supporting framework had become detached. The main fuselage was compressed and bent upwards (relative to its normal attitude) at a point just aft of the rear passenger door. The vertical fin had also become partially detached at the forward attachment points. The flaps were in the stowed position, with the flap select lever in the zero flap position. Both wing fuel tanks had been disrupted and significant amounts of fuel had been released onto the grass.

Later detailed inspection of the propeller blades showed that the blades from the right engine were worn at the tips, consistent with striking the runway. This damage was distinct from the distortion caused by the main impact with the ground and was not present on the blades from the left engine. The tip damage was minor in nature and was consistent with the shallow depth of the strike marks observed on the runway surface. Inspection of the blade feathering system for the right engine, confirmed that it had not been damaged by the contact with the runway surface.

An assessment of the pre-impact continuity of the flight control system was not possible due to the extent of the impact and fire damage. However, there was no supporting evidence to suggest this was an issue.

Maintenance review

A review of the maintenance history and aircraft documents revealed no evidence of any issues with the maintenance work carried out or the serviceability of the aircraft. The instructor who accompanied the pilot on the leg from Prague to Biggin Hill reported that there had been a minor fault during that sector relating to the autopilot not maintaining the selected heading. In all other respects, the aircraft was fully serviceable.

Aerodrome information

Runway 30 has a displaced threshold, with a landing distance available of 2,444 m. High intensity approach lights, with five crossbars, are on the extended centre-line. The elevation of the airfield is 390 ft. Figure 3 shows the Newquay Airport Aerodrome Chart indicating the location of the ATC Tower.

Recorded information

Radar and GPS data

The pilot's tablet computer was recovered from the aircraft wreckage and, despite damage, was successfully downloaded at the AAIB. The pilot was using flight planning and navigation software which logged GPS position and altitude once per second. This, along with the programmed active route, was successfully recovered. In addition, OK-OKD was captured on a number of radar heads during the flight, including one at Newquay Airport. Recorded radar data was made available which consisted of recorded position and Mode C altitude to the nearest 100 ft. In this report, Mode C altitude has been corrected for a QNH of 1018 hPa, to give altitude amsl.

At 1827 hrs, the aircraft was approximately 7 nm south-east of Newquay Airport, heading in a westerly direction at 2,200 ft amsl. It then commenced a turn towards the airport and began to descend, crossing the Runway 30 threshold at 1831:03 hrs at a derived groundspeed of approximately 90 kt. The reported wind was from 350° at 7 kt, which gave a headwind component of 4.5 kt. The initial touchdown point could not be established, due to the accuracy and resolution of the GPS altitude, but the groundspeed at the lowest recorded GPS altitude, 393 ft amsl, was 76 kt. Groundspeed continued to decrease and, as it did, the heading decreased slightly from 303°M to 300°M over a period of 6 seconds. This occurred in the approximate region of the propeller strike marks on the runway.

The heading then increased and continued to do so until the end of the GPS recording (see Figures 4 and 5). At 1831:20 hrs, the aircraft reached its minimum derived groundspeed of 63 kt as the GPS altitude increased to 421 ft amsl, over the runway. The GPS recording

