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COMMERCIAL AIR TRANSPORT

GENERAL AVIATION

SPORT AVIATION / BALLOONS

CONTENTS (Continued)

ADDENDA and CORRECTIONS

(ALL TIMES IN THIS BULLETIN ARE UTC)

ACCIDENT

Aircraft Type and Registration:	Boeing 737-8AS, EI-DLR
No & Type of Engines:	2 CFM56-7B turbofan engines
Year of Manufacture:	2006
Date & Time (UTC):	13 November 2008 at 1920 hrs
Location:	Stand D 61, London Stansted Airport, Essex
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 4 Passengers - 164
Injuries:	Crew - None Passengers - None
Nature of Damage:	No 1 engine cowling damaged, tow bar attachment broken
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	53 years
Commander's Flying Experience:	14,000 hours (of which 2,500 were on type) Last 90 days - 270 hours Last 28 days - 23 hours
Information Source:	AAIB Field Investigation

Synopsis

A cross-bleed engine start procedure was initiated prior to the completion of the aircraft pushback. As the power was increased on the No 1 engine in preparation for the No 2 engine start, the resulting increase in thrust was greater than the counter-force provided by the tug and the aircraft started to move forwards. The towbar attachment failed and subsequently the aircraft's No 1 engine impacted the side of the tug, prior to the aircraft brakes being applied.

History of the flight

The accident happened during the hours of darkness. It was raining and the surface of the apron was wet. The flight crew were starting their third sector of the day, on the same aircraft, and were running about 25 minutes behind schedule. The aircraft was operating with a deferred defect; the Auxiliary Power Unit (APU) was inoperative, which required the crew to carry out a ground-air start of one engine on stand and, subsequently, a cross- bleed start of the other engine once away from the stand. The procedure had been carried out successfully on the previous two sectors but both times there had been some difficulty in maintaining sufficient pneumatic duct pressure during the cross-bleed start. On both previous occasions the aircraft had been stationary with the parking brake set before the cross-bleed start was attempted.

The aircraft was parked on Stand D61L at Stansted Airport. The co-pilot received clearance from ATC to

start on stand and the procedure for a ground-air start was read out from the operations manual. The commander initiated the start sequence on engine No 1, but was unable to get sufficient engine rotation (N_2), so aborted the start. He contacted the groundcrew headset operator on the flight interphone, and asked if he could increase the air supply from the ground-air cart. This was done and, at the second attempt, engine No 1 was started successfully. The ground equipment was cleared away and pushback clearance was obtained. The operations manual was then consulted for the procedure relating to a cross-bleed start.

The pushback from stand D61L requires a 'dogleg' manoeuvre to be carried out, see Figure 1. As the tug was starting to straighten the aircraft onto the taxiway centreline, the headset operator called the commander and said 'CLEAR TO START NUMBER TWO'. The commander responded by stating that he would be increasing the thrust on the No.1 engine, to which the response was 'OK'.

The commander increased the thrust to give an initial duct pressure of around 40 psi, in an attempt to prevent a recurrence of the previous slow starts. He was monitoring the N_2 rotation when he became aware that the nosewheel was skidding. He then heard the headset operator say "STOP PLEASE EMERGENCY STOP", but he reported that this message did not make sense to him because, while he was being pushed back, the aircraft was under the control of the headset operator and the tug driver. Nevertheless, he reduced the No 1 engine thrust to idle. He questioned the headset operator several times, but did not get a reply, and then saw ground personnel waving at him. When he heard the headset operator say "SHUT IT DOWN NOW", the commander advised him that there was no APU. He opened his window and looked

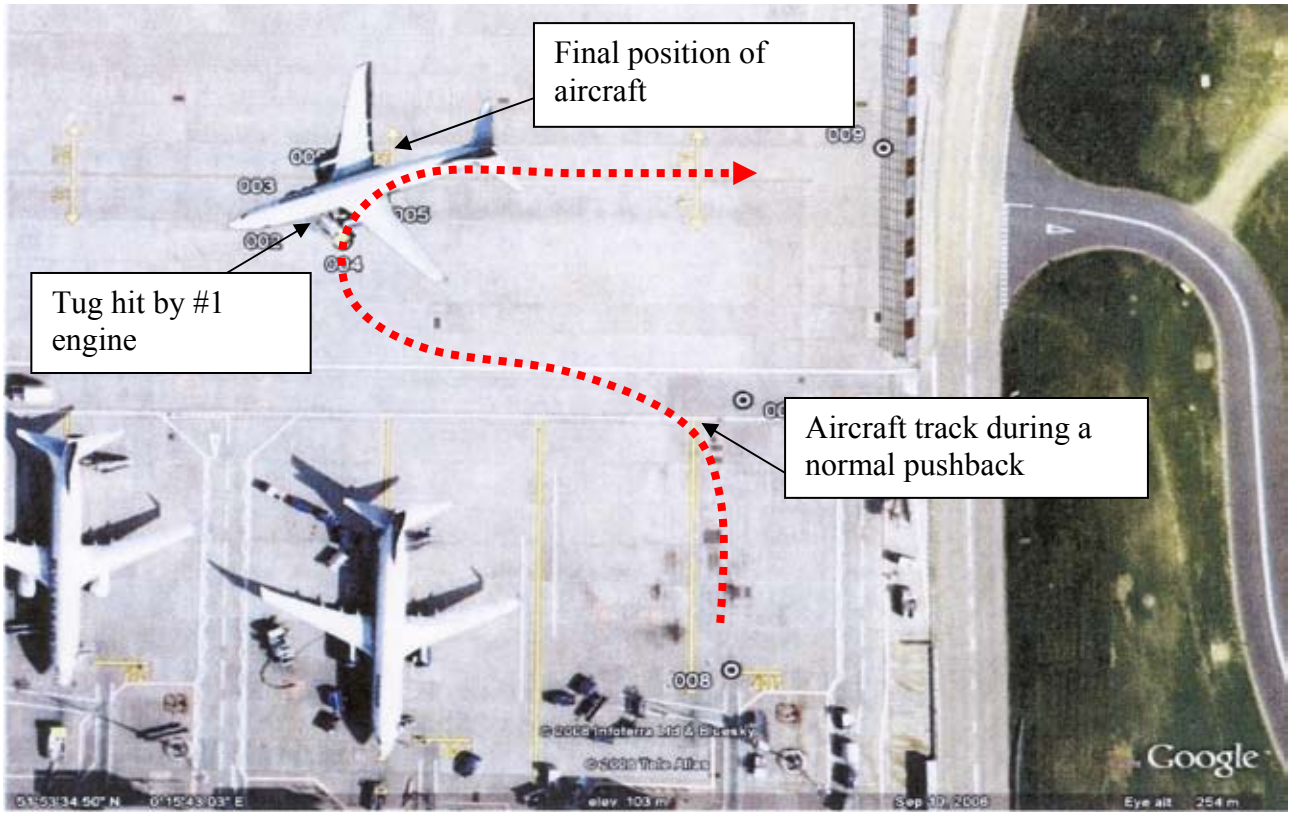


Figure 1

'Dogleg' pushback manoeuvre from Stand D 61 at London Stansted Airport

out to see what was happening, and then applied the brakes. The aircraft, and by now driverless tug, stopped moving. Shortly afterwards, engine No 1 was shut down. After the commander had checked outside, he spoke to the passengers to explain what had happened. They were subsequently disembarked from the aircraft by means of steps placed at the rear door.

Initial examination

It was apparent that the towbar attachment to the nose landing gear had failed as the aircraft started to move forward. Before it came to rest, it had contacted the tug with the nose cowl of the No 1 engine, and pushed the tug across the apron for a short distance.

Aircraft information

Procedures for pushback and towing of aircraft, and normal, ground-air and cross-bleed engine starts, were all provided in the company Operations Manual, shown in Figure 2.

The manufacturer provides a Flight Crew Training Manual (FCTM), which contains additional operational information for pilots, as follows:

> *'Push Back or Towing*
>
> *Each operator should develop specific pushback and towing procedures and policies which are tailored for their specific operations. The flight operations and maintenance departments need to be primary in developing these procedures.'*

and

> *'Engine start may be accomplished during pushback or towing, or delayed until pushback or towing is completed. Ground personnel should be on headset to observe and communicate any possible safety hazards to the flight crew'*

A review of data supplied by the manufacturer, with regard to duct pressure required for engine start, shows that it varies with ambient temperature and duct delivery air temperature. For the prevailing conditions at Stansted, an indicated duct pressure of approximately 35 psi needs to be maintained during engine start[1].

Ground handling pushback procedures

This type of accident had been anticipated by the ground handling agent responsible for the pushback of the operator's aircraft at Stansted. Their training material for headset operators stated that cross-bleed starts should not be permitted during pushback. Aircraft must be stationary and the park brake applied before start clearance can be given. The tug driver was aware of this requirement and advised that it was complied with in normal practice. The headset operator had successfully undergone this training, and passed an exam on the subject in December 2006, in order to gain company approval to operate in this capacity during pushback operations.

Information from personnel

Commander

The commander stated that he would not normally have intended to carry out a cross-bleed start while the aircraft was still being pushed back. However, when the headset operator said "CLEAR TO START", it had triggered the start process in his mind and he had

Footnote

[1] During a crossbleed start, the live engine is able to maintain the required pressure whilst delivering a high volume of air to the engine being started. It is often the case, however, that the air pressure from a ground-air vehicle falls significantly when delivering a high volume of air, and this may lead to a hesitant start, or a failure of the engine to start.

Pushback or Towing Procedure

The Engine Start procedure may be done during pushback or towing.

CAUTION: Do not use airplane brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.

Starting with Ground Air Source (AC electrical power available)

Engine No. 1 must be started first.

When cleared to start:
APU BLEED air switch ..... OFF
Engine No. 1 start ..... Accomplish
Use normal start procedures.

WARNING: To minimize the hazard to ground personnel, the external air should be disconnected, and engine No. 2 started using the Engine Crossbleed Start procedure.

Engine Crossbleed Start

Prior to using this procedure, ensure that the area to the rear is clear.

Engine BLEED air switches .....ON
APU BLEED air switch ..... OFF
PACK switches ..... OFF
ISOLATION VALVE switch .....AUTO Ensures bleed air supply for engine start.
Engine thrust lever (operating engine) .....Advance thrust lever until bleed duct pressure indicates 30 PSI[2]
Use normal start procedures with crossbleed air.
After starter cutout, adjust thrust on both engines, as required.

Figure 2

Extract from the Company Operations Manual

Footnote

[2] The duct pressure gauge is located on the overhead panel above the co-pilot's seat.

automatically begun the procedure. He remarked that, had there been any guidance in the Operations Manual regarding the potential risk of carrying out a cross-bleed start during pushback, then he would have seen it and would not have increased the left engine thrust.

The instruction to stop given by the headset operator as the aircraft started to overpower the tug, had not made sense to him because he thought the aircraft was still being moved by the tug. However, the commander was aware that, as cautioned in the Operations Manual, brakes must not be used while the aircraft is being pushed or towed. He was mindful that the flight was running late but considered that it was not necessarily a factor in the accident.

Co-pilot

The co-pilot was monitoring the ATC frequency during the pushback and also had the interphone selected at a low level. He became aware of a juddering during the push and heard the headset operator say "STOP" and repeated this to the commander. Because it was dark outside, he was unaware of the relative motion of the aircraft and was surprised when he later saw the positions of the tug and aircraft.

The co-pilot had been qualified on this aircraft type for about six months. During his initial training he had carried out cross-bleed starts in the simulator, but not on a stand requiring pushback. He commented that he had never, until the day of the incident, carried out a cross-bleed start during line operations.

Tug driver

The tug driver had carried out this 'dogleg' pushback on many previous occasions. He knew that a cross-bleed start was not allowed during pushback under his company operating procedures and was surprised when he heard the engine power increasing. He felt the tug start to lose grip and attempted to steer to correct, but then realised that he was being pushed by the aircraft. He saw that he was being forced towards the engine and, as it came closer, decided to get out of the way. He opened the cab door and, after running clear of the area towards the front of the aircraft and the headset operator, turned around and started waving and shouting to attract the flight crew's attention.

Headset operator

The headset operator was shocked by the event and was not available for interview after the accident.

Recorded information

Pertinent recordings were recovered from the Cockpit Voice Recorder (CVR) and the Flight Data Recorder (FDR) installed on the aircraft. These showed that engine No 1 had been started on stand, after clearance was given by ATC, and in communication with the ground crew. Permission was given by ATC to push back and, again, the flight crew and ground crew coordinated this with each other. The aircraft was pushed back in a 'dogleg' manoeuvre from the initial heading of 225° through to 157° before a turn back towards 315°. Just after this reversal in direction, the ground crew said to the flight crew that they were clear to start engine No 2. The flight crew responded by stating that they would increase the power on engine No 1; this was acknowledged by the ground crew. Approximately 20 seconds later, with the heading increasing through approximately 230°, the N_1 of engine No 1 started to increase, reaching a peak of 51% N_1 within ten seconds, before a slow reduction in power.

Approximately 10 seconds after the peak in N_1 speed, the aircraft heading increased to just over 300°M when the ground crew called "...STOP PLEASE EMERGENCY

STOP". At this point the aircraft had a ground speed of approximately 1.5 kt, although the direction of travel was not recorded. Clarification of the situation was sought by the flight crew from the ground crew. Within three seconds of the emergency stop call the N_1 of engine No 2 registered a small increase from 0% to 1%, later peaking at just over 2%; the igniters had not been triggered. Just under 10 seconds from the start of the emergency stop call, the aircraft brakes were applied and the 'inertial' ground speed fell to zero. Further urgent requests from the ground crew to "STOP" were recorded as were further flight crew queries about the problem. Fifty seconds after the initial emergency call the ground crew instructed "SHUT IT DOWN NOW"; the flight crew responded, stating that there was no APU, following which the recordings stopped.

Engineering examination

Accident site

The aircraft and tug had been removed from the accident site prior to the commencement of the AAIB investigation, as the collision had occurred on an active taxiway. However, the positions of the tug and the aircraft's wheels had been marked on the taxiway using spray paint. A skid mark was present to the left of the taxiway centreline, leading to and terminating at, the point where the aircraft nose gear tyre position had been marked on the ground. A short skid mark was located at the left rear corner of the area which had been marked as the tug position.

Photographic evidence

Photographs were taken immediately after the accident by attending airport staff. These show the towbar had disconnected from the aircraft, but that it was still attached to the front of the tug, and aligned approximately along the tug's centreline. The tug was located in front of the aircraft's left engine, aligned at an angle of 45° to the right of the engine centreline. The engine cowl had contacted the top edge of the tug, in line with its right rear wheel, and the tug was canted over to the left (looking towards the front of the tug).