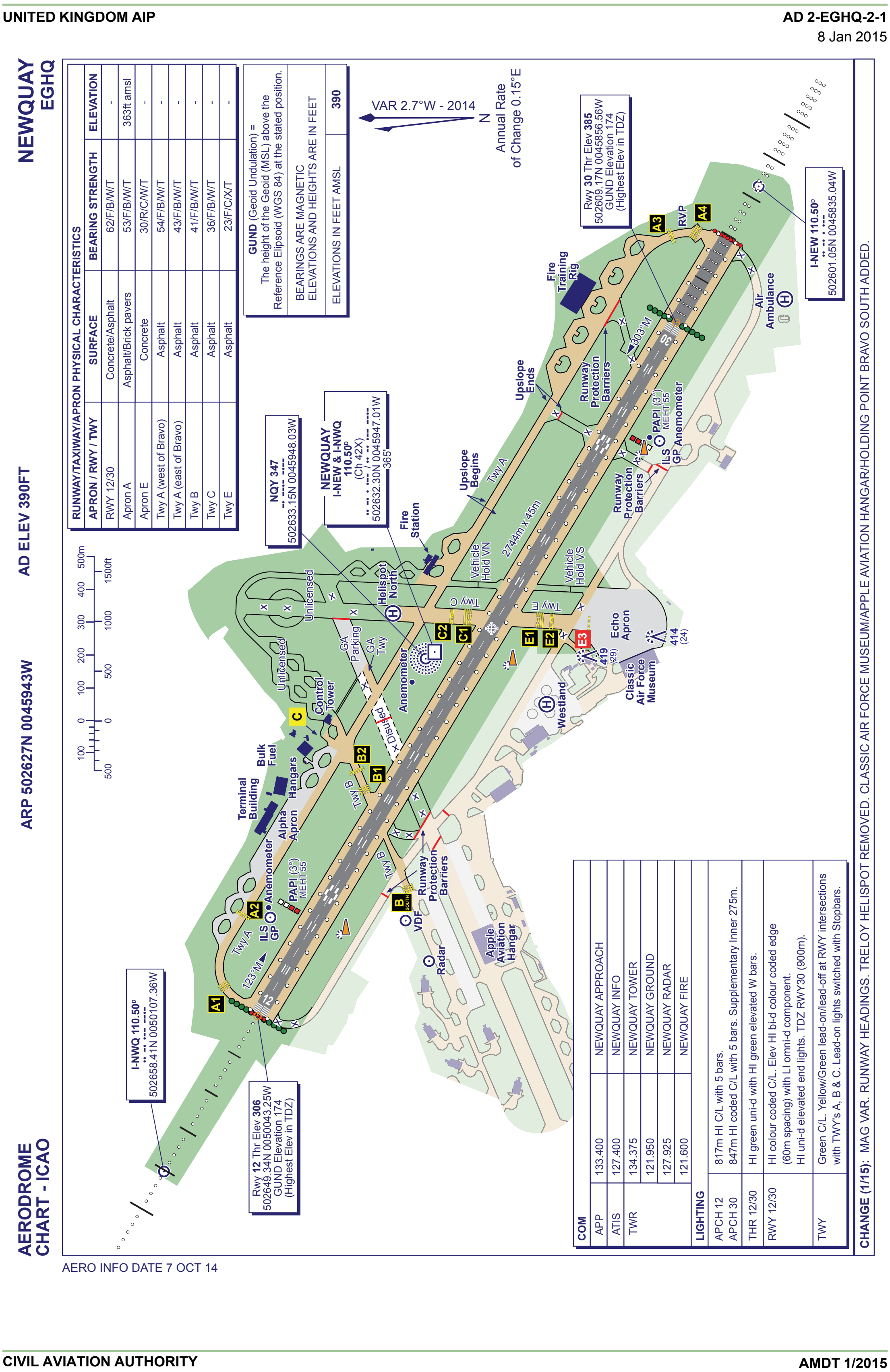

Figure 3

Newquay Airport, yellow boxed 'C' indicates position of ATC tower ceased at 1831:25 hrs but the Newquay Airport radar head continued recording Mode C altitude and position every four seconds. Due to the limitations in the accuracy of the radar position, groundspeed for the remainder of the flight could not be calculated accurately but the recordings showed a turn to the right, following the approximate route described by eyewitnesses. The corrected Mode C altitude increased from 330 ft (±50 ft) to a maximum of 530 ft amsl (±50 ft) over a period of 18 seconds.

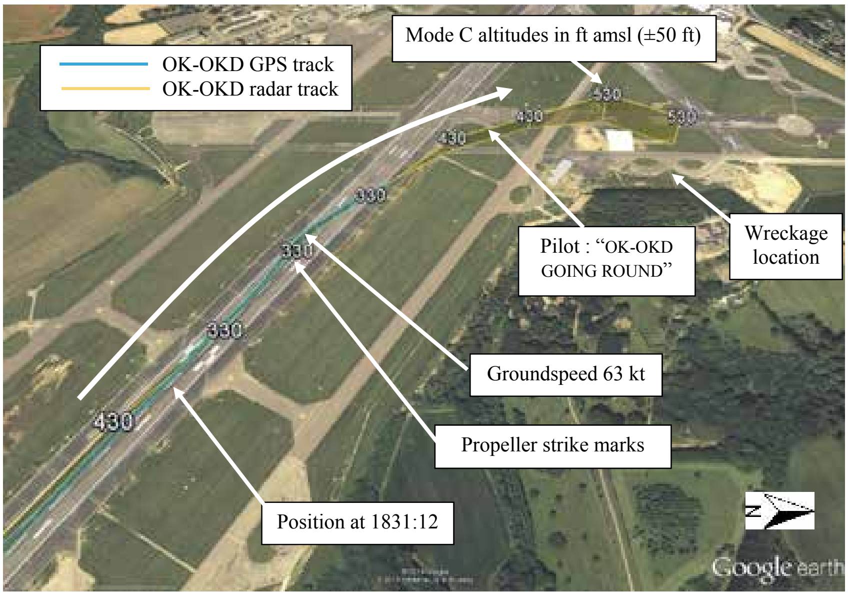

Figure 4

OK-OKD GPS and radar tracks showing corrected Mode C altitudes in ft amsl

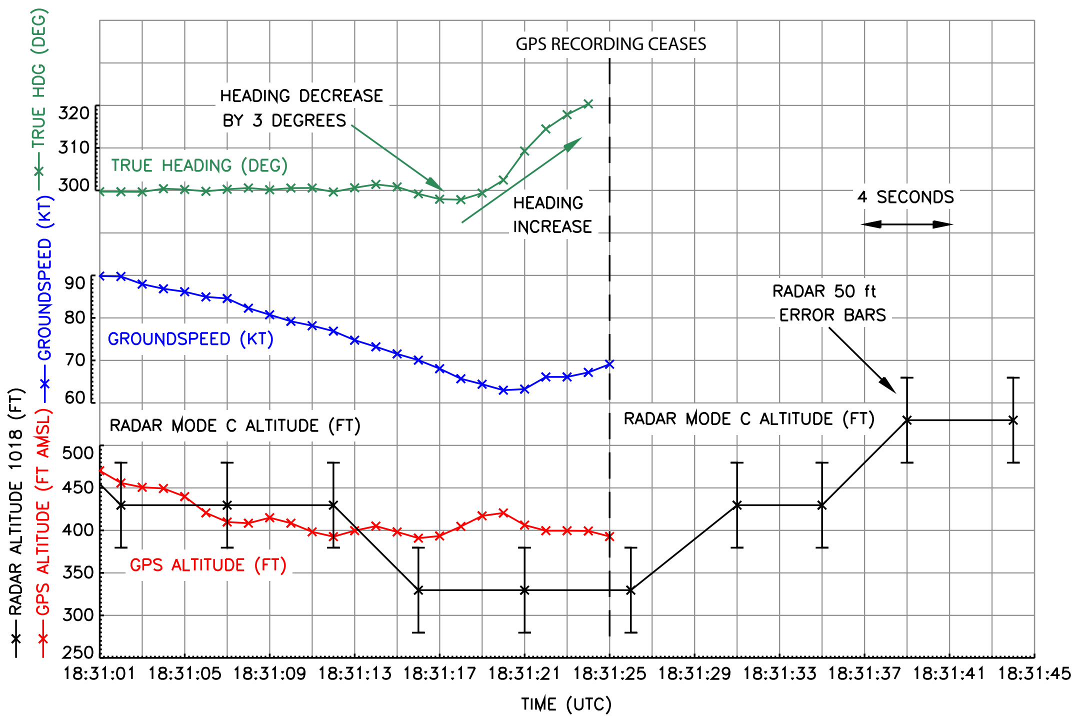

Figure 5

OK-OKD GPS and radar data

Aircraft avionics

The aircraft was fitted with a Digital Display and Monitoring Panel (DDMP) which was capable of displaying engine, fuel and electrical data on a digital display. It also recorded up to 200 engine exceedences in its memory, including overspeed and high oil temperature and pressure. This unit was recovered from the aircraft wreckage and downloaded. There were no engine exceedences recorded from the day of the accident.

Analysis

Engineering

No issues were identified with the aircraft maintenance and no evidence of a contributory fault was found on the aircraft.

Using the recorded GPS groundspeed at the point on the runway where the propeller strike took place and the distance between the strike marks, the contact was calculated to have lasted for approximately 0.14 seconds and occurred when the engine was at idle rpm. This, combined with the superficial nature of the ground marks and the limited damage to the propeller blades and feathering mechanism on the right engine indicated that the damage to the propeller blades had little, if any, effect on the thrust produced by the right engine. As such, it is unlikely that the propeller strike contributed to the subsequent flight profile of the aircraft.

Analysis of evidence from the wreckage and accident site showed that the aircraft struck the ground almost vertically and came to rest inverted. The final position of the wreckage relative to the initial impact ground marks showed that there was some rotation to the right in yaw. This was consistent with the right wing of the aircraft stalling in a turn to the right and the aircraft entering an incipient spin. This was supported by the radar data and witness statements.

Operations

The pilot had owned a number of different types of aircraft, both single and twin-engine, but for the last six years, the evidence suggested that he mainly flew his single-engine Piper Saratoga, with an occasional MEP rating renewal on a twin-engine aircraft. The Saratoga was sold in June 2015. Thus, when he started his familiarisation training on the Seneca, his recent MEP flying practice was limited. After ten hours of familiarisation training at Pribram in the Czech Republic, the instructor considered the pilot was sufficiently practised to be able to conduct a solo cross-country flight in good visual weather conditions.

The flight to Biggin Hill, in the UK, was conducted under IFR with the instructor on board, using the autopilot in navigation mode, although, apparently, the pilot preferred to fly manually. The instructor described the pilot's conduct of the flight from the Czech Republic and his approach and landing at Biggin Hill as good and told the pilot it was his best landing yet.

It is not known when or why the pilot changed his plans from staying overnight near Biggin Hill to continuing the flight later the same afternoon. The weather conditions were good, as was the forecast for the following day. The pilot held a current medical certificate and the post-mortem did not find any evidence of a medical problem, although, by his own acknowledgement he was tired. The two-hour flight to Newquay, possibly flown manually, as was his preference, would have increased his level of fatigue.

When the pilot contacted Newquay ATC he requested a visual approach. At the time, the sun was low in the sky, about 15° to the left of Runway 30, and he reported that it was affecting his ability to see the runway. He turned right to establish on the runway centreline at a range of 8 nm and was visual with the runway by 4 nm. However, the sun could still have been affecting his ability to see the runway.

The airspeed on the final stages of the approach reduced steadily and reached approximately 94 kt, slightly higher than the recommended final approach speed with flap selected, by the time the aircraft crossed the runway threshold. The precise touchdown point could not be determined but was in the region of the touchdown zone. The aircraft was then seen to bounce several times before going around.

Flap selection and landing gear

There are several possibilities for the flaps being found in the stowed position, with the flap select lever in the 0° flap position. It is possible that the flap was never selected, either intentionally or inadvertently, or that the flap was retracted during the go-around.

It is considered unlikely that the pilot deliberately flew a flapless approach, for two reasons; he had not practised flapless approaches and, with the sun low on the horizon, the higher nose-up attitude with 0° flap would have restricted his view ahead[3].

A possible explanation is that the approach was flown without flap, inadvertently. The distraction of the sun in his eyes could have caused the pilot to omit the selection of flap and/or completion of the '*Normal Landing*' checklist. The landing gear was found selected DOWN, which suggests that the '*Approach and Landing'* checklist was completed. If the '*Normal Landing*' checklist had then been carried out, the lack of flap selection should have been detected. The pilot was tired, unfamiliar with the aircraft and flying an approach into sun, all which may have contributed to him inadvertently omitting the flap selection.

It is improbable that the flap had been selected on final approach and retracted fully during the go-around, as there would have been no urgency to do so and it is not part of the go-around procedure until after the landing gear is UP. The flap selection lever, located on the lower right instrument panel is out of the pilot's direct view and would require him to reach across to make a selection. After lifting off from the runway, the pilot would have been busy controlling the aircraft, looking out and making his radio transmission.

Footnote

3 The effect of carrying out an approach without flaps would have been to increase the nose-up attitude of the aircraft, for a given speed.

The go-around

The aircraft bounced on landing, perhaps several times, and at some point the pilot decided to go around. The propeller strike was brief and it is not known whether he was aware of it. Propeller marks on the runway ran along the centreline and the evidence indicated that the deviation to the right probably occurred after the propeller strike. The minimum calculated groundspeed of 63 kt, which equated to an airspeed of 67 to 68 kt, occurred just beyond the location of the propeller strike, with the aircraft apparently airborne, having bounced. The aircraft then started to accelerate and, from the combined evidence, appeared to descend back on to the runway, while deviating at least 20º to the right for reasons that could not be established.

The aircraft then lifted off the ground, heading towards the ATC tower. Its airspeed was probably still below the baulked landing climb speed of 85 kt as it performed a climbing turn to the right. The bank angle was seen to increase and the aircraft climbed to an estimated height of between 100 and 200 feet in 15 seconds. As the angle of bank increased, so did the stalling speed. When the left wing appeared almost vertical, the aircraft seemed to stall and enter an incipient spin, at a height and attitude from which recovery was not possible.

The initial turn during the go-around may have been to avoid obstacles but the reason for the increase to a steep angle of bank could not be established. The pilot gave no indication of concern in his radio transmission during the go-around and there was no evidence of a contributory fault on the aircraft.

The FAA publication concerning '*Transition to Multi-engine Airplanes*' highlights the importance of maintaining adequate speed throughout the go-around manoeuvre: '*The first priority is always to maintain control and obtain adequate flying speed'.*

ATC actions after the accident

This was a private, domestic flight and there was no requirement for the pilot to advise Newquay ATC of the number of persons on board the aircraft. Although the controller thought there was only the pilot, he realised that he could not be certain and advised the RFFS accordingly. The RFFS attended the scene quickly and controlled the fire. They checked on the condition of the pilot but then, because of uncertainty about the number of persons on board, checked the interior of the cabin.

The Newquay airport authority is considering whether to require all inbound aircraft, for whom details are not already provided, to inform them of the number of persons on board.

Conclusion

The pilot made the decision to go around after a bounced landing. The aircraft was at a slow speed and a degree of directional control appeared to have been lost. The aircraft commenced a continuous climbing turn, with an increasing angle of bank, before appearing to stall and enter an incipient spin at a height from which it was not possible to recover.