Aircraft, tug and towbar damage

A large dent and a crease along the outside edge of the cowl, at the four o'clock position looking aft, was present on the aircraft's No1 engine nose cowling, together with an open crack along the circumference of the nose cowl leading edge where the cowl had distorted. Paint had been removed along the line of the crease and blue paint from the tug had transferred onto the cowling across the whole depth of the dent, Figure 3. The left nosewheel tyre tread exhibited a large cut and missing sections of tread. The towbar attachment bar on the front of the nose landing gear had been distorted.

A large section of scuffed paint was evident on the right rear bodywork above the rear wheel of the tug, but the tug was otherwise undamaged. A single shear bolt had failed on the towbar and the two lugs which clamp over the aircraft attachment bar had broken off.

Figure 3

Cowling damage

Tug and towbar details

The tug was a TMX100 model, manufactured by TLD. It weighed approximately 12.5 tonnes and had a drawbar pull (DBP) of 9,090 daN. It was last serviced on 4 September 2008, in accordance with a routine maintenance schedule. Its next scheduled service was due on the 18 November 2008. Both the tug and its tyres appeared to be in good condition, with no reported defects. Apart from the damage sustained in the accident, the towbar also appeared to be in good condition. This was last serviced on 22 October 2008.

Analysis

Operational analysis

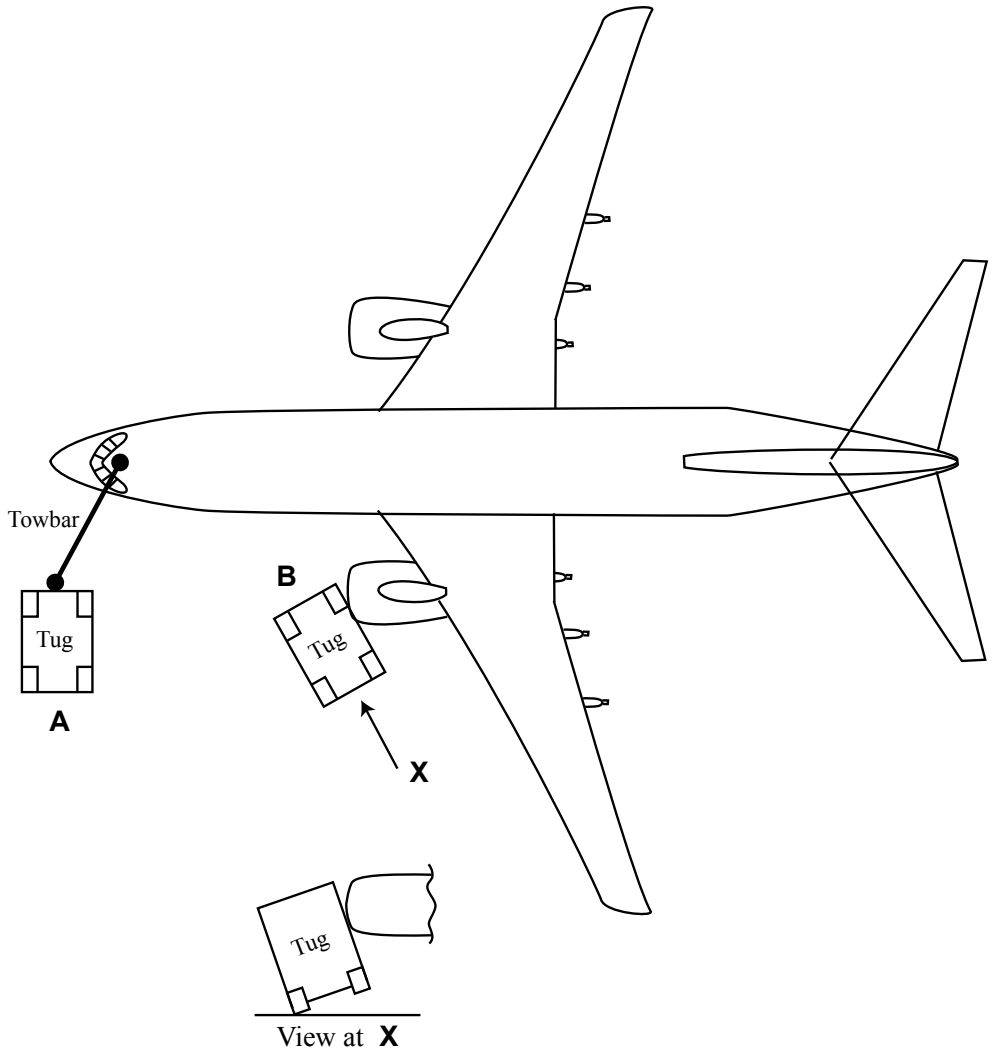
The attempted start of the No 2 engine during the pushback appears to have been initiated without either the headset operator or the commander originally having intended it to take place. Although the procedures of the ground handling company stated that cross-bleed starts were not to be carried out on pushback, the aircraft Operations Manual did not contain a similar instruction. It was the aircraft manufacturer's recommendation that operators should devise their own procedures for pushback and start, but guidance was given that the area behind the aircraft should be checked as clear.

The headset operator should have been aware that clearance was not to be given for a cross-bleed start until the pushback had been completed. It is most likely, therefore, that he had simply forgotten this when he gave the clearance. This, however, acted as a trigger for the commander to start the No 2 engine. Had it had been stated in the Operations Manual that cross-bleed starts were not to be made during pushback, the commander considered that he probably would not have done so.

The ground crew and the flight crew, because of their physical positions, had different perceptions of what was happening as the aircraft moved forward. The ground crew did not appreciate that the flight crew had very little information as to what was happening outside the aircraft so consequently, when they tried to give instructions, the words they used were not understood by the flight crew. When the commander asked for more information he did not get a response. The flight crew did not realise what had happened, leading the commander to question the ground crew instructions, because he did not want to carry out an inappropriate action, or to deprive the aircraft of electrical power under conditions of darkness.

Engineering analysis

Plotting of the ground markers identified that, in its final position, the aircraft was pointing approximately 30° to the left of the taxiway centreline, Figure 1. Although the pushback procedure used on this stand is known as a 'dogleg' pushback, the aircraft actually transcribes a path closer in shape to a letter 'S'. In order to achieve this, the tug faces almost at right angles to the centreline of the aircraft prior to the manoeuvre being completed, Figure 4. Given the angle of the towbar relative to the aircraft as a consequence of this manoeuvre, the tug would have been able to exert relatively little resistive force to the forward movement of the aircraft. The aircraft's nosewheels would also have been pushed to a high angle of turn at this point so, as the aircraft moved forward, the tyres skidded rather than rolled, leaving the ground marks observed. The tug driver vacated his cab, given its increasing proximity to the aircraft's operating engine, leaving the tug in the path of the oncoming aircraft. The left engine then contacted the side of the tug, rotating it and pushing it sideways. At this point, the pilot applied the brakes and stopped the aircraft.



A Approximate position of tug relative to the aircraft when the aircraft began to move forward

B Position of tug relative to the aircraft when the aircraft came to rest

Figure 4

Diagram showing the approximate relative positions of tug and aircraft

Attempting starts with 30 psi indicated pressure resulted in the 'hesitant' start of the right engine experienced by the crew during the two previous sectors. Analysis of the flight data for the accident shows that the left engine had achieved 51% N_1 during the aborted right engine start. This is consistent with an attempt to increase duct pressure sufficiently to prevent a repeat of the start problems experienced during the previous sectors, but does not appear to have been excessive. However, once the aircraft began to move forward the resistive force applied by the tug was acting almost perpendicular to the aircraft thrust line and quickly resulted in an overload of the towbar attachment. This removed any ability of the tug to prevent further forward movement of the aircraft. Although the tug in use was relatively lightweight and the taxiway conditions were wet, these were not considered to be significant contributory factors in this case.

Safety action

Since this event, the operator has added the following information to their Part-A - Operations Manual, Section 8.2.6.4.2:

*'Flight Crew shall **not** attempt to crossbleed start until:*

- *Pushback is complete, **and***
- *The park brake is set, **and***
- *The tug is disconnected, **and***
- *ATC clearance is obtained.'*

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 747-436, G-BNLA
No & Type of Engines:	4 Rolls-Royce RB211-524G2-19 turbofan engines
Year of Manufacture:	1989
Date & Time (UTC):	29 July 2009 at 0359 hrs
Location:	Heathrow Airport
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 19 Passengers - 237
Injuries:	Crew - None Passengers - None
Nature of Damage:	Minor damage to No 1 engine cowling.
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	57
Commander's Flying Experience:	19,569 hours (of which 6,831hours were on type) Last 90 days - 58 hours Last 28 days - 58 hours
Information Source:	AAIB Field Investigation

Synopsis

The aircraft was proceeding onto Stand 409 at London Heathrow Airport with the Aircraft Parking Information System (APIS) providing correct lateral guidance. The distance indication to the stopping point did not function and the aircraft passed 11 metres beyond its correct stopping point. A baggage container was incorrectly parked and was protruding into the stand area. The outboard cowling of the left outer engine contacted the container which caused superficial damage.

The APIS had not been activated but due to a wiring defect, the lateral guidance was illuminated which it should not have been.

History of the flight

The crew were scheduled to carry out a flight from London Heathrow to Singapore departing 25 July 2009 and returning to Heathrow, arriving 29 July. The flight crew consisted of four pilots divided into two crews, each crew comprising a captain and a co-pilot. The crew for the outbound flight were supported by the second crew to relieve them during their in-flight rest period. The relief crew is referred to as the 'heavy crew'. On the return flight, the outbound heavy crew became the operating crew for the sector.

Following the required 48-hour rest period in Singapore the aircraft departed after a short air traffic delay. After departure the heavy crew took their rest period for about four hours before relieving the operating crew

who took their rest for approximately six hours before returning to the flight deck. The heavy crew took a further two hours rest before rejoining the handling crew in the descent.

Shortly before the top of descent, the aircraft's Aircraft Communications and Automatic Reporting System (ACARS) was used to notify the company of the ETA at Heathrow and receive the parking stand allocation which was Stand 409. It was 18 months since the commander had parked at Terminal 4 and he consulted the Aerodrome Booklet, a document by the operator, to remind him of its use. Although information was available for stands at Terminal 5, there was no information included for stands at Terminal 4. As the commander was used to using different types of system, he was not overly concerned and decided to see what type of Stand Entry Guidance (SEG) was installed on arrival.

There was no air traffic delay on arrival at Heathrow and the aircraft landed on Runway 27R with the co-pilot as the handling pilot. He taxied the aircraft to Taxiway 'T' as instructed by ATC and handed control to the commander for the turn onto stand. The SEG system was the Aircraft Parking Information System (APIS) which provides lateral and distance-to-stop parking information displayed on illuminated boards when activated by the Turn Round Manager (TRM).

In accordance with the operator's procedures, the aircraft may only be turned onto the stand when the APIS is activated. At the distance at which the aircraft was turned onto the stand, this was most easily established by the illuminated lateral guidance board, which was clearly visible in the half light.

The TRM arrived on Stand 409 five minutes before the aircraft and inspected the area for obstructions. He noted that a number of metal baggage containers of the type loaded into aircraft holds were incorrectly parked and were protruding from the safe area. He attempted to contact Heathrow Airport Limited (HAL) Marshalling to get the equipment moved and also to provide a marshaller as he was not prepared to activate the APIS with the containers in position. He departed the stand to enter the terminal building to accomplish these tasks.

The commander, having taken control of the aircraft, made a visual check of the stand which appeared to be clear. He did not see the baggage container protruding onto the stand as it was probably hidden behind other vehicles and containers as he turned onto the stand. He noted that the APIS lateral guidance was illuminated and interpreted this as the system having been activated. He commenced the left turn onto the stand monitoring the lateral guidance which was functioning correctly.

The TRM, who was about to enter the terminal building and establish more details regarding the arriving aircraft, heard it taxiing onto the stand. He moved back onto the stand and approached the front left side of the aircraft and attempted to signal the commander to stop using his hands to form a cross above his head. There was no radio communication between the TRM and the flight deck. His signal was not seen by the commander and with the aircraft not stopping, the TRM ran around the front of the stand and activated the STOP button.

As the aircraft progressed along the centreline of the stand, the commander monitored the distance bar waiting for it to activate. He had not read the horizontal aircraft type bar and was surprised that although well onto the stand there was no indication of distance to go. He began to feel uneasy at the proximity to the terminal building and stopped the aircraft. This was coincident with the word STOP illuminating on the horizontal bar.

After the aircraft was shut down it was established that the forward left side of the No 1 engine cowling had contacted the baggage container which was protruding onto the stand. The resulting damage was a minor dent with an associated abrasion of the paintwork.

Aircraft Parking Information System (APIS)

When activated, the APIS SEG provides both lateral and distance guidance for parking on a stand. Figure 1 shows Stand 409 APIS with the information windows indicated.

System operation is as follows:

When the system is not activated:

- The upper alphanumeric display will show 'STND which is an abbreviation for Stand and the lower alphanumeric display will show the stand number, in this case, 409.

- The distance thermometer and azimuth guidance display will not be illuminated providing no indications.