AAIB Correspondence Reports

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

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

The accuracy of the information provided cannot be assured.

ACCIDENT

Aircraft Type and Registration:	Boeing E75 Stearman, N43YP	
No & Type of Engines:	1 P & W R1340 Series piston engine	
Year of Manufacture:	1942 (Serial no: 75-6018)	
Date & Time (UTC):	13 April 2016 at 1257 hrs	
Location:	North Weald Airfield, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 2	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Abrasion to undersides of left and right lower wingtips and ailerons and fractured left wheel rim	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	63 years	
Commander's Flying Experience:	1,199 hours (of which 102 were on type) Last 90 days - 8 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The aircraft was landing on the asphalt Runway 20 at North Weald, with the control tower reporting the wind as from 240º at 4 kt with occasional gusts of 15 kt from 290º. The pilot adopted his usual wing down/opposite rudder approach technique and touched down on the mainwheels, performing a 'wheeler' landing. He allowed the tail to lower as elevator authority was lost but, after a few seconds in the three-point attitude, a swing to the right developed. He countered this with full left rudder but the swing continued to diverge. The left lower wingtip and aileron contacted the asphalt before the aircraft left the runway and ran briefly onto the grass before encountering a paved taxiway. It completed a 270º groundloop before coming to rest, having also grazed the right wingtip and aileron. The pilot subsequently realised that the left mainwheel had been damaged as it crossed the grass/paved surface interface. He also noted that, on several occasions during the hour following, the windsock was horizontal and perpendicular to the runway indicating occasional crosswind gusts.

ACCIDENT

Aircraft Type and Registration:	Cessna 182P Skylane, G-OJHC	
No & Type of Engines:	1 Continental Motors Corp O-470-S piston engine	
Year of Manufacture:	1976 (Serial no: 182-64535)	
Date & Time (UTC):	10 May 2015 at 15:26 hrs	
Location:	Carlisle Lake District Airport, Cumbria	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Aircraft damaged beyond economic repair	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	19 years	
Commander's Flying Experience:	94 hours (of which 12 were on type) Last 90 days - N/K hours Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot was preparing to land at Carlisle Lake District Airport following a flight from Cambridge. He completed an overhead join and was passed the information that the runway in use was Runway 19 and the wind was 220° at 15 kt. He continued the approach but saw an aircraft ahead of him on finals, so he extended the base leg. When established on finals, he called to that effect and was passed the wind information of 220º at 22 kt, gusting 36 kt.

The pilot stated that he decided to go around because of the wind, but the engine did not respond. He continued with the approach down to about 50 ft above the runway, when the engine suddenly "revved up", but it was too late to prevent a very heavy landing on the nosewheel which badly damaged the aircraft. The pilot cited "loss of engine and weather" as the causes of the accident.

ACCIDENT

Aircraft Type and Registration:	1) Cirrus SR20, G-GCDC 2) Piper PA-38-112 Tomahawk, G-BLWP
No & Type of Engines:	1) 1 Teledyne Continental IO-360-ES piston engine 2) 1 Lycoming O-235-L2C piston engine
Year of Manufacture:	1) 2008 (Serial no: 2008) 2) 1978 (Serial no: 38-78A0367)
Date & Time (UTC):	20 January 2016 at 1419 hrs
Location:	Runway 10, Swansea Airport
Type of Flight:	1) Private
Persons on Board:	1) Crew - 1 Passengers - 2 2) Crew - None Passengers - None
Injuries:	1) Crew - None Passengers - None 2) Crew - N/A Passengers - N/A
Nature of Damage:	1) G-GCDC - Propeller, left and right wings, main landing gear, left elevator, nosewheel detached, and engine shock-loaded 2) G-BLWP - Right wing
Commander's Licence:	Private Pilot's Licence
Commander's Age:	66 years
Commander's Flying Experience:	641 hours (of which 70 were on type) Last 90 days - 2 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further inquiries by the AAIB

Synopsis

During pre-flight checks, the pilot realised that he had inadvertently engaged the autopilot with the corner of his kneeboard. After correcting this, he performed a number of touch-and-go landings. During the final touch-and-go, the aircraft lost control and deviated to the left of the runway, eventually impacting a parked aircraft. The reason for the accident could not be established but is considered likely to be a combination of the gusting wind from the right, a bounced landing and wingtip strike, the effect of applying full power during the touch-and-go and the possibility of inadvertent autopilot engagement.

History of the flight

The pilot planned to perform circuits at Swansea Airport along with a short local flight. He reported performing the usual pre-flight checks which are listed on one of the aircraft's digital displays. One of these is a check of the aircraft's electric trim which was found to be "abnormal". The pilot reported that the trim was "lethargic and resistant to my commands from the 'Cooley hat'[1] trim controller" and that the correct takeoff trim could not be set.

During troubleshooting, the pilot pressed the autopilot disconnect button and the disconnection warning sounded. Further investigation revealed that the pilot's kneeboard, which was strapped to his right leg, had inadvertently nudged the autopilot control panel and engaged the autopilot HDG (heading) mode (see Figure 1). This came as a surprise to the pilot as it was the first time he had experienced this issue with his kneeboard after "dozens of flights in this aircraft". He repeated the action and demonstrated it to his passengers on three further occasions.