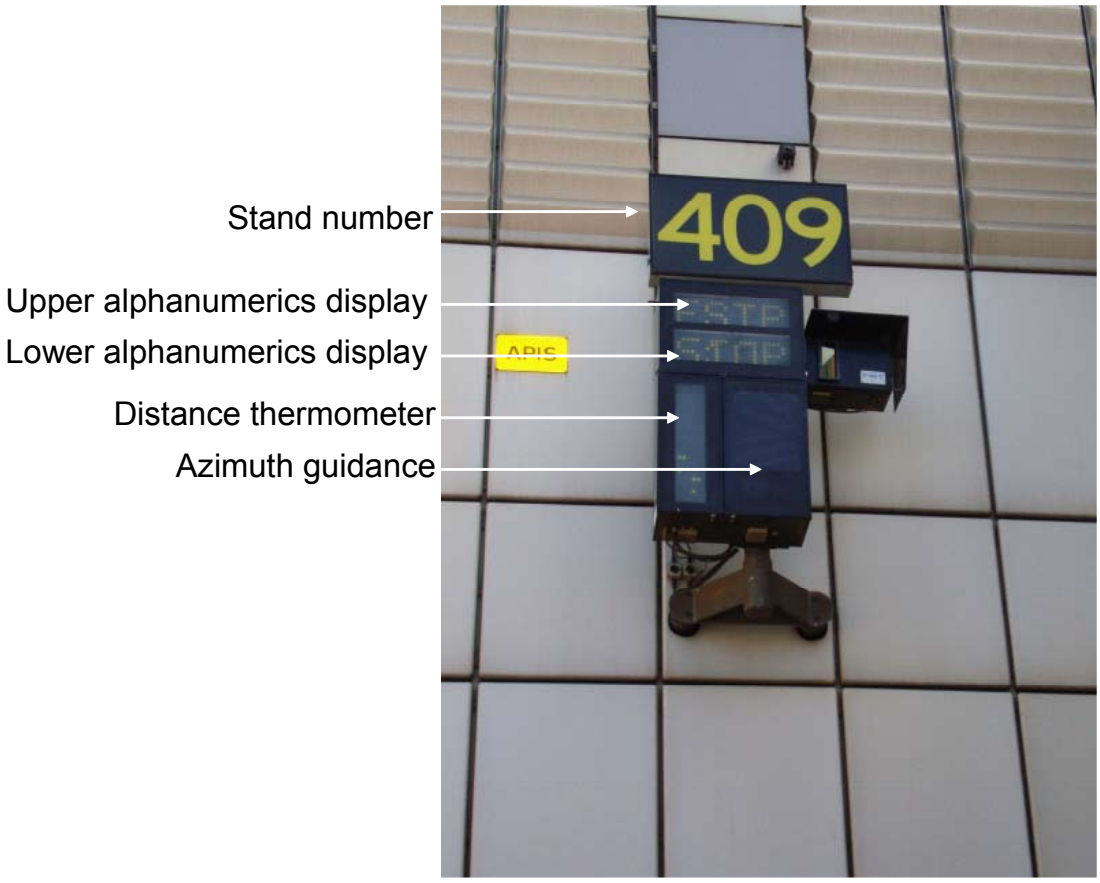


Figure 1

Stand 409 Aircraft Parking Information System (APIS)

When the system is activated:

- The upper alphanumeric display shows the aircraft type, in this case, B747.

- The closing rate thermometer panel will be fully illuminated.

- The azimuth guidance display shows the pilot black arrow heads indicating which direction to steer for the centreline. When the aircraft is properly aligned in azimuth, a black vertical bar will be displayed.

- At approximately 20 m, the system detects the aircraft and at about 17 m from the stop position, the closing rate thermometer lights will start to progressively extinguish from the bottom upwards, indicating the aircraft's movement towards the stop position. When this position is reached, the thermometer will be totally black and both the upper and lower alphanumeric displays will change to read 'STOP'.

Should the ground crew believe that the aircraft is in danger of overrunning its nosewheel stop position, they are to push a button which will immediately show the words 'ESTP' (emergency stop) on the upper and 'STOP' on the lower alphanumeric displays.

The APIS is one of four different stand entry guidance systems installed at London Heathrow Airport. The basic APIS fitted at Stand 409 was installed 15 years ago and is in the process of being replaced by a more up-to-date system.

The stand entry guidance systems are checked for correct operation every six months. This procedure did not include a visual check of the display to ensure that no elements were incorrectly illuminated. If a system is found to be unserviceable, the stand remains available but the system is not used and aircraft would be marshalled onto the stand.

A fault history of the APIS is recorded by the logic computer and this was downloaded for the investigation. It provided no record of when the fault which caused the lateral guidance board to remain illuminated when the system was de-activated. Further inspection of the faulty APIS showed that a wire in the lateral guidance module was defective and this caused the board to remain illuminated. It could not be established when the fault had occurred but there were no recorded reports of the problem.

Duties of the Turn Round Manager (TRM)

When the TRM arrives on the stand to meet an aircraft, he first checks that the stand is clear of obstructions. If the stand is clear he then activates the APIS by entering a code followed by the aircraft type. He visually checks the APIS in order to ensure that the correct aircraft type is displayed and that the lateral guidance is illuminated. He remains on the stand adjacent to the emergency stop button and monitors the progress of the aircraft onto the stand. Once the aircraft is safely parked and chocked, he moves onto the airbridge and positions it to the aircraft door. It was not part of the TRM's pre-activation check to see if any of the display panels were illuminated.

Aircraft parking Standard Operating Procedures (SOPs)

The operator provided comprehensive procedures in Part A of the Operations Manual for the entry onto a

stand and the parking of an aircraft. The procedures are set out below:

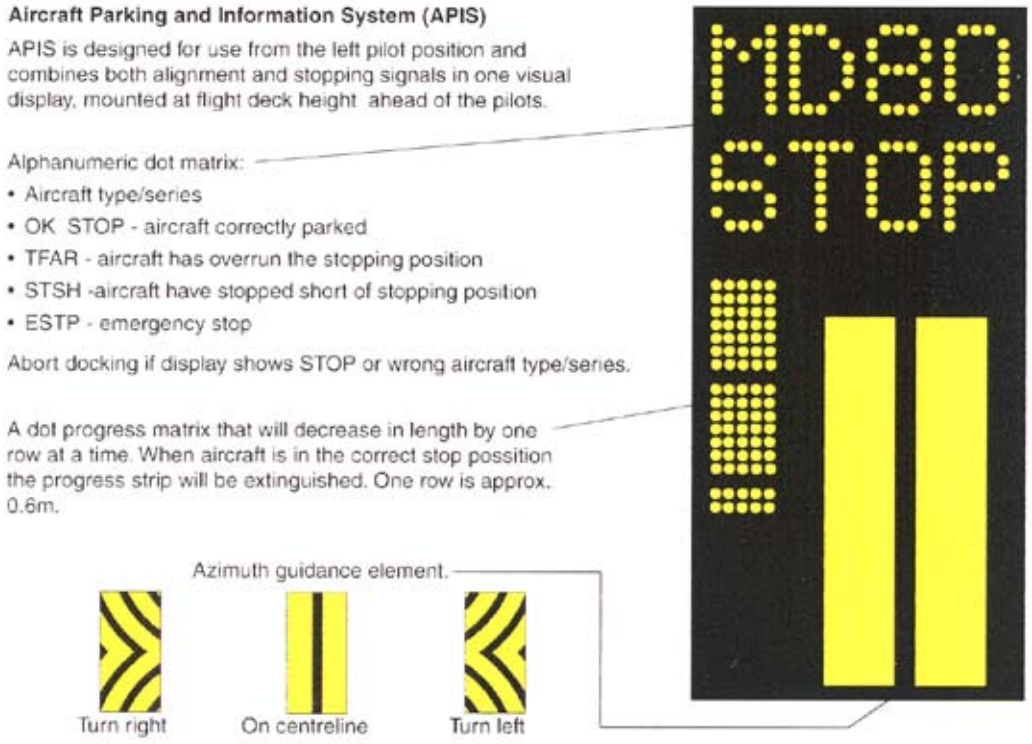
> ***'Ground Procedures***
>
> ***Parking on Stand; Azimuth and Stopping Guidance***
>
> *When approaching the assigned parking stand, Flight Crew must ensure that the stand is clear of all equipment so that the aeroplane may be parked safely.*
>
> *Different Stand Entry Guidance (SEG) systems may be encountered and are detailed in the applicable Aerodrome Booklet. The illumination or activation of any guidance system does not mean that the stand is clear for the aeroplane to be safely parked.*
>
> *If an aircraft cannot enter a stand, the aircraft should be brought to a halt. ATC (GMC) must be informed immediately of your position, ATC (GMC) acknowledgement received and marshalling assistance requested.*
>
> *Whenever a "dynamic" (e.g. APIS – Aircraft Position Is Detected) guidance system is employed on a stand, Flight Crew should ensure that the system is operating and indicating the correct aircraft type* ***before*** *final alignment onto the stand centreline.*
>
> *If the aircraft is already aligned and proceeding onto stand, before the system is correctly set, or if the guidance system fails after turning onto stand, stop and await marshalling assistance.*
>
> *Turning on and stopping short of the final stopping position, awaiting system activation, can lead to incorrect indications once the system operates, even if the correct aircraft type is subsequently displayed. After a failure it is possible for the system to provide false guidance information even if electronic guidance is restored.*
>
> *Whenever a STOP SHORT sign is displayed, the aeroplane should be taxied to a position just short of the airbridge and adjacent to the sign.*
>
> *If the tail of the aeroplane is likely to infringe the taxiway or airside road behind the aeroplane, ATC must be informed.*
>
> ***Additionally, within the UK (from UKAIP)***
>
> *Pilots must not enter the marked aircraft stand area unless the Stand Entry Guidance is illuminated or a marshaller has signalled clearance to proceed. An aircraft stand is normally delineated from the taxiway by a double white line'*

NB: Text in **bold** was included by the operator.

Information for the pilot interpretation of the APIS was contained in the aircraft library. It was not included in the Aerodrome Booklet but in the Aerodrome and Legend Specification booklet which is a separate document. The information is set out in Figure 2.

Airport Operations

Heathrow Airport Limited (HAL) is the airport operator and has programmes to identify and deal with safety issues. The problem of vehicles and equipment not being parked within designated areas is recognised. and handling agents have internal programmes for reminding staff of the importance of correct parking. If a handling agent fails to address parking violations, ultimately their licence to operate at Heathrow may be withdrawn.



Safety actions

Following the incident on Stand 409 involving G-BNLA, permission was given by AAIB for the operator to move the aircraft to a remote stand to inspect the damage. At this stage the problem with Stand 409 APIS had not been identified. The stand was used to park another aircraft, which was completed safely as the APIS was working normally. The fault was not identified until an inspection was made after that aircraft had departed the stand and the APIS was subsequently de-activated.

HAL then withdrew use of the APIS and following an internal investigation, changed the unit. It also undertook to inspect the remaining systems to ensure no others were defective. This would include a visual check of the display windows before the SEGS was activated to ensure they were indicating correctly. HAL has also undertaken to re-emphasise the need for vehicles and equipment to be correctly parked.

The aircraft operator carried out a review of Part A of their Flight Operations Manual and have updated the information relating to SEGS operation.

Analysis

The crew were properly licensed and qualified to conduct the flight and had received the required rest periods prior to and during the flight. Fatigue was not considered to be a contributory factor.

When Stand 409 was allocated to the aircraft for parking, the Commander wanted to establish what type of SEG system was installed. He believed this was included in the Aerodrome Booklet as stated in Part A of the Operations Manual and was surprised

that it only included those installed at Terminal 5. He was unaware that the information was in the Aerodrome and Legend Specification booklet and was therefore unable to remind himself of the operation of the APIS.

In accordance with SOPs, he checked the stand was clear before turning onto it but did not see the baggage container protruding onto the stand area. The commander considered that he was subject to confirmation bias in continuing to taxi because the lateral guidance element of the APIS was illuminated and indicating in the correct sense. Although he was aware of the text in the alpha numeric displays, he did not read either display This is critical to this type of guidance system because the correct aircraft type displayed confirms that the stand has been activated. If no aircraft type is displayed, the stand has not been activated and any illuminated guidance indicates a defective APIS.

If the baggage container had been correctly parked within the designated area, the contact with the engine cowling would not have occurred even though the aircraft overran its stop position.

SERIOUS INCIDENT

Aircraft Type and Registration:	Boeing 757-258, G-STRZ
No & Type of Engines:	2 Rolls-Royce RB211-535E4 turbofan engines
Year of Manufacture:	1997
Date & Time (UTC):	28 January 2009 at 2335 hrs
Location:	Following departure from Accra, Ghana
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 9 Passengers - 96
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	59 years
Commander's Flying Experience:	12, 000 hours (of which 3,500 were on type) Last 90 days - 45 hours Last 28 days - 30 hours
Information Source:	AAIB inquiries, company investigation reports and FDR data

Synopsis

The aircraft had a blocked pitot tube, causing an airspeed discrepancy, which was detected early during the takeoff roll. The commander decided to continue the takeoff and deal with the problem whilst airborne. After passing FL180 the crew selected the left Air Data switch to ALTN, believing this isolated the left Air Data Computer (ADC) from the Autopilot & Flight Director System (AFDS). Passing FL316, the VNAV mode became active and the Flight Management Computers (FMCs), which use the left ADC as their input of aircraft speed, sensed an overspeed condition and provided a pitch-up command to slow the aircraft. The co-pilot was concerned about the aircraft's behaviour and, after several verbal prompts to the commander, pushed the control column forward. The commander, uncertain as to what was failing, believed that a stick-pusher had activated. He disengaged the automatics and lowered the aircraft's nose, then handed over control to the co-pilot. A MAYDAY was declared and the aircraft returned to Accra. The operator's subsequent engineering investigation discovered the remains of a beetle-like creature in the left pitot system.

History of the flight

The aircraft commenced its takeoff roll from Accra, Ghana at 2334 hrs with the commander as PF. Before the '80 kt' call was made, the commander noticed that his ASI was not functioning. He elected to continue the

takeoff using the co-pilot's and standby ASIs, which appeared to be functioning normally, as he believed the weather conditions were suited to resolving the problem when airborne. The Engine Indication and Crew Alerting System (EICAS) messages, AIRSPEED UNRELIABLE, MACH/SPEED TRIM and RUDDER RATIO illuminated during the initial climb below 400 ft. The commander handed over control to the co-pilot who, at 1000 ft, called for the Vertical Navigation (VNAV) mode of the AFDS and the right autopilot (AP), to be engaged. During flap retraction the crew considered that the aircraft was not accelerating normally so the autopilot was disconnected and the aircraft flown manually.

The crew asked a company engineer on board the aircraft to assist them with diagnosing the airspeed problem. The right AP was re-engaged, and the QRH consulted. The crew considered that the pitch attitude and thrust were relatively normal for the stage of flight so left the AP, Auto-Throttle (AT) and Flight Directors (FD) engaged. The engineer advised the crew that the EICAS messages were displayed because the left Air Data Computer (ADC) was unserviceable; he had experienced the same defect on another company aircraft several months earlier when a bug had blocked the left pitot tube. On that occasion, the aircraft was flown without incident using the right AP until rectification could take place on the ground. In accordance with the QRH, the commander selected ALTN on the air data switch and believed that he had isolated the problem with the left ADC. He retook control of the aircraft and continued the climb with the right AP engaged using the Lateral Navigation (LNAV) and Flight Level Change (FLCH) modes.