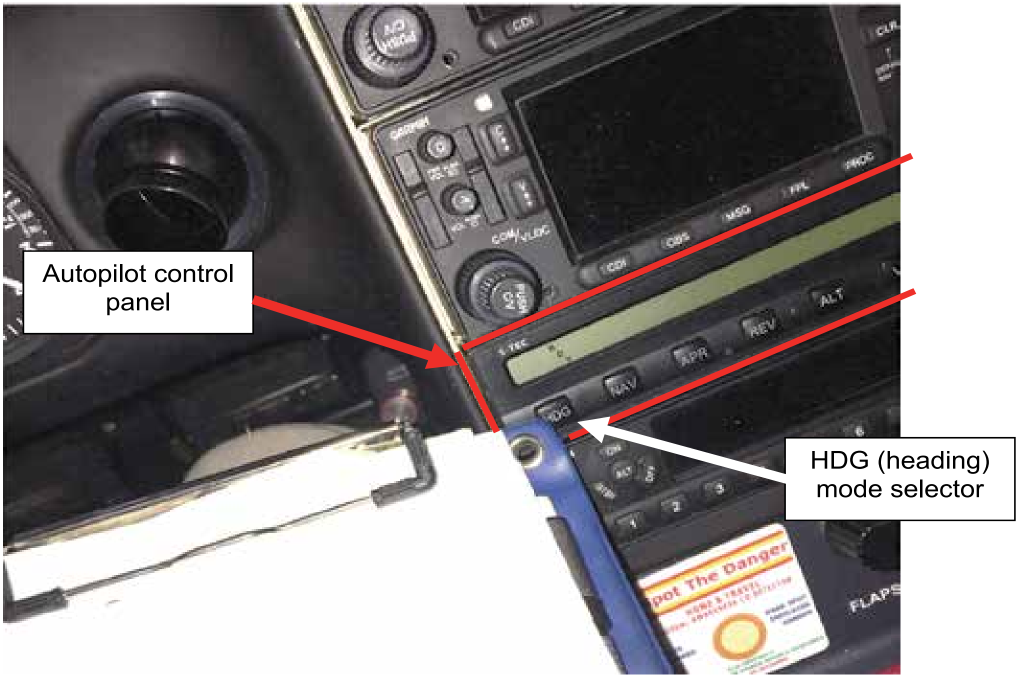

Figure 1

G-GCDC pilot's kneeboard showing proximity to autopilot control panel

After moving the kneeboard further up his leg, the pilot considered that the issue had been resolved and continued with his flight preparations.

The aircraft took off at 1329 hrs for a flight over the west of the Gower Peninsula and then returned to the airfield to perform three touch-and-go landings. This was followed by a local flight over Swansea before returning to the airfield for another planned touch-and-go on Runway 10. The pilot reported that the weather was hazy, slightly grey and damp with

Footnote

1 The term Cooley hat refers to a conical trim button located on top of the control yoke.

10 km visibility and no significant cloud cover, with wind from 100° to 120° at 10 kt, gusting to 16 kt. He described his approach as "routine" achieving an "acceptable rate of descent" using 100% flap and a speed of 78 KIAS.

As the aircraft overflew the runway numbers, the pilot reduced the rate of descent to deliberately avoid being on the ground at the intersection with Runway 04/22 (See Figure 2); there are some reported ridges at this point which have caused bounced landings in the past. As the pilot waited for the aircraft to touch down, he noted a slow drift to the left side of the runway which was assumed to be caused by gusting wind from the right. The aircraft then rolled to the left allowing the left wheel to contact the runway and the aircraft to bounce. The pilot was unaware of any other ground contact and elected to continue with his touch-and-go by applying full power.

The pilot was unsure of subsequent events but reported a sudden turn to the left, rolling to about 45° left and adopting a high pitch attitude. The aircraft was recovered to a wings level attitude over the Taxiway Bravo with the aircraft described as flying at 20 ft agl by a member of the airport's staff who witnessed the event. The aircraft then descended and the nosewheel struck a grass verge and detached. The propeller struck the ground and the aircraft slid along the apron until it impacted a parked aircraft (G-BLWP).

All occupants were wearing full harnesses, were uninjured and exited the aircraft through the doors. There was no fuel leak and the aircraft's airbags did not deploy. It was subsequently discovered that the left wingtip had also contacted the runway at the estimated point of the first touchdown.

Two weeks after the pilot's statement was received at the AAIB, he raised the possibility of the autopilot being inadvertently engaged during the final stages of the flight. He recalled that the heading would have been set to north and that, if the autopilot had engaged during the touch-and-go, this would have exacerbated the turn to the left. The aircraft was not examined by the AAIB but, after the event, it was reported that the roll trim was set to left roll.

Aircraft information

The SR20 control surfaces are controlled by the pilot through either of two single-handed side control yokes mounted beneath the instrument panel. G-GCDC was fitted with two large electronic flight display units: the Primary Flight Display (PFD) and the Multi-Function Display (MFD) along with three conventional instruments, an altimeter, airspeed indicator and artificial horizon. When power is applied at low airspeed, the slipstream effects from the propeller are such that the aircraft will yaw to the left unless it is countered by applying right rudder.

Autopilot

The aircraft was fitted with an S-TEC 55X autopilot which can control the roll and pitch axes of the aircraft. A number of autopilot modes are available which are selectable by pressing the appropriate mode selector switch. A visual indication is provided on the PFD and the autopilot selection panel when the autopilot engages. The autopilot can be engaged at any time, including on the ground, as long as there are no system failures which inhibit it. The aircraft's Pilot Operating Handbook (POH) indicates that the autopilot may be engaged at heights above 400 ft agl.

When the autopilot is engaged in the HDG (heading) mode the aircraft will turn to and follow the heading selected by the pilot on the heading bug. There is no audible alert when this autopilot mode is engaged.

Autopilot heading control is achieved using an interface to the electric roll trim motor. The amount of autopilot trim authority is limited to allow the pilot to override any autopilot input using control yoke and rudder inputs. The aircraft's POH states that *'It is possible to easily override full trim or autopilot inputs by using normal control inputs'.*

The autopilot can be disengaged by a number of means but normally by pushing the disconnect button on the control yoke. Pitch or roll control inputs to the control yoke will not disengage the autopilot. Disconnection will trigger an audio alert and an appropriate display on the PFD screen and the autopilot control panel.

Pilot information

The pilot successfully completed the SR20 '*Cirrus Transitional Training Course*' in May 2013. He last flew with an instructor in February 2014 which included crosswind landings, but not in a Cirrus aircraft. The pilot confirmed his familiarity with the crosswind landing and touch-and-go requirements of flying the Cirrus, including the need to apply right rudder to counter the propeller slipstream effects.

In the calendar year prior to the accident, the pilot had flown for 24 hours in this aircraft. In November 2015, he flew five touch-and go-landings. The next flight was the accident flight where three touch-and-go landings were successfully performed prior to the accident.

Other events

The aircraft manufacturer confirmed that they were not aware of any other instances of inadvertent autopilot engagement by a pilot's kneeboard. A search of the AAIB and NTSB (USA) accident database did not reveal previous accidents or incidents involving inadvertent autopilot engagement in such a manner.

Recorded information

The aircraft was fitted with a Recoverable Data Module (RDM) which is a crash-hardened recorder located in the vertical stabiliser. This was recovered to the AAIB and downloaded but the last recorded flight was in September 2013. The electronic flight displays also recorded some data including engine parameters and position but only at six second intervals and no autopilot information could be recovered. Heading information was calculated from recorded position but analysis of a dynamic event, such as a loss of control on landing, is not possible with such a low sampling rate. Salient parameters are shown in Figure 2.

Engine rpm increased from 2,160 rpm to 2,460 during the touch-and-go (maximum recorded for this flight was 2,660 rpm) but then reduced to 1,550 rpm as the aircraft departed to the left of the runway. Due to the position and sampling rate resolution, it could not be established whether this reduction in rpm was prior to, or as a consequence of, the propeller strikes on the paved surface. The last recorded position corresponded with that indicated by the pilot.

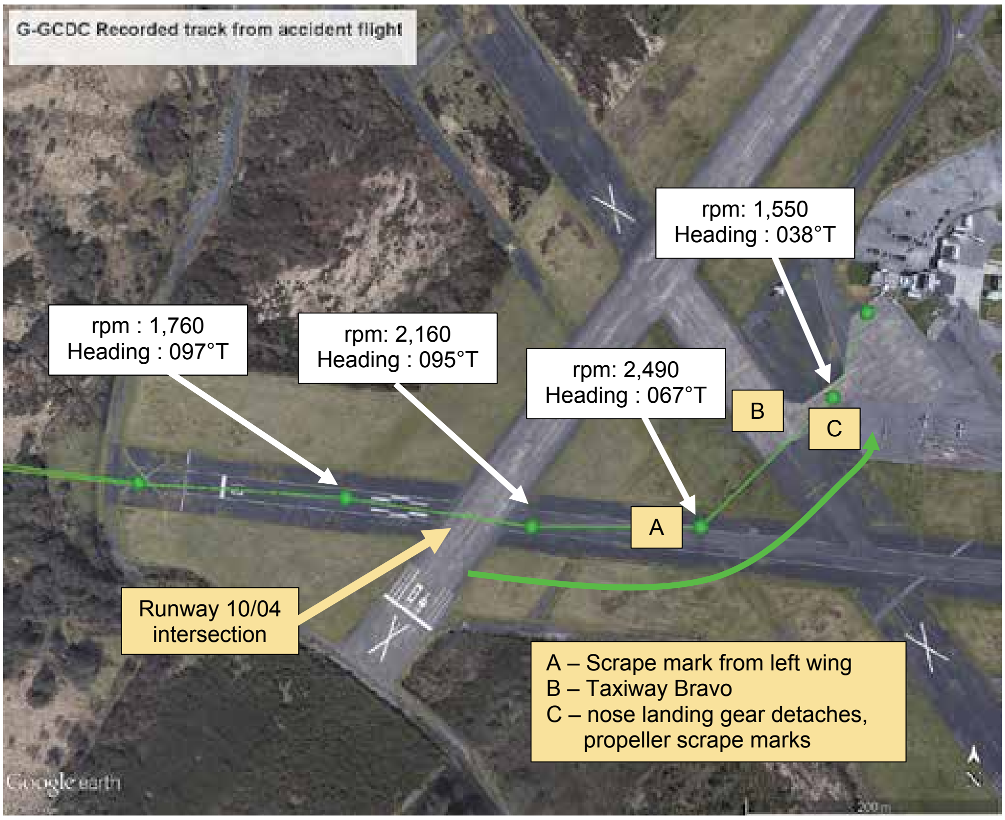

Figure 2

Salient recorded parameters

Discussion

The pilot reported that during the pre-flight checks, the autopilot heading bug was not aligned with the runway heading but probably set to north. Autopilot engagement is possible at any time as long as no system failures are present. This allowed identification of the inadvertent activation of the heading mode during the pre-flight checks, leading to an adjustment of the kneeboard position with a view to preventing recurrence. Despite "many dozens" of previous flights wearing this kneeboard, the pilot was unaware of having inadvertently engaged the autopilot with it. He thought it likely that a combination of kneeboard and seat positioning on this flight had exacerbated the situation.

Prior to the accident, the pilot had successfully completed three touch-and-go landings on Runway 10. For the accident landing, he reported that the approach to Runway 10 was normal. At the touchdown point, the aircraft drifted and rolled to the left, causing it to bounce on the left main landing gear and for the left wingtip to contact the runway. In the absence of recorded data, the cause for this initial deviation to the left could not be determined. It was considered to be either due to the effects of a gust of wind from the right, an inadvertent engagement of the autopilot with the pilot's kneeboard, or a combination of both.

After the initial bounce, the pilot applied full power to continue the touch-and-go. The effects of this will be a yaw to the left, from the propeller slipstream, which is normally countered with right rudder. The amount of right rudder application is unknown and, after full power was applied, the aircraft lost control and turned rapidly to the left. The pilot did not recall seeing any autopilot annunciation changes on the PFD, but may not have been able to due to the rapid nature of the ensuing events.

He reported regaining control as the aircraft crossed Taxiway Bravo but the nose then dropped, the aircraft descended rapidly, the nose gear detached and the propeller impacted the paved surface. The aircraft then slid across the ground, eventually impacting a parked aircraft.

After the accident, aircraft examination revealed the roll trim was to the left and, as the pilot stated that he had not commanded it, it is considered likely to have been commanded by the autopilot. Unfortunately, no evidence was recovered that could confirm the status of the autopilot throughout the accident sequence, including the times of any engagement. However, the aircraft manufacturer confirmed that the autopilot trim authority is limited to ensure that the pilot can always override an autopilot input using control yoke and rudder inputs.

The exact cause of the accident could not be established due to lack of evidence. It is likely to have been caused by a combination of the gusting wind from the right, the bounced landing and wingtip strike, the effect of applying full power during the touch-and-go and the consequence of a possible inadvertent autopilot engagement by the corner of the pilot's kneeboard.