The commander recalled selecting VNAV at about FL250. At approximately FL320, the co-pilot became aware that the aircraft's rate of climb had started to increase, and that the indicated airspeed was decreasing. He called "climb rate" and the commander attempted to select vertical speed (vs) mode and reduce the rate of climb to 1,500 ft per minute. The commander recalled that the Mode Control Panel (MCP) alternated between vs mode with a 4,000 fpm climb and altitude hold (alt hold) modes, but the aircraft's pitch attitude seemed normal. The co-pilot was now concerned with the situation and he urgently expressed concerns about the aircraft's deviations from the normal flight profile. As the AP did not appear to be following the MCP selections the co-pilot disconnected the AP and pushed forward on the control column to "increase the speed and prevent an increasing ROC (rate of climb)". He recalled calling out "I have it", but the commander had no recollection of this.

As the IAS reduced to approximately 250 kt, the commander noticed the control column move forward and he considered that a stick pusher must have activated[1]. He disconnected the AP and AT, moved the thrust levers forward, and pitched the aircraft to 3-5 degrees nose-down. Even with the AP and AT out, and the speed increasing through 245 kt, the commander could feel the control column was being pushed forward. He became aware that the co-pilot was on the controls and handed control to him while he transmitted a MAYDAY. A nearby aircraft observed from its Traffic Collision Avoidance System (TCAS) that G-STRZ's indicated level was FL310. The FD's were disengaged and the aircraft returned to Accra with the co-pilot flying. As the aircraft neared Accra, and appeared to be operating normally, the MAYDAY was downgraded to

Footnote

[1] The Boeing 757 aircraft is not fitted with a stick pusher but the commander had previously flown an aircraft which had been fitted with a stick pusher

a PAN and the commander flew an uneventful approach and overweight landing.

Engineering investigation

The operator's engineers performed the engineering investigation and they found the remains of a "beetle-like creature" in the left-hand pitot system. No faults were found with the ADC, the autopilots, or any of the relevant systems.

Flight Control Computer (FCC) and FMC air data source selection

The FCCs select an air data source based on the AFDS engagement status. The FCCs use air data from the right ADC whenever the right AP is engaged in command (or first-in-command for multi-channel operation), or when only the co-pilot's FD is switched ON. Otherwise, the FCCs use air data from the left ADC. If a failure is detected on the selected ADC source, the FCCs will automatically switch to the alternate source.

In FLCH mode, the FCCs provide pitch commands to maintain the airspeed selected on the MCP. During VNAV climb operations, the FCCs provide pitch commands to maintain the speed required by the FMC.

The FMCs use data from the left ADC unless a failure has been detected, in which case the FMCs use data from the right ADC. The ADC may not determine a blockage in the pitot system to be a system failure.

Company SOPs during the takeoff roll

The company SOPs state that once the takeoff has commenced, the crew should only stop in the event of certain specific malfunctions, or if the captain decides to stop. The captain is given the additional guidance:

> '*that up to 80kts, the take-off may be rejected for any significant malfunction. At or above 80kts the take-off should be rejected only for major malfunctions.*'

There is no specific guidance in the SOPs on what to do should the ASIs disagree.

Flight Data Recording

The aircraft was fitted with a Cockpit Voice Recorder (CVR), a Flight Data Recorder (FDR) and a Quick Access Recorder (QAR). By the time the event was notified, the CVR recordings had been overwritten. The FDR and QAR contained the same data set which was used, with the assistance of the aircraft manufacturer, to provide further analysis of the event. This showed that during the initial part of the takeoff, the captain's computed indicated airspeed lagged behind ground speed. At rotation, the ADC computed airspeed was 70 kt, and the ground speed was 155 kt.

As the aircraft altitude increased, the captain's computed airspeed began to rise because the pitot pressure, trapped in the blocked pitot tube, remained constant whilst the static pressure decreased with altitude. This caused the ASI to initially under-read, then over-read at altitude.

When the aircraft climbed through 8,000 ft, the right autopilot channel was selected. This caused the FCCs to use air data from the right ADC. The AFDS FLCH mode was active during this time, and should have operated normally using air data from the right ADC. Passing 18,150 ft in the climb, his alternate air data source was selected, and the captain's computed airspeed dropped from 350 kt to 280 kt. The alternate air data source remained selected for the remainder of the flight.

As the aircraft climbed through 31,600 ft, the AFDS VNAV mode became active. Because the FMCs were using left ADC data, the they sensed an overspeed condition and provided a pitch-up command to reduce the airspeed. When the aircraft climbed through 32,500 ft, vertical speed mode became active with an initial climb rate of 4,000 fpm. Immediately afterward, the AFDS transitioned to altitude capture. The flight data recorder does not indicate the MCP selected altitude, but Boeing considered it likely that the altitude capture criteria was satisfied, which caused the AFDS to transition to altitude capture. Shortly after the transition to altitude capture, the autopilot was disconnected and the aircraft was manually pitched nose-down. The maximum rate of descent recorded was 6,919 fpm.

Previous Occurrences

In February 1996 a Boeing 757 struck the sea off the coast of the Dominican Republic about 5 minutes after take off from the Gregorio Luperon International Airport in Puerto Plata. The aircraft was destroyed and all 189 occupants were fatally injured. The report into the cause of that accident stated that:

> *'confusion of the flight crew occurred due to the erroneous indication of an increase in airspeed.'*

The erroneous airspeed indications were caused by an obstruction of the aircraft's left upper pitot tube.

In October 1996 a Boeing 757 struck the Pacific Ocean off the coast of Lima, Peru, about 30 minutes after takeoff from Jorge Chavez International Airport in Lima on a night flight to Santiago, Chile. The aircraft was destroyed and all 70 occupants were fatally injured. The flight crew had realised immediately after takeoff that their altimeters and airspeed indicators were not providing correct information and had declared an emergency, but they were unable to land the aircraft safely. The probable cause of this accident was blocked static ports.

Comment

The company have amended their engineering procedures to include the fitting of pitot covers and blanks when the aircraft is on the ground during long turnarounds.

While the previously mentioned accidents and this incident are clearly different events, they demonstrate that flying a large aircraft with unreliable instruments is demanding, and crews can become 'task saturated'. There were times during this flight where the flightcrew were confused as to what was happening. In this incident, the commander recognised a failure of his ASI before 80 kt and the takeoff could have been safely rejected. Instead, he continued the takeoff using the co-pilot's and standby ASIs and encountered a number of related emergencies. These eventually led to the declaration of a MAYDAY and return to the departure airfield. Although the commander considered that conditions were suitable for resolving the problem when airborne, a low speed rejected takeoff would have been more appropriate in these circumstances.

As a result of this incident, the company has implemented refresher training for its pilots on the AFDS, its modes, and operation. A blocked pitot tube event is also included as a part of their simulator recurrent training. The company now advise their crews to reject the takeoff if the problem is recognised at speeds below 80 kt.

ACCIDENT

Aircraft Type and Registration:	Acrosport 2, G-NEGG
No & Type of Engines:	1 Lycoming O-360-A4M piston engine
Year of Manufacture:	1992
Date & Time (UTC):	14 June 2009 at 1410 hrs
Location:	1 km from Bidford Airfield, Warwickshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Serious) Passengers - N/A
Nature of Damage:	Damage to propeller, landing gear, wings and fuselage structure, possibly beyond economic repair
Commander's Licence:	Private Pilot's Licence
Commander's Age:	60 years
Commander's Flying Experience:	469 hours (of which 8 were on type) Last 90 days - 3 hours Last 28 days - 0 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Following a normal takeoff, the engine began to lose power and the pilot had to make a forced landing in a field of barley. The aircraft was seriously damaged and the pilot suffered a head injury.

History of the flight

The pilot intended to undertake a local flight of about 30 minutes duration. After all pre-flight, pre-start and post-start checks had been performed from a printed checklist, with no abnormalities noted, he taxied approximately 250 yards to the normal run-up area for the power checks. Nothing unusual was noted during these checks so he taxied a further 50 yards to the threshold of grass Runway 24 and commenced the takeoff roll.

Using his normal procedure, the pilot opened the throttle smoothly to full power and raised the tail as speed built up. However, as the aircraft climbed away, he felt that it was not climbing at its usual rate. He checked that full throttle was applied and entered a shallow left turn with the intention of flying a truncated circuit to land back on Runway 24. He recalled that the power seemed to reduce further and that it appeared that a circuit would be unachievable, so he straightened up and attempted to climb straight ahead to gain what height he could. The power seemed to reduce further and he was left with no option but to lower the nose and look for a suitable field for a forced landing. This was made difficult by the combination of low height (estimated to be about

200-300 feet), poor visibility over the nose and a steep glide angle, but a field of barley about 1 metre high was selected.

The pilot remembers nothing about the subsequent forced landing or evacuation and only recalls knocking on a farmhouse door for assistance about 100 metres from the aircraft. From the pilot's statement and examination of photographs of the accident site, it appears that the aircraft struck the field at slow speed and came to rest rapidly, tearing off the main landing gear. However it remained upright and he struck his head on the windscreen or coaming due to the abrupt deceleration in the tall crop.

A video of the accident taxi-out and takeoff was taken by the pilot's wife. The audio track suggests that the engine was not developing full RPM during the takeoff roll and confirms the pilot's account that the engine note gradually reduced but did not stop during the climb-out, which was noticeably shallow for an aircraft of this performance. The video ceases as the pilot straightened up from the left crosswind turn. He makes the observation that he was wearing a new active noise reduction headset which produced an unfamiliar sound of the engine to his ears and, had he been wearing his normal conventional headset, he might have been aware earlier that the engine was not producing full power.

Subsequent limited examination of the aircraft did not reveal any pre-impact damage but did show that the spark plugs associated with the left magneto were very sooty. The owner of the aircraft intends to salvage the engine and will report to the AAIB any problems discovered with the magneto or the engine during overhaul.

ACCIDENT

Aircraft Type and Registration:	Aero AT3 R100, G-SBRK
No & Type of Engines:	1 Rotax 912-S2 piston engine
Year of Manufacture:	2007
Date & Time (UTC):	15 August 2009 at 1000 hrs
Location:	Halton Airfield, Buckinghamshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to nosewheel, left wing and propeller
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	57 years
Commander's Flying Experience:	57 hours (of which 24 were on type) Last 90 days - 10 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft was flying from Sywell, Northhamptonshire, to Bembridge, Isle of Wight, in company with two other AT3 aircraft. At the time the pilots planned the flight, the weather was suitable; however, as the aircraft passed to the south of Aylesbury and over the Chiltern Hills, they encountered rain and low cloud. A decision was made to divert, initially to Wycombe Air Park but, as the conditions worsened, this was changed to Halton. The aircraft became separated from each other due to the poor visibility but the pilot of G-SBRK could see the other AT3 aircraft on final approach into Halton. He joined the circuit and made a normal approach to land on Runway 20. However, the aircraft touched down on the nose landing gear, which collapsed, causing damage to the propeller and the left wing, coming to rest on the runway. Both occupants were able to exit the aircraft normally.

The pilot subsequently considered that he had allowed the airspeed to drop too low on final approach, and that he should have carried out a go-around. He also considered that he may have been distracted on the approach by the other aircraft, which were in the process of vacating the runway, rather than monitoring his airspeed.

ACCIDENT

Aircraft Type and Registration:	DA 42 Twin Star, G-PETS
No & Type of Engines:	2 Thielert TAE 125-01 piston engines
Year of Manufacture:	2006
Date & Time (UTC):	8 August 2009 at 1412 hrs
Location:	Jersey Airport, Channel Islands
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Slight scuffing of left winglet of G-PETS and crushed wingtip fairing, and three foot slit in underwing surface of a stationary aircraft
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	82 years
Commander's Flying Experience:	13,050 hours (of which 90 were on type) Last 90 days - 43 hours Last 28 days - 18 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

While taxiing out for an instructional flight, with the student at the controls, the aircraft's left winglet struck a stationary aircraft. Just before the collision the instructor had momentarily diverted his attention from monitoring the student and the aircraft's progress to write down the aircraft's off-chocks time. Neither occupant was injured.

Background information

Visiting light aircraft are parked on the grass at the end of a paved track that passes in front of the Aero Club at Jersey Airport. Parking in front of the Aero Club is for Club members only. The stationary aircraft was visiting Jersey for a few hours but was parked in front of the Aero Club approximately in line with other aircraft.

The UK Aeronautical Information Publication (AIP) states the following in the section on Jersey Airport:

> ***'2 Ground Movement***
>
> *The (block paved) access track from the east of Holding point Hotel to the grass parking area at the Aero Club has not been formally designated by the Airport Authority as a taxiway. The access track does not comply with the criteria for a*

taxiway contained in CAP 168. Therefore, the painted centre-line is only provided for assistance and does not offer the usual clearances either side of the access track that would normally be associated with a taxiway. It is most important that pilots exercise caution when using this access track to ensure that they have suitable wing tip clearance on each side.'

The commercially available airfield charts which the occupants were using at the time contain the following warning:

'Pilots are to exercise caution when using access track from the East of holding point H to the grass parking area to ensure that they have suitable wing tip clearance on each side.'

History of the flight

The instructor stated that he was planning on flying the second instructional flight of the day for an experienced qualified pilot who occupied the left seat. Having received clearance from Jersey ATC to taxi to Holding Point Golf, the student taxied the aircraft from the visiting light aircraft park. The aircraft park was full and the instructor closely monitored the student and the aircraft's progress until it had exited the parking area and was on the paved track that passes the Aero Club en route to Taxiway Alpha.

Once the aircraft was on the access track, he briefly diverted his attention to record the aircraft's off-chocks time just as the collision occurred. The top of the winglet of the left wing had struck the underside of the right wing of a parked aircraft.

After the collision both occupants vacated the aircraft uninjured without informing ATC of the accident. As the Tower controller was unable to raise the pilot of G-PETS on the radio, he sought assistance from another taxiing aircraft to establish what had happened. He subsequently activated an Aircraft Ground Incident.

The instructor stated that he had not read the notes about the access track on the airfield chart or in the AIP and that the lesson learned "when the aircraft is on the ground is not to write notes at all while it is moving".