Unexpected control inputs at critical stages of flight can be hazardous. Although unaware of any previous events of this specific nature, and none being recorded on the AAIB or NTSB accident databases, the aircraft manufacturer is considering promulgating details of this event in its routine safety bulletins available to pilots operating its aircraft.

ACCIDENT

Aircraft Type and Registration:	Eurofox 912(S), G-CHUP
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2013 (Serial no: LAA 376-15188)
Date & Time (UTC):	31 March 2016 at 1301 hrs
Location:	Shobdon Airfield, Herefordshire
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right landing gear leg
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	82 years
Commander's Flying Experience:	3842 hours (of which 22 were on type) Last 90 days - 6 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Whilst landing on Runway 27 at Shobdon Airfield, the pilot reported that the right main landing gear leg failed as the aircraft turned off the runway to the left at slow speed. He believed the failure was due to damage that had resulted from a previous accident on 2 September 2014 (AAIB report EW/G2014/09/02 refers).

INCIDENT

Aircraft Type and Registration:	Europa XS, G-CCUL	
No & Type of Engines:	1 Rotax 912 ULS piston engine	
Year of Manufacture:	2004 (Serial no: PFA 247-13119)	
Date & Time (UTC):	5 June 2016 at 1700 hrs	
Location:	Rayne Hall Farm Airfield, Essex	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Damage to two propeller blades and transponder antenna	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	55 years	
Commander's Flying Experience:	1,661 hours (of which 420 were on type) Last 90 days - 11 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

The pilot arrived overhead the airfield from the north-east and joined crosswind for Runway 09. He heard several partial radio calls on the SAFETYCOM frequency but could not identify the source of any of these transmissions. On final approach, the pilot stated that he was high on his approach path and that his speed seemed less stable than usual but he did not perform a go-around. Upon landing, the aircraft settled lower than expected, pitched nose-down and slid to a halt. The pilot and passenger were uninjured during the gear-up landing and vacated the aircraft in the normal way. The pilot attributed the incident to his failure to action the before-landing checklist, possibly because he was distracted by the partial radio transmissions.

ACCIDENT

Aircraft Type and Registration:	Guimbal Cabri G2, G-CILU
No & Type of Engines:	1 Lycoming O-360-J2A piston engine
Year of Manufacture:	2015 (Serial no: 1092)
Date & Time (UTC):	29 June 2016 at 1536 hrs
Location:	Cotswold (Kemble) Airport, Gloucestershire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damaged main rotor blades, landing skids, fuselage and tail
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	2,208 hours (of which 1,290 were on type) Last 90 days - 95 hours Last 28 days - 15 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The student pilot was flying a downwind 'quick-stop' manoeuvre as part of a dual training flight. The helicopter lost height suddenly during the turning manoeuvre and the instructor was unable to prevent the main rotor blades from striking the ground.

History of the flight

The helicopter was engaged on a training flight with a student pilot and his instructor on board. At the time of the accident, it was operating within the airfield perimeter, to the south of Runway 08/26. The weather was fine, with a surface wind from 220° at 15 to 25 kt.

The student was tasked to fly a downwind 'quick-stop' manoeuvre, which required that the helicopter first be established in downwind flight at 30 ft agl and 60 kt IAS. The intended profile for the manoeuvre was a left turn and flare, bringing the helicopter to a hover headed into wind.

The manoeuvre proceeded normally until the mid-point of the turn, when the low rotor rpm warning horn sounded and the helicopter descended rapidly. The instructor later reported that the student had 'over pitched' the main rotor blades in response to a sudden loss of height which was induced by turbulence.

As the warning horn sounded, the instructor announced "I HAVE CONTROL" and attempted to level the helicopter. The student pilot appeared not to release the controls immediately which, combined with the very limited time available, meant that the instructor was unable to regain controlled level flight before the main rotor blades struck the ground.

The helicopter skidded upright over the grass surface before coming to a stop. The occupants, who were uninjured, vacated the helicopter through the main doors.

ACCIDENT

Aircraft Type and Registration:	MCR-01 Banbi, G-CUTE
No & Type of Engines:	1 Rotax 912 ULS piston engine
Year of Manufacture:	2000 (Serial no: PFA 301-13511)
Date & Time (UTC):	5 June 2016 at 1600 hrs
Location:	Brimpton Airfield, Berkshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Landing gear damaged, minor propeller tip damage
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	72 years
Commander's Flying Experience:	2,641 hours (of which 851 were on type) Last 90 days - 7 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot was at the hold ready for departure when the airfield was closed because of an accident. He shut the aircraft down and opened the canopy. The airfield reopened after approximately three hours and the pilot repeated his pre-takeoff checks with the exception of a visual check of the canopy locks, which were behind his shoulders.

The canopy opened after takeoff and the pilot reported that he struggled to gain height despite using full power. He concentrated on flying the aircraft and commenced a left hand circuit to return to the runway. He reported that control difficulties due to the canopy being open prevented him from achieving a normal flare. The aircraft landed heavily, damaging the landing gear and propeller.

The pilot concluded that the canopy had been left unlocked and he had not identified the error because he did not check the locks before takeoff. He considered that he had not taken enough time to ensure the pre-takeoff checks were properly carried out and that, given the break, the checks should have be started again from the beginning, despite any time pressure.

ACCIDENT

Aircraft Type and Registration:	Mooney M20F Executive, G-CEJN
No & Type of Engines:	1 Lycoming IO-360-A1A piston engine
Year of Manufacture:	1966 (Serial no: 670216)
Date & Time (UTC):	17 April 2016 at 0900 hrs
Location:	Wellesbourne Mountford Airfield, Warwickshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to right flap, right aileron tip and tail skid
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	45 years
Commander's Flying Experience:	1,180 hours (of which 467 were on type) Last 90 days - 43 hours Last 28 days - 16 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional enquiries by the AAIB

Synopsis

After a normal touchdown, the right Main Landing Gear (MLG) collapsed. Examination revealed that a rod which actuates the right MLG was bent and the downlock had not overcentred.

History of the flight

The aircraft had taken off for a local flight to check system serviceability prior to its forthcoming annual inspection. As it returned to Wellesbourne Mountford Airfield, the pilot lined up to land on Runway 18 with a light southerly wind prevailing. He flew the approach at the recommended speed of 80 mph and checked that the single green GEAR DOWN light had illuminated and that the physical check of the mechanism using a window in the cockpit floor also indicated that it was in the correct position. He also acknowledged a call from the control tower to "Check 3 greens".