ACCIDENT

Aircraft Type and Registration:	Denney Kitfox Mk 2, G-BXBP
No & Type of Engines:	1 Jabiru Aircraft Pty 2200A piston engine
Year of Manufacture:	2001
Date & Time (UTC):	10 July 2009 at 1505 hrs
Location:	Jackrells Farm Airfield, West Sussex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Minor)
Nature of Damage:	Damage to nose, propeller, spinner, landing gear and left wing
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	51 years
Commander's Flying Experience:	158 hours (of which 12 were on type) Last 90 days - 12 hours Last 28 days - 12 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

On the morning of the accident day, the pilot had carried out circuit practice at Bembridge with an instructor in order to complete his tailwheel familiarisation and conversion training on the Kitfox. He then returned to his base at Jackrells Farm and later that day planned a local flight with a passenger. He completed the pre-flight checks and lined up on Runway 21. The wind was 4 kt to 7 kt from a direction of 240°. As the pilot advanced the throttle the aircraft accelerated but as it did so, it began to drift towards the left side of the runway. The pilot applied right rudder to correct the drift and rotated. He did not have time to look at the airspeed as the aircraft became airborne in a wings level attitude and began to climb. The pilot then became aware that he was heading towards a line of trees located to the right of the runway. He recalled that he yawed the aircraft to the left, but the aircraft immediately stalled, descended and hit the ground in a left wing-down attitude. As the pilot was unable to open the left door due to structural damage, he exited the aircraft via the right door.

The pilot subsequently considered that the initial application of power was excessive, with the tail still on the ground, and this had caused the aircraft to yaw left. Furthermore, the application of right rudder was an overcorrection and the aircraft became airborne prematurely with a high pitch attitude whilst yawing to the right. He was then distracted by the possibility of impact with the trees and had allowed the aircraft to stall from a height of between 30 ft and 50 ft.

ACCIDENT

Aircraft Type and Registration:	DH82A Tiger Moth, G-APAP
No & Type of Engines:	1 De Havilland Gipsy Major I piston engine
Year of Manufacture:	1940
Date & Time (UTC):	24 June 2009 at 1420 hrs
Location:	Henlow Airfield, Bedfordshire
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Right lower wing damaged
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	62 years
Commander's Flying Experience:	6,300 hours (of which 1,010 were on type) Last 90 days - 48 hours Last 28 days - 28 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The examiner, who was sat in the front seat of the Tiger Moth, was undertaking a renewal flight for the student's lapsed SSEA[1] NPPL rating. The surface wind was from approximately 090° at less than 10 kt and Runway 09 was in use. Aircraft taxiing from the parking area to Runway 09 normally use a taxiway that runs along the left side of Runway 31 but as a large model aircraft and a car were parked on the taxiway, the student had to taxi along Runway 31. The taxi was uneventful until they approached the parked car, when the aircraft veered to the right and departed the runway. The examiner saw a hay bale, which he thought would be hit by the left wing, and took control of the aircraft, steering it to the right. He then observed a second hay bale, which was not an immediate threat to the aircraft, and after clearing the first bale he steered to the left to position the aircraft back onto the runway. During this manoeuvre the aircraft struck a third bale that had been obscured from his view by the right wing.

The examiner and student believe that the accident occurred because they had been distracted by the car and model aircraft parked on the taxiway.

Footnote

[1] Simple Single-engine Aircraft.

ACCIDENT

Aircraft Type and Registration:	Europa XS, G-CEMI
No & Type of Engines:	1 Rotax 912ULS piston engine
Year of Manufacture:	2009
Date & Time (UTC):	5 September 2009 at 1045 hrs
Location:	Gloucestershire Airport, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damaged propeller and nose leg
Commander's Licence:	Private Pilot's Licence
Commander's Age:	67 years
Commander's Flying Experience:	320 hours (of which 42 were on type) Last 90 days - 4 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Following an uneventful flight and approach to Runway 22 at Gloucestershire Airport, the aircraft initially landed on its main wheels but when the nose was lowered the aircraft became airborne again. This took the pilot by surprise and he attempted to apply power for a go-around, but the aircraft landed again on its nosewheel and bounced, followed by a heavy landing on all three landing gear legs. During this landing the propeller struck the ground and the nose leg was damaged. The pilot was uninjured and was able to exit the aircraft normally. The wind at the time was from 240° at 7 kt.

The pilot stated that, in his opinion, he had probably flared slightly late and as a result the aircraft's speed was still high at touchdown, leading to a bounce and the aircraft becoming airborne again. As the bounce was unexpected the pilot assessed that his reactions were not quick enough to initiate a go-around before the aircraft touched down again, this time on its nosewheel.

ACCIDENT

Aircraft Type and Registration:	Grumman AA-5B Tiger, G-BFXW
No & Type of Engines:	1 Lycoming O-360-A4K piston engine
Year of Manufacture:	1978
Date & Time (UTC):	21 August 2009 at 1530 hrs
Location:	Cromer Airfield, Norfolk
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to propeller, nose and main landing gear, engine shock-loaded
Commander's Licence:	Private Pilot's Licence
Commander's Age:	61 years
Commander's Flying Experience:	567 hours (of which 344 were on type) Last 90 days - 20 hours Last 28 days - 9 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The aircraft was on approach to Runway 22 at Cromer Airfield, with full flaps deployed and at an airspeed of 65 kt. The wind was 270°/10 kt. The aircraft had just crossed over a railway line located 125 m from the displaced threshold when it descended rapidly, hitting the ground in a nose-up attitude. It bounced forward onto the nose, striking the propeller on the ground and collapsing the nose landing gear. The pilot reported that there was no time to apply power and he did not recall hearing the stall warning. The aircraft came to rest just before the displaced threshold.

The pilot considered that the aircraft may have been affected by turbulence from a passing train.

ACCIDENT

Aircraft Type and Registration:	Isaacs Fury II, G-BZAS
No & Type of Engines:	1 Canadian Air Motive Cam 100 piston engine
Year of Manufacture:	2000
Date & Time (UTC):	11 August 2009 at 1210 hrs
Location:	Little Rissington Airfield, Gloucestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Substantial
Commander's Licence:	Private Pilot's Licence
Commander's Age:	47 years
Commander's Flying Experience:	531 hours (of which 1 was on type) Last 90 days - 7 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot lost control of the aircraft during landing and it departed the runway, coming to rest inverted. He was uninjured and was able to vacate the aircraft unaided. The pilot, who is experienced on other tailwheel aircraft, commented that the varying wind direction and his unfamiliarity with this aircraft type were contributory factors. Although he usually wore a helmet, he did not on this occasion, as the microphone on his helmet was unserviceable. He considered himself fortunate to have escaped injury and he intends to wear a helmet in future whenever flying in open cockpit aircraft.

ACCIDENT

Aircraft Type and Registration:	Mickleburgh L107, G-BZVC
No & Type of Engines:	1 Martlet VW 1824 piston engine
Year of Manufacture:	2006
Date & Time (UTC):	21 February 2009 at 1053 hrs
Location:	Fenland Airfield, near Spalding, Lincolnshire
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:	FAA Private Pilot's Licence
Commander's Age:	69 years
Commander's Flying Experience:	242 hours (of which 95 were on type) Last 90 days - 1 hour Last 28 days - 35 minutes
Information Source:	AAIB Field Investigation

Synopsis

Shorty after a normal takeoff, at a height of between 400 ft and 700 ft, the aircraft was seen to enter a steep left turn. When asked by the aerodrome Flight Information Service officer (FISO) what his intentions were, the pilot responded with a MAYDAY transmission, stating that he intended to land back at the airfield. After starting to turn to line up with Runway 36, the aircraft was seen to enter a spin to the left and strike the ground. It was determined that a fault existed within the carburettor air heat mechanism which, under the prevailing conditions, may have led to a loss of engine power due to serious carburettor icing.

History of the flight

The pilot towed his aircraft in its trailer to Fenland Airfield, where he rigged it for flight. He talked to staff at the aerodrome, before walking out to inspect the runways and assess their suitability for use. The weather was fine, with a westerly wind of around 10 kt, clear skies, a temperature of 9°C, and a dewpoint of 5°C. He booked out for a flight to Tibenham in Norfolk, started his aircraft, and taxied for departure.

Witnesses observed that he taxied "quite fast", and the FISO on duty commented that he did not stop at the Bravo holding position as instructed, but taxied to the end of Runway 26, before reporting ready for departure. The FISO took no action as there was no other traffic in the vicinity. The pilot was cleared to take off at his

discretion, and the aircraft became airborne before the intersection of Runways 26 and 18/36.

The aircraft climbed normally until, at a height estimated by witnesses of between 400 and 700 ft, it entered a steep left turn which brought the aircraft onto the crosswind leg. The FISO asked the pilot what his intentions were, and the pilot responded with a MAYDAY call, stating that he intended to land on Runway 36. He did not report the nature of his difficulty. Witnesses stated that the left turn was either level or the aircraft was climbing slightly during the turn, and that it appeared controlled.

The FISO activated the crash alarm and the fire crew made their way to their vehicle. The aircraft began a turn onto the final approach for Runway 36, but flew through the extended centreline. Witnesses then saw the aircraft stall and enter a spin, which lasted perhaps two or three turns, before the aircraft struck the ground. The fire and rescue vehicle arrived very promptly, but the pilot had sustained fatal injuries in the impact. There was no post-crash fire.

Pilot's history

The pilot had learnt to fly in America in 1991/2 and gained an FAA PPL. He had undertaken the required Biennial Flight Reviews to retain currency, and the instructor with whom he had flown most recently recalled that there was nothing remarkable about the review flight.

Aircraft information

The pilot had both designed and built the aircraft. The process had been overseen by an inspector from the Popular Flying Association (now the Light Aircraft Association), who ensured that the required construction standards were achieved. The aircraft was then tested by an experienced test pilot, who commented in his report that:

> *'the aircraft is well suited for the issue of Permit to Fly… it has no untoward handling or performance characteristics and should be capable of being flown in a safe manner by an average PPL [holder].'*

With regard to stalling, he stated that:

> *'Airframe buffet is present and increases as the stall approaches commencing around five knots prior to the stall.'*

and that:

> *'Incipient spinning behaviour with immediate recovery action at the wing drop was totally innocuous.'*

The accident site

The accident site was in a field approximately 275 metres from the southern end of Runway 18 at Fenland Airfield. The area between the accident site and the airfield consisted of a flat agricultural field, separated from the airfield by a wide drainage ditch edged by a low sparse hedge, aligned in an east/west direction. The land to the west, south and east of the accident site consisted of large flat agricultural fields interspersed with farm buildings, occasional large trees, small roads and numerous wide drainage ditches.

Information given by some local pilots indicated that the fields surrounding the airfield may not have been suitable for a forced landing as, at the time of the accident, they were waterlogged.

Examination of the accident site showed that all parts of the aircraft were present. The aircraft's initial impact with the ground was with the lower engine cowling, left landing gear wheel and left wing tip. At the time of this initial impact it is estimated that the aircraft was on a heading of about 014°, flying at a speed in the region of 30 kt with a relatively high rate of descent, pitched nose down by about 35°, banked to the left and spinning to the left. After the initial impact, the forward part of the aircraft came to an almost instant halt whilst the rear of the fuselage continued downwards and to the right, causing it to break in the cockpit area, just to the rear of the main landing gear to fuselage attachment.

There was very good evidence that the propeller was not rotating at the time of the impact. The fuel tank was empty, but this had been ruptured in the impact in a manner which would have allowed any fuel to drain away. A slight smell of fuel was apparent around the wreckage.

The fuel cock and the engine ignition switches were found in the ON position. The engine throttle control was found in the idle position and the carburettor air hot/cold control was in the partial hot air position. The lock mechanism on this control was found to be disengaged. No fire occurred and there was no evidence of an airborne collision.

Engineering examination

A detailed examination of the flying control system found no evidence of pre-impact disconnection or restriction. There were witness marks to indicate that, at impact, the ailerons were at the full right wing-down position, the elevator was almost at the full aircraft nose-down position and the rudder was possibly at the full nose-right position. The wing flaps were found to be fully extended.

Examination of the five point seat harness found that the stitching of the strap material of the upper right torso restraint at the rear attachment to the fuselage fitting, had failed. This failure was consistent with having occurred in the impact and was attributed to the poor quality of the stitching.

The engine and engine systems were examined and no pre-impact fault or failure was found, except for the carburettor hot air system,

The carburettor hot air system provides engine-generated warm air to the carburettor air intake, to prevent or remove ice build-up within the carburettor's venturi. Attached to the carburettor's air intake is a hot/cold air box which has two inlets: one draws in ambient air and the other air warmed by the engine exhaust system. Inside the hot/cold air box is a moveable flap which controls the amount of warm and cold air that enters the carburettor's air intake. The position of the movable flap is controlled manually by the pilot from the cockpit.

The carburettor hot/cold air box on this aircraft was constructed from two 'U' shaped rectangular lightweight composite channels, mounted one over the other to form a rectangular box, and held together using two plastic ties, Figure 1.

The movable flap was located inside the upper channel section and attached to a round metal rod which formed the pivot for the flap, mounted across the inside of the section. An operating lever arm was located at one end of the rod and secured by the clamping action of a small screw. A spring attached to the lever arm biased the moveable flap towards the cold air position. The Bowden cable from the carburettor heat control in the cockpit was attached at the end of the lever arm, Figure 2.

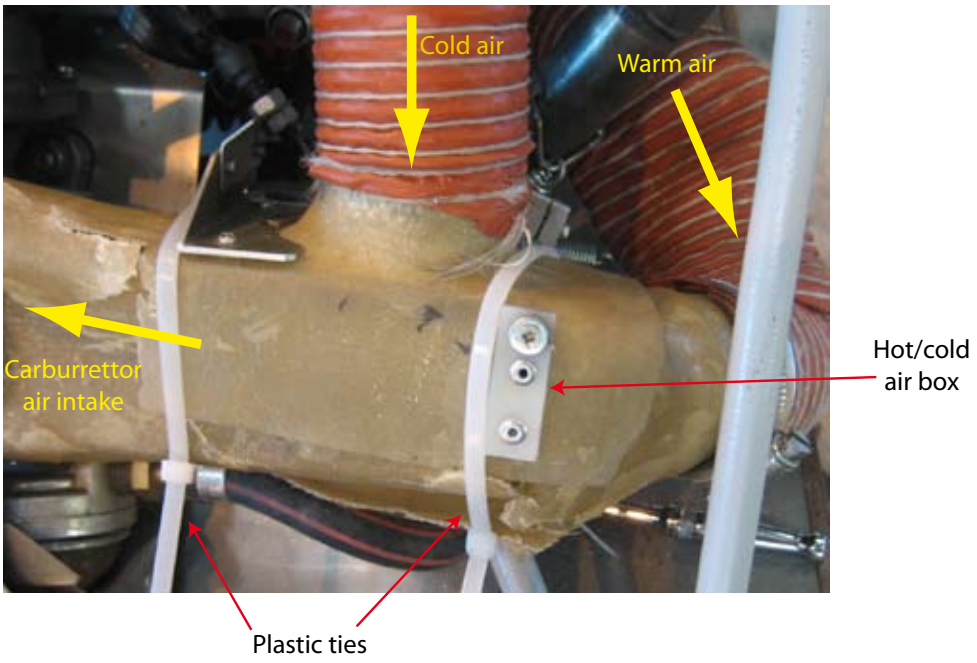


Figure 1

Carburrettor hot/cold air system

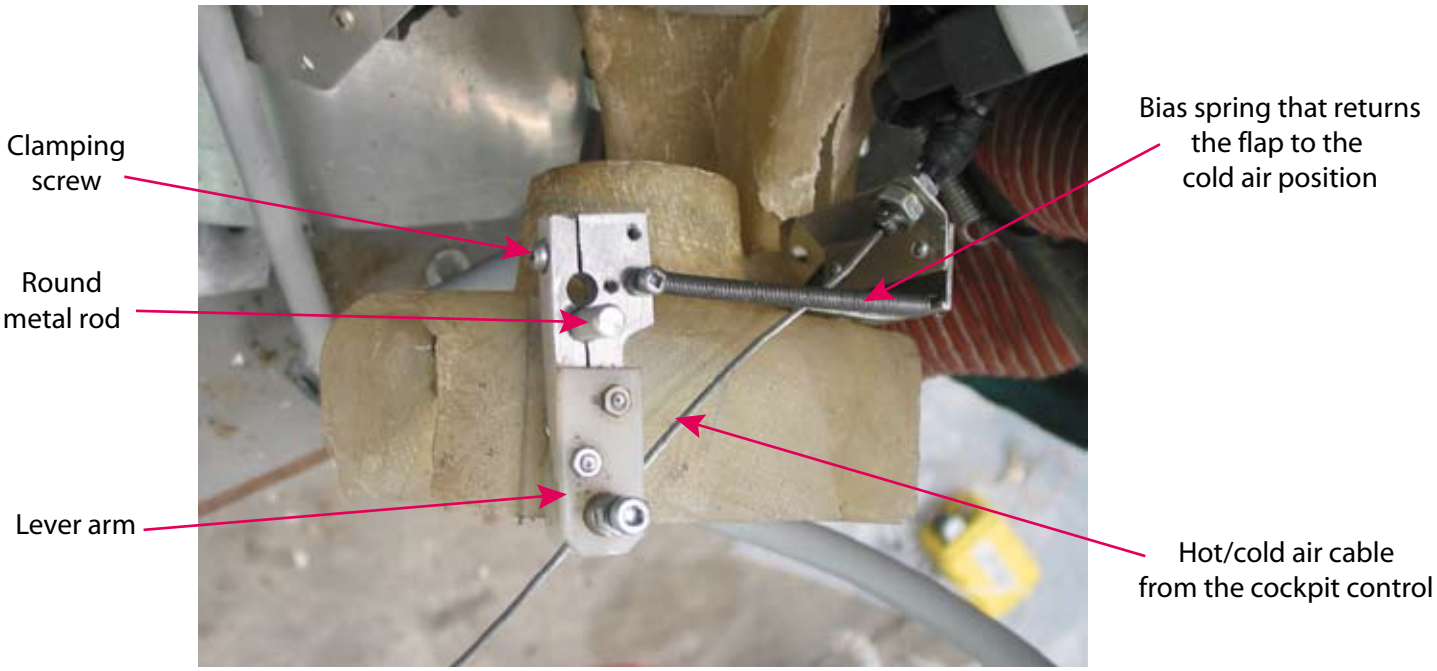


Figure 2

Hot/cold air lever arm mechanism

Examination of the system showed that, although all the components were connected, the lever arm was loose on the flap pivot rod. When the two 'U' shaped channels were separated it was seen that the movable flap was in the cold air position and was catching against one side of the lower 'U' channel, tending to cause the flap to stick in the cold air position. There was good evidence that the movable flap had been rubbing against the inside of the lower 'U' channel over its full range of travel for a considerable period of time. Detailed examination of the lever arm to metal rod connection showed that the arm had become loose as a result of the flap interference with lower 'U' channel, Figure 3.

Meteorology

The Chief Flying Instructor at Fenland described experiencing significant carburettor icing during a flight in a Cessna 152 prior to the time of the accident. He stated that, when he carried out the engine power checks, …"On selecting hot air, the engine speed rose by more than 500 rpm, so there was quite significant carburettor icing building up."

Carburettor icing probability

A weather aftercast was obtained from the Met Office for the Fenland Airfield area for the mid-to-late morning of 21 February which specifically gave air temperature, dew point and humidity from the surface to 1,000 ft. When these figures were plotted on the Civil Aviation Authority's Carburettor Icing Prediction Chart, Figure 4, they gave a prognosis that serious carburettor icing could occur at any power setting between the surface and 1,000 ft above sea level.

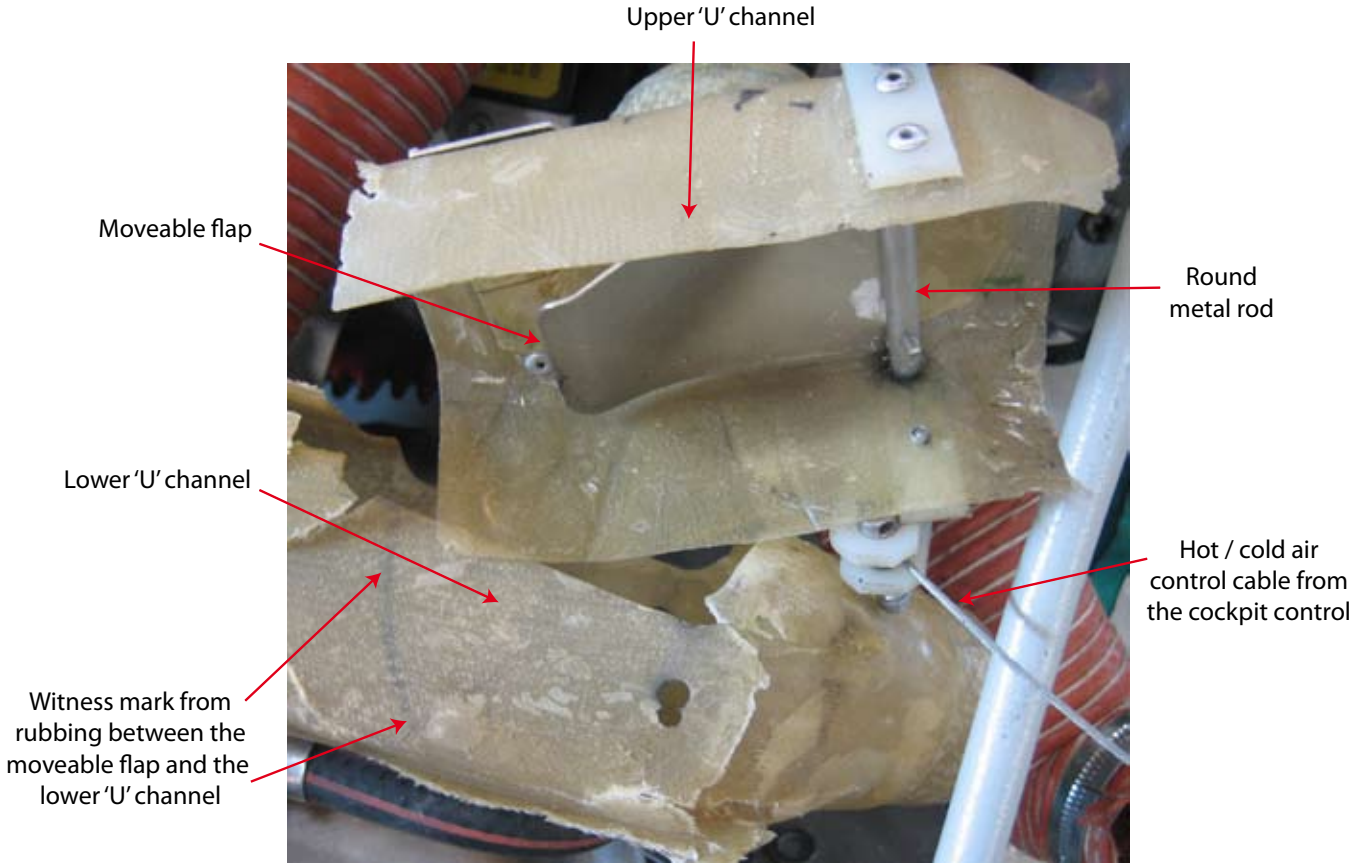


Figure 3

Inside the hot/cold air box

Previous accident

In June 2007, the aircraft and pilot were involved in a landing accident on a grass airstrip[1]. The pilot lost control during the landing roll, and the aircraft pitched over onto its back. Although the canopy shattered, the pilot was trapped in the aircraft for a few minutes until assistance arrived.

Analysis

Aside from the pilot's failure to stop at the holding point when taxiing, and his higher-than-normal taxi speed, there was nothing remarkable about the flight until the aircraft levelled off and entered a steep turn to the left shortly after takeoff. This turn, and the pilot's statement in his MAYDAY call that he intended to return to land on Runway 36, indicated that some problem had arisen which required urgent action on his part. The witness reports that the aircraft flew level or continued to climb indicated the unlikelihood of a complete loss of power at this stage. It seems likely that there was a partial loss of power, probably associated with the carburettor heat malfunction identified by the engineering investigation, and brought about by meteorological conditions conducive to serious carburettor icing at any power

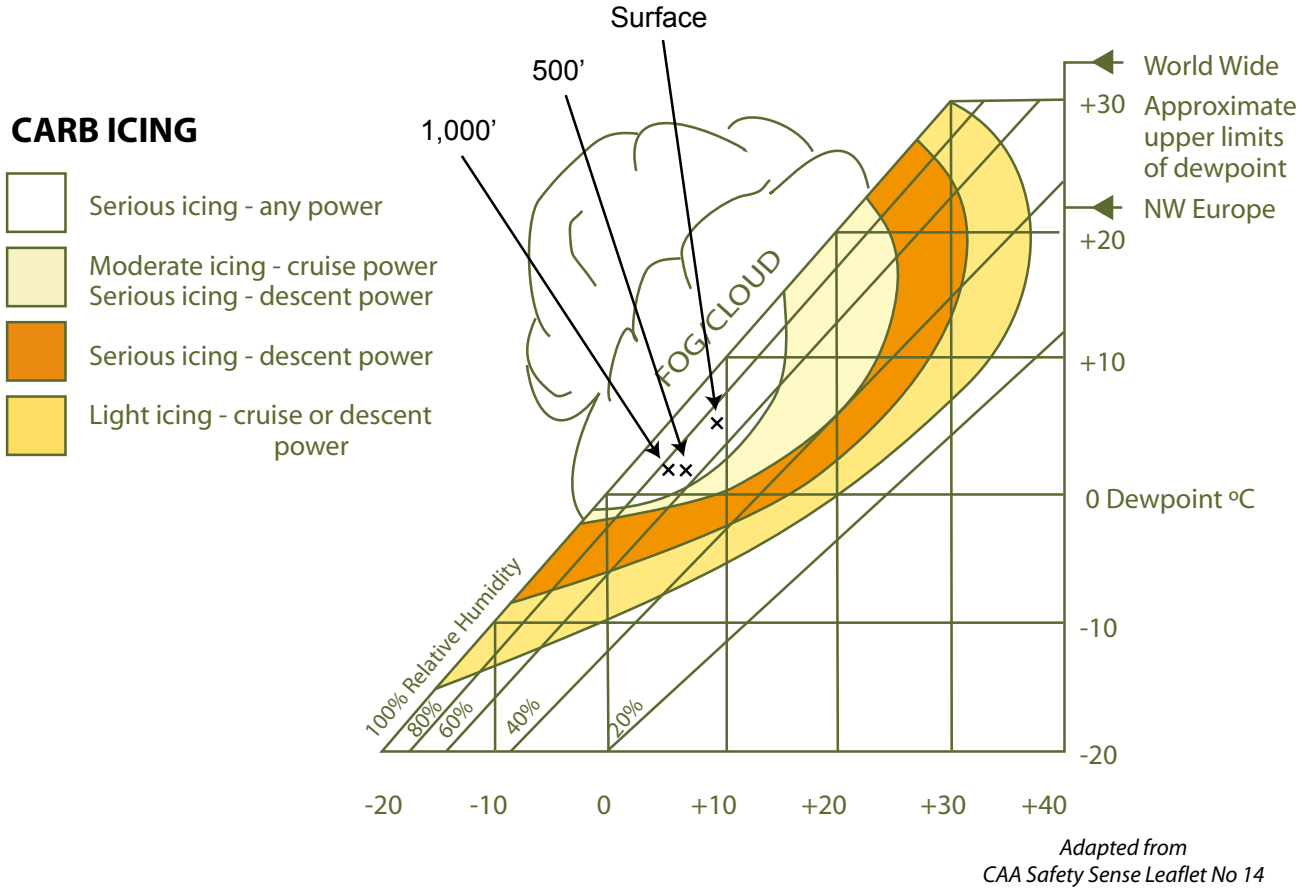


Figure 4

Footnote

[1] AAIB Bulletin 10/2007 reference EW/G2007/06/04.

setting. However, the possibility remains that some other factor, not identified during the investigation, caused the pilot to return to the airfield.

As the pilot announced his intention to land on Runway 36, it is possible that he may have been concerned about the suitability of the surrounding fields for a forced landing, considering the care which he took to examine the airfield surface before flying. Moreover, his previous accident may have led to a concern that the aircraft might pitch onto its back in a forced landing, and that he might become trapped.

However, an aircraft which has achieved sufficient height after takeoff may be able to achieve a safe return to the airfield of departure following engine failure, but manoeuvring an aircraft close to the ground, at low speed, and without engine power, places significant demands on the pilot's handling skills. The flight test reports indicated that the aircraft's handling characteristics were not unusual. However, the pilot's relative lack of currency may have been a factor in his handling of the aircraft in a manner which resulted in the spin.

Witnesses saw the aircraft fly towards, and then through, the extended centreline of Runway 36. In a turn at low speed, slight additional aft stick may be sufficient to prompt an aircraft to stall. If any yaw is present, the stall may develop into a spin. It is possible, therefore, that the accident resulted from such circumstances. Another factor may have been that, as the aircraft was low and flying downwind, the pilot perceived the aircraft's airspeed to be greater than it was.