The aircraft touched down gently on the threshold but, as it slowed, the pilot sensed that the right wing was dropping, so he applied left aileron whilst simultaneously pulling on the mixture control to shut down the engine. The tailskid and right flap contacted the runway and the aircraft veered to the right onto the grass where it came to a halt. On vacating the aircraft, the pilot could see that the right MLG had collapsed.

Engineering investigation

The original Mooney M20 series of aircraft had manual extension and retraction of the landing gears, although many owners retro-fitted an electrical actuation system to reduce work for the pilot – G-CEJN was one such aircraft. A single electric motor operates rods to move the nose and MLG. The engineer who maintained the aircraft for some time examined it after the accident and noted that the actuating rod for the right MLG was bent, which could indicate that the gear had not been in its overcentre locked condition and had attempted to react to the landing loads through the retraction rod. It was also possible that slight distortion of the rod due to some previous event might have been responsible for the failure to overcentre. Both the indicator light and the mechanism checking window do not provide confirmation that any of the three gears are locked down, only that the actuating rods are in the correct position.

ACCIDENT

Aircraft Type and Registration:	Aeroprakt A22 Foxbat, G-CHAD
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2002 (Serial no: PFA 317-13909)
Date & Time (UTC):	22 June 2016 at 1340 hrs
Location:	Mitton Farm Airstrip, near Penkridge, Staffordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Propeller, nose leg and nose leg fuselage brackets
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	67 years
Commander's Flying Experience:	254 hours (of which 138 were on type) Last 90 days - 3 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Mitton Farm Airstrip has a single grass runway orientated 10/28. Adjacent to both sides of the runway was a crop of wheat, which was about 70 cm tall. The wind at the time of the landing was from 135° at between 5 and 10 kt. The approach and initial touchdown on Runway 10 appeared normal but, as the pilot applied the brakes during the rollout, the aircraft skidded and departed the left side of the runway and entered the wheat crop before coming to a stop. The pilot was uninjured but the aircraft sustained damage to the nose leg, the nose leg fuselage brackets and propeller.

The pilot had visited Mitton Farm Airstrip previously and considered that, for the accident landing, the grass was "much longer than normal" and that this, combined with the surface being damp from recent rain, had contributed to the loss of directional control.

ACCIDENT

Aircraft Type and Registration:	Ikarus C42 FB UK, G-IKUS
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2004 (Serial no: PFA 322-14130)
Date & Time (UTC):	30 May 2016 at 1100 hrs
Location:	Strubby Airfield, Lincolnshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Minor)
Nature of Damage:	Aircraft substanitially damaged
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	56 years
Commander's Flying Experience:	1,450 hours (of which 1,092 were on type) Last 90 days - 35 hours Last 28 days - 12 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional inquiries by the AAIB

The pilot was attempting to take off from a mown strip of grass perpendicular to, and north of the asphalt runway at Strubby Airfield (Figure 1). When he realised he would not clear the hedge at the end, he turned to avoid it and the aircraft impacted the ground. The pilot referred to the strip as Runway 36, but the airfield owner advised that it was not a designated runway.

Figure 1

Mowed strip in the direction of takeoff

Using commercially available aerial imagery, the length of the mowed strip was estimated to be 140 m. The takeoff weight was reportedly 446 kg and manufacturer's performance data states that at a Maximum Take Off Weight of 450 kg, the takeoff distance to clear a 15 m obstacle is 205 m.

The pilot stated that he had taken off from the mowed strip previously and he believed his ability to climb on the accident flight had been compromised by rotor effect from the hedge, which he estimated to be between three and four metres in height.

CAA Safety Sense Leaflet 7c ('*Aeroplane Performance*') reminds pilots of the actions necessary to ensure adequate takeoff performance for the conditions.

ACCIDENT

Aircraft Type and Registration:	Quik GT450 Quik, G-CJAJ
No & Type of Engines:	1 Rotax 912UL piston engine
Year of Manufacture:	2016 (Serial no: 8750)
Date & Time (UTC):	19 June 2016 at 1540 hrs
Location:	Sutton Meadows Airfield, Cambridgeshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - None
Nature of Damage:	Aircraft severely damaged
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	188 hours (of which 64 were on type) Last 90 days - 13 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot reported that, following a 30-minute local flight, he returned to Sutton Meadows Airfield where he made a standard overhead join for a landing on Runway 19. From the overhead position he observed the windsock indicating that the wind was light with a slight crosswind from the right of the runway. The pilot stated that the approach was uneventful and there was no indication of any strong thermals. However, as he started to flare the aircraft for landing, there was a strong gust of wind that lifted the right wing and pushed the aircraft sharply to the left of the runway. As the pilot attempted to level the wings and commence a go-around, a second gust of wind from the right resulted in the left wingtip making contact with the ground. The pilot lost control of the aircraft which came to rest adjacent to the runway. During the accident, the pilot injured the ligament in his right shoulder and the aircraft was severely damaged.

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
DME	Distance Measuring Equipment
EAS	equivalent airspeed
EASA	European Aviation Safety Agency
ECAM	Electronic Centralised Aircraft Monitoring
EGPWS	Enhanced GPWS
EGT	Exhaust Gas Temperature
EICAS	Engine Indication and Crew Alerting System
EPR	Engine Pressure Ratio
ETA	Estimated Time of Arrival
ETD	Estimated Time of Departure
FAA	Federal Aviation Administration (USA)
FDR	Flight Data Recorder
FIR	Flight Information Region
FL	Flight Level
ft	feet
ft/min	feet per minute
g	acceleration due to Earth's gravity
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
hrs	hours (clock time as in 1200 hrs)
HP	high pressure
hPa	hectopascal (equivalent unit to mb)
IAS	indicated airspeed
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
IP	Intermediate Pressure
IR	Instrument Rating
ISA	International Standard Atmosphere
kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	knots indicated airspeed
KTAS	knots true airspeed
km	kilometre(s)
kt	knot(s)
lb	pound(s)
LP	low pressure
LAA	Light Aircraft Association
LDA	Landing Distance Available
LPC	Licence Proficiency Check
m	metre(s)
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