Conclusions

It is probable that a partial power loss, caused by the failure of the carburettor heat system in conditions conducive to serious carburettor icing at any power setting, prompted the pilot to return to land. During the turn onto final approach, the aircraft entered a spin and struck the ground.

ACCIDENT

Aircraft Type and Registration:	Piper PA-28-161 Cherokee Warrior II, G-BNXT
No & Type of Engines:	1 Lycoming O-320-D3G piston engine
Year of Manufacture:	1977
Date & Time (UTC):	18 August 2009 at 1335 hrs
Location:	Bromley, Kent
Type of Flight:	Training
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Minor) Passengers - N/A
Nature of Damage:	Substantial - beyond economic repair
Commander's Licence:	Student Pilot
Commander's Age:	59 years
Commander's Flying Experience:	88 hours (of which 70 were on type) Last 90 days - 13 hours Last 28 days - 4 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent AAIB enquiries

Synopsis

During a solo circuit exercise, the aircraft reportedly lost power and the student pilot attempted to make a forced landing. The aircraft landed in a tree on the edge of a school playing field.

History of the flight

The student pilot flew three circuits with her instructor, who then briefed the student to carry out some solo circuits. On the second solo circuit, she was instructed by ATC to orbit during the downwind leg and, on rolling out of the orbit, she perceived that she was further downwind than expected. Having turned onto base leg, she recognised that she was slightly above the circuit height. She recalled selecting carburettor heat, reducing power to approximately 1,700 rpm, and selecting two stages of flap.

The aircraft then "did not feel right" and descended more rapidly than she expected. She recalled attempting to apply power but there was little response. She transmitted a MAYDAY call and manoeuvred towards a field with houses close by.

The aircraft struck a tree on the edge of a school playing field within the built-up area of Bromley and then fell through the branches of the tree, coming to rest close to ground level. The pilot suffered injuries to her legs and ankles, but was able to exit through the door, which

had opened in the impact. Her exit was made awkward by substantial tree limbs which had penetrated the cabin during the impact sequence. There was no fire.

Recorded data

Radar and RTF recordings of the accident flight were obtained. The radar recorded only track over ground which showed a descending right turn culminating in ground impact in a downwind direction. The surface wind was 220°/9 kt.

Pilot training

The pilot began training towards a PPL in January 2007. Her total flying time of 88 hours, included two hours solo. Training records showed that she had only flown one exercise involving emergencies in the circuit, conducted in October 2007. This exercise had covered engine failure after takeoff drills, away from the aerodrome. The pilot reported she had not been taught how to deal with engine failure other than during the initial climb after takeoff.

Engine investigation

The engine was examined by engineers contracted by the aircraft owner. No fault was found.

Carburettor icing

CAA Safety Sense Leaflet SSL 14 discusses piston engine icing, and includes a graph depicting the likelihood of carburettor icing depending upon temperature and dewpoint. The temperature at the time of the accident was 20°C and the dewpoint was 13°C. Under these conditions the graph indicated that moderate icing was possible at cruise power and serious icing at descent power.

The chief flying instructor of the flying club commented that he did not believe that PA-28-161 aircraft were particularly prone to carburettor icing.

Analysis

No malfunction or defect was found to account for the loss of power which the pilot reported. The environmental conditions were conducive to carburettor icing, and this may explain the partial loss of power and the engine's slight response to the opening of the throttle.

Pilots of single-engine aircraft must be ready to cope safely with power loss at any time. Student pilots early in their solo flying are generally not trained to deal with every eventuality and this student pilot had not received any training in dealing with engine failure other than in the climb after takeoff (EFATO). She was successful in avoiding impact with buildings, but unable to execute a forced landing. Her landing was downwind, and this meant that the groundspeed at impact was higher than it would have been had she been able to land into wind.

INCIDENT

Aircraft Type and Registration:	Piper PA-31-350 Navajo Chieftan, G-VIPW
No & Type of Engines:	1 Lycoming LTIO-540-J2BD piston engine and 1 Lycoming TIO-540-J2BD piston engine
Year of Manufacture:	1979
Date & Time (UTC):	13 May 2009 at 1046 hrs
Location:	10 miles south of Isle of Man Airport, Isle of Man
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to right engine and right engine cowling
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	29 years
Commander's Flying Experience:	1,321 hours (of which 483 were on type) Last 90 days - 147 hours Last 28 days - 46 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB

Synopsis

During the initial climb after takeoff the right engine lost power at FL60. The pilot shut down the right engine and carried out an uneventful landing. The right engine failure was caused by separation of the No 2 engine cylinder, but the cause of the cylinder separation could not be determined.

History of the flight

After a normal departure from Isle of Man Airport the aircraft was climbing through FL60 when the pilot heard an unusual noise and the right engine suddenly lost power. He identified that the right engine had failed from the right yaw of the aircraft. He decided not to try to set full power on both engines due to the noise coming from the right engine and the fact that the aircraft was at a safe speed of 130 KIAS. He then carried out his engine shutdown checks which included feathering the propeller, although photographs taken of the aircraft after landing showed the right propeller unfeathered. The pilot reported that he had no difficulty flying the aircraft on just the left engine and made an uneventful landing back at Isle of Man Airport.

The pilot reported that all engine indications had been normal during the takeoff and the climb. The power setting on both engines was 35 inches of manifold pressure, with rpm set to 2,400 and the mixture set to 30 USG/hour.

Aircraft examination

The left forward section of the right engine cowling had split apart revealing that the No 2 cylinder had detached from the engine but was still retained within the cowling. The left side of the cowling was coated in oil see Figure 1.

Figure 1

Right engine cowling revealing the separated No 2 engine cylinder

Maintenance history

The failed engine was a Lycoming LTIO-540-J2BD six-cylinder piston engine. It had last been overhauled, by the engine manufacturer, in April 1998 and had accumulated 1,744 hours at the time of the failure. The engine's approved 'Time Between Overhauls' (TBO) was 1,800 hours. The No 2 cylinder had been replaced on 3 November 2006 at 1,280 engine hours, so this cylinder had accumulated 464 hours at the time of failure. The replacement was as a 'cylinder kit', due to the previous cylinder having a worn exhaust valve guide, and no further work to this cylinder was recorded until the time of the incident.

There were two 'WDC' numbers found imprinted on the spine of the engine crankcase which indicated that the crankcase had been repaired some time between 1995 and 1997 by a particular FAA-approved engine overhaul facility. This facility was contacted regarding the nature of the repairs, but they only held records for the past two years, in accordance with FAA regulations. The aircraft operator reported that they did not hold any logbooks for the engine for the period prior to 1998.

Engine examination

Six of the eight studs that had retained the No 2 cylinder had failed in overload and the remaining two studs had been stripped from the casing. The small end of the No 2 connecting rod had failed and its failed end had been crushed in subsequent impacts with the piston, while the engine continued to turn see Figure 2. The big end of the connecting rod was still securely attached to the crankshaft.

The No 2 piston was found seized inside the cylinder. To remove the piston the top half of the cylinder was cut away and a press was applied against the piston head. A force of 2,000 lb was required to free the piston. The piston appeared to have seized as a result of distortion to its lower sidewall where it had suffered multiple impacts from the failed connecting rod; a large piece of the piston sidewall had broken off as a result of these impacts. All three piston rings were found broken in half at their approximate mid-points and parts of the remains of these piston rings were later retrieved from inside the engine crankcase. There was no evidence on the piston sidewall of overheat distress and the cylinder bore was in good condition, with no evidence of overheat distress. The piston gudgeon pin was in good condition with no evidence of overheat, as was the inner surface of the connecting rod small end.

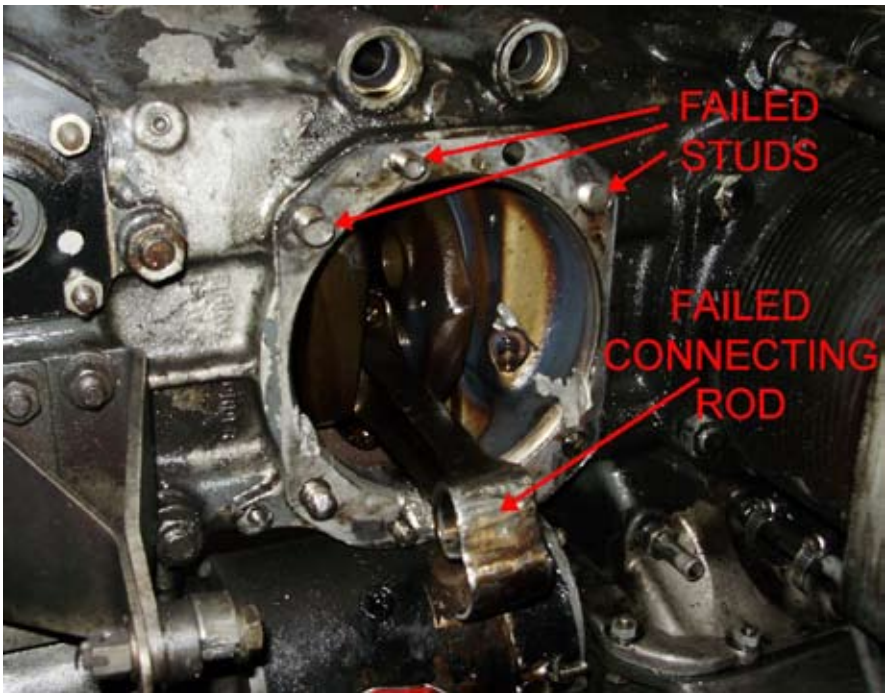


Figure 2

Location of detached No 2 cylinder revealing failed studs and failed connecting rod small end

Analysis

The engine manufacturer was consulted regarding the cause of the cylinder separation. They stated that they had seen similar cylinder separations and that piston ring failure was usually a consequence, rather than a cause, of a cylinder separation. They stated that, in many cases, cylinders had separated as a result of either insufficient or excessive torque on the hold-down nuts, or as a result of improper or illegal weld repairs of the crankcase in the area of the cylinder pad. If insufficient or excessive torque is applied to the hold-down nuts during cylinder installation, the nut can work itself loose, and the stresses that result from the ensuing cylinder movement can cause a cylinder to detach. The engine manufacturer stated that they had also seen six cases of cylinder detachment in the previous two years as a result of improper or illegal crankcase repairs. The engine manufacturer had not approved any crankcase repairs that included welding, but the FAA had approved several engine overhaul facilities to carry out weld repairs, including the facility that had carried out an unspecified repair on the failed engine in this incident. The engine manufacturer stated that a potential consequence of a crankcase weld repair near a cylinder is that the cylinder hold-down pad area starts to soften, and this softening leads to the cylinder flange pounding into the material, eventually causing the hold-down nuts to loosen.

The No 2 cylinder had accumulated 464 hours prior to failure. If the hold-down nuts had been installed incorrectly with either excessive or insufficient torque, it is likely that a failure would have occurred sooner. However, if the torque was only slightly outside the specification, a nut might become loose after 464 hours, but no data was found to substantiate this. The possibility of a weld repair leading to a loosening of hold-down nuts was also considered, although a visual examination of the crankcase in the vicinity of

the No 2 cylinder did not reveal any obvious evidence of welding. The aircraft operator has tasked an engine overhaul organisation to carry out a further inspection of the crankcase but the results of this inspection had not been received at the time of publication. In conclusion, there was insufficient evidence available to determine the cause of the cylinder separation.

ACCIDENT

Aircraft Type and Registration:	Rebel, G-CCPK
No & Type of Engines:	1 Lycoming O-235-C2C piston engine
Year of Manufacture:	1995
Date & Time (UTC):	9 August 2009 at 1315 hrs
Location:	Field near Kidderminster, Worcestershire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Landing gear, carburettor, lower fuselage, wingtips
Commander's Licence:	Private Pilot's Licence
Commander's Age:	71 years
Commander's Flying Experience:	953 hours (of which 784 were on type) Last 90 days - 4 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Shortly after taking off, the engine stopped. After turning back, the pilot selected a field in which to make a forced landing. However, the field sloped downwards, and the pilot was unable to land before being forced to make a turn to avoid a railway embankment. During the turn, the aircraft's wingtip and landing gear contacted the ground and the aircraft was damaged. No positive reason for the engine failure was a established by the pilot, although vapour locking or carburettor icing were possible factors.

History of the flight

Earlier in the day the aircraft had departed with full fuel tanks from Shobdon on a flight to Sleap, before continuing to Droppingwells Farm strip near Kidderminster. It landed at approximately 1400 hrs and the two occupants left the aircraft briefly before embarking once more for the return flight to Shobdon. The pilot reported the wind as being light and variable; it was a sunny day with a temperature of 25°C and a dew point of 17-18°C.

The aircraft taxied to the eastern end of the airfield and took off towards the west. However, at a height of around 1,100 ft the engine stopped. The pilot checked the fuel and attempted to restart the engine, but to no avail. He considered his options for a forced landing and decided to turn back, aiming for a cornfield to the west of the airstrip. The flaps were deployed for the landing but the downward slope of the field caused the

aircraft to remain airborne. By this stage the aircraft was approaching a railway embankment, forcing the pilot to initiate a turn to the right. There was insufficient space in which to return the aircraft to a wings level attitude prior to touchdown, and contact with the ground was made by the right wingtip, followed by the landing gear. The aircraft then rocked onto its left wingtip before coming to rest. The occupants were uninjured and exited the aircraft via the doors.

Discussion

The underside of the aircraft of the aircraft had been damaged in the forced landing to the extent that the carburettor had become detached from the engine, which was otherwise intact. However, the pilot could find no cause for the engine failure. In excess of 20 litres of fuel were recovered from the aircraft, suggesting that some leakage had occurred following the accident, as approximately 40 litres had been on board at takeoff.

The pilot subsequently considered that 'vapour lock' was a potential cause for the power loss. As noted earlier, the temperature was 25°C and there would have been a tendency for the fuel in the wings to warm up in the sunshine during the period the aircraft was on the ground. In the event, the aircraft was parked for only a few minutes. The engine would not have cooled down significantly during this time, so it is possible that heat-soak affected the fuel lines within the engine compartment. Additional heat may have been generated whilst the aircraft was taxiing prior to takeoff.

'Vapour lock' is more frequently associated with aircraft in which the fuel tank is level with, or below, the height of the carburettor. Wing-mounted fuel tanks in high-wing aircraft, such as the Rebel, provide a positive pressure to the fuel system, which can suppress the tendency of vapour to form when the fuel lines become warmed.

When the temperature and dew point are plotted on the Carburettor Icing Probability chart (see CAA Safety Information Leaflet No. 14 - Piston Engine Icing), it is on the boundary between the occurrence of serious icing at descent power and moderate icing at cruise power. Despite the fact that the engine had been at high power for takeoff, it is nevertheless considered possible that carburettor icing my have been a factor in the loss of power.

ACCIDENT

Aircraft Type and Registration:	Skystar Kitfox MK5, G-LESZ
No & Type of Engines:	1 Rotec R2800 piston engine
Year of Manufacture:	2003
Date & Time (UTC):	2 July 2009 at 1230 hrs
Location:	Swanborough Farm, East Sussex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to both wings, fin rudder stabilizer and elevators, rear end of fuselage, propeller broken, engine pushed back and tubes around cockpit distorted
Commander's Licence:	Private Pilot's Licence
Commander's Age:	79 years
Commander's Flying Experience:	22 hours (of which 22 were on type) Last 90 days - 40 minutes Last 28 days - 0
Information source:	Aircraft Accident Report Form and photographs submitted by the pilot

Synopsis

After touching down from a normal approach, the pilot was unable to prevent the aircraft from veering to the left and colliding with a hedge. Although no defects could be found with the tailwheel assembly, it is possible that, on takeoff, the wheel had disengaged from its detent connecting it to the rudder and that a misaligned operating spring had foreshortened the tailwheel controls, biassing the wheel to the left

History of the flight

A few yards after touching down after an uneventful test flight, the aircraft began to drift to the left. The pilot was unable to contain the drift, despite application of full right rudder and as much right brake as he dared. An attempt to increase rudder effectiveness with a brief burst of power had no effect as the aircraft continued to veer left towards the boundary hedge. Consideration was given by the pilot at this stage to switching off the magnetos, but to do so would have entailed letting go of the throttle, with attendant risk that the spring-biased control to the Bing carburettor would revert to its 'failsafe' full throttle position. This idea was discarded, and the aircraft ran into the hedge at an oblique angle.

As the left wing struck the hedge, the aircraft yawed violently to the left, causing the whole nose section to bury itself briefly in the hedge, before sliding backwards into the hedge where it came to rest. The hedge was dense and comprised mainly hawthorn, with embedded tree trunks about four inches in diameter, a barbed wire fence supported on three inch diameter wooden posts, and a wire netting fence also supported on three inch diameter wooden posts. As a consequence, the aircraft suffered significant damage.

Although the pilot suffered whiplash, he was otherwise uninjured and, after all movement had ceased, was able to extract himself unaided. There was no fire.

Aircraft examination

Photographs taken shortly after the accident with the aircraft in situ, showed the aircraft's wheel tracks diverging left towards the hedge. In photographs taken of the aircraft during its takeoff and subsequent approach to land, it was possible to discern that the tailwheel was offset to the left from the time it become airborne, Figure 1, but even after detailed inspection, the pilot was unable to offer any explanation for the offset.

Figure 1

G-LESZ on takeoff, with the tailwheel apparently displaced slightly to the left

Subsequent discussion of the issue at his local LAA Strut meeting produced a consensus opinion that the tailwheel offset most probably had something to do with the springs in the tailwheel operating linkage. After some experimentation at home, the pilot found that it was possible for the disconnect links in the tailwheel operating horn to become displaced and shorten the effective length of the associated tailwheel control, producing an offset tailwheel with the rudder in the neutral position. Figures 2 and 3 respectively illustrate the implicated link in its normal and displaced positions.

The pilot considered the tension induced in the affected spring to be insufficient alone to break the tailwheel out of its 'detented' straight-ahead position, and it was not possible to confirm that such a condition had

Figure 2

Normal position

Figure 3

Displaced position

caused the accident. It is conceivable, however, that with the link displaced in this way, an operational side force on the wheel kicking it left as just as it lifted off, could potentially have broken it out of its detent, and maintained a left offset thereafter.

The pilot reported that the tailwheel assembly in question was of a generic type in widespread use on light and microlight aircraft.

ACCIDENT

Aircraft Type and Registration:	Yak-50, G-HAMM
No & Type of Engines:	1 Ivchenko Vedeneyev M-14P piston engine
Year of Manufacture:	1983
Date & Time (UTC):	27 June 2009 at 0740 hrs
Location:	North Weald Airfield, Essex
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to landing gear and propeller
Commander's Licence:	Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	1,151 hours (of which 391 were on type) Last 90 days - 8 hours Last 28 days - 5 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot joined right-hand downwind for Runway 20 at North Weald. He recalled lowering the landing gear and feeling it deploy. He did not report on final approach as the frequency was busy. Approximately 100 m after touchdown, the gear collapsed and the propeller struck the ground. Subsequent tests of the landing gear were satisfactory and no obvious defects were found. The pilot considered that omitting the call on final may have been a contributory factor, as he had missed the opportunity to check that the gear was down and locked prior to landing.

ACCIDENT

Aircraft Type and Registration:	Robinson R22 Beta, G-INKY
No & Type of Engines:	1 Lycoming O-320-B2C piston engine
Year of Manufacture:	1989
Date & Time (UTC):	27 May 2009 at 0830 hrs
Location:	Wester Cartmore Farm, Lochgelly, Fife
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Severe damage to main and tail rotor assembly, fuselage and right skid
Commander's Licence:	Private Pilot's Licence
Commander's Age:	42 years
Commander's Flying Experience:	374 hours (of which 366 were on type) Last 90 days - 79 hours Last 28 days - 24 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The helicopter was being operated from a private site in a rural location. The reported surface wind at Edinburgh Airport, 10 nm to the south, was from 220° at 16 kt. The pilot stated that the surface wind at the site was similar to that at Edinburgh and that the wind direction during start up was from 90° to the right of the helicopter nose. As the helicopter lifted to the hover, the pilot reported that a gust of wind caught him by surprise and, while correcting for this, the right skid and main rotor struck the ground. The helicopter then settled back onto both skids and remained upright, having turned 90° to the left. The pilot reported that the main and tail rotors and right side of the fuselage were damaged. He was uninjured.

ACCIDENT

Aircraft Type and Registration:	BFC Challenger II, G-MGAA
No & Type of Engines:	1 Rotax 582 piston engine
Year of Manufacture:	1997
Date & Time (UTC):	13 August 2009 at 1100 hrs
Location:	Private farm strip near Yarmouth, Isle of Wight
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to port wing, fuselage and nose landing gear
Commander's Licence:	Private Pilot's Licence
Commander's Age:	67 years
Commander's Flying Experience:	290 hours (of which 290 were on type) Last 90 days - 4 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The aircraft's left wing struck a hedgerow whilst landing at a farm strip. The aircraft was damaged but there was no fire and the pilot was uninjured.

History of the flight

The aircraft was landing at a grass farm strip when the accident occurred. The strip, which was orientated 17/35, was about 460 m long and ran across three fields. The central portion of the strip was 230 m long. At either end of the central portion, the strip passed through gaps made in substantial hedgerows that separated the fields. The northerly gap was the smaller of the two, at about 20 m wide.

When the aircraft took off, the surface wind was almost calm, the strip was dry and the weather fine. On returning to the strip 50 minutes later, the windsock indicated a stronger surface wind, being easterly and gusting to an estimated 15 mph. The aircraft touched down on the northerly runway, about mid-way along the central portion of the strip.

Before the aircraft had fully settled on the ground, and with the 20 m gap in the hedgerow approaching, it began to veer to the left. The pilot attributed this deviation to a gust of wind. He was unable to correct the swing with rudder, and nosewheel steering was ineffective because the nosewheel was not in contact with the ground at this point. The aircraft's left wing

struck the hedge to the left of the gap at an estimated 35 mph. The aircraft suffered damage to the left wing, the fuselage and the nose landing gear. There was no fire and the pilot was uninjured.

ACCIDENT

Aircraft Type and Registration:	Cameron Z-275 hot air balloon, G-CDIH
No & Type of Engines:	None
Year of Manufacture:	2005
Date & Time (UTC):	8 August 2009 at 1905 hrs
Location:	Keynsham, Bristol
Type of Flight:	Commercial Air Transport (Passenger)
Persons on Board:	Crew - 1 Passengers - 13
Injuries:	Crew - None Passengers - 1 (Minor)
Nature of Damage:	Damage to balloon basket consisting of scuffs, buckling and a small hole. Ornamental stone steps damaged
Commander's Licence:	Commercial Pilot's Licence (Balloon)
Commander's Age:	35 years
Commander's Flying Experience:	969 hours (of which 103 were on type) Last 90 days - 11 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Following an uneventful flight, varying wind conditions and a late change of touchdown point resulted in the balloon striking an obstacle on the ground. The balloon basket was damaged and one passenger sustained minor injuries. The obstacle, stand-alone ornamental steps, was also damaged.

History of the flight

The balloon had departed from Ashton Court Estate, on the outskirts of Bristol, at 1810 hrs for a local sightseeing flight. At the end of the flight, the pilot selected a landing site at a sports field that was suitable for the forecast conditions and which he had used before. About nine other balloons had already landed at the site, including one piloted by the operator's chief pilot. The balloon pilot estimated that the surface wind was from 230° at about 4 to 8 kt, based on the distance he had observed some of the other balloons being dragged across the ground during their landings. This compared with a wind of 260°/5 kt which had been forecast for the Bristol area. Accordingly, the pilot established the balloon on an approach to the field and stopped the descent at a height of about 30 ft, 300 m from the property boundary. While level, the wind veered to 290° at 6 kt and the pilot selected a position just inside the boundary as his landing point. At a distance of about 30 m from the boundary the chief pilot called up to him, advising that the balloon was going to land on

a golf putting green. In order to avoid damage to the green, the pilot climbed the balloon to a height of 50 ft and selected what he thought was a suitable landing site about 300 m further on. His view of this landing site was slightly obscured by trees but the pilot was confident that this would only be relevant if the wind backed again towards a direction of 230°. He operated the parachute[1] to initiate a relatively steep descent into this site, at which point the wind backed and increased in strength, possibly as much as 12 kt. The balloon drifted into the area of the landing site that had been obscured from the pilot's view, revealing stand-alone ornamental stone steps. The pilot attempted to abort the landing by operating two burners but this had little effect, so he switched off the burners and deployed the deflation system fully.

The balloon basket struck a low pillar on the end of a wall on the stone steps, which penetrated the basket structure at a point where there was no padding. The basket was dragged through another low wall on the steps and came to rest, on its side, approximately 5 to 10 m further on. One passenger who was braced against the non-padded section of the basket received bruising to his back, which required an overnight stay in hospital.

Pilot comment

The pilot commented that his decision making was based on the forecast and observed winds and that he did not leave sufficient margin for the unexpected. The balloon landed with one hour of fuel remaining but with only about 30 minutes of daylight available. His inability to abort the landing was, he believes, due to the wind curling over the tops of the adjacent trees.

Witness comment

An experienced balloon pilot, who was flying in the area at the time and witnessed the accident, confirmed that the surface wind was greater than that at altitude and commented that other balloons appeared to have found the landing conditions challenging.

Footnote

[1] The balloon deflation system which allows the controlled release of hot air (venting) and the complete deflation of the envelope.

ACCIDENT

Aircraft Type and Registration:	Gemini Flash II, G-MNWI
No & Type of Engines:	1 Rotax 503 piston engine
Year of Manufacture:	1986
Date & Time (UTC):	26 June 2009 at 1930 hrs
Location:	Ardgowan Airfield, Inverkip, Ayrshire, Scotland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to propeller and wing
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	63 years
Commander's Flying Experience:	57 hours (of which 33 were on type) Last 90 days - 5 hours Last 28 days - 3 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

The pilot carried out a cross-runway landing to minimise the effect of a crosswind from the right. After a normal touchdown the pilot turned left to vacate the runway, at which point a strong gust of wind from the right lifted the right wing tip and tipped the aircraft onto its left side.

History of the flight

The Gemini Flash II is a two-seat flex-wing microlight aircraft. The pilot had departed from the grass Runway 02 at Ardgowan Airfield at about 1730 hrs when the wind was from 040° to 060°, at 8 kt gusting to 12 kt. After about an hour's local flight he returned to Ardgowan to assess the wind conditions. While approaching the airfield from the south he encountered turbulence and sink just short of the southern end of the airfield. While overflying the airfield he noticed that the windsock was indicating about a 30° to 40° crosswind from the right. He then completed a left-hand circuit and approached along the left-hand side of the runway in order to carry out an into-wind cross-runway landing. The aircraft touched down normally and the pilot tracked into wind, towards the right-hand edge of the runway. Once slowed to a fast taxi he turned left, at which point the aircraft was struck by a strong gust of wind from the right which lifted the right wing. The pilot tried to counter the wing lift but was unable to prevent the left wing tip hitting the ground.

The aircraft tipped over onto its left side and the wings folded. The propeller was also damaged when it hit the ground. The pilot and his passenger were able to release their seatbelts normally and exit the aircraft unassisted.

The pilot reported that wind measurements taken after the accident indicated that the wind was from 040° at 10 kt with gusts up to 20 kt and veering by 80° to 120°.

Crosswind limitations

The pilot's manual for the aircraft type stated the following regarding crosswind takeoff and landings:

> *'Cross winds to 15 knots (17 mph) have been demonstrated, but we would recommend an 8 knot (10 mph) maximum. No special techniques are required, but be ready to correct steering direction on touch down, and to prevent the upwind wing from rising.'*

Pilot's assessment of the cause

The pilot stated that it was unusual for the wind conditions at the airfield to change so significantly during a one hour period late in the day. With the benefit of hindsight he stated that he should have stopped while still facing into wind and then requested assistance in moving the aircraft.

ACCIDENT

Aircraft Type and Registration:	Pegasus Flash, G-MNKX
No & Type of Engines:	1 Rotax 447 piston engine
Year of Manufacture:	1986
Date & Time (UTC):	8 August 2009 at 1245 hrs
Location:	North Moor Airfield, South Humberside
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Wing damaged and light damage to trike unit
Commander's Licence:	Private Pilot's Licence
Commander's Age:	65 years
Commander's Flying Experience:	962 hours (of which 509 were on type) Last 90 days - 15 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

During takeoff the engine stopped suddenly, resulting in the aircraft landing back on the runway but then overrunning the end of the runway and entering a dyke. The reason for the sudden loss of the engine was most likely due to fuel vapour lock. The aircraft's fuel tank, made of metal and painted black, had been fuelled with MOGAS and prior to the flight the pilot had parked the aircraft in a sunny spot, with the ambient air temperature at about 20°C.

History of the flight

Following a morning of uneventful flights, the aircraft was parked in a sunny area. The ambient air temperature at the time was about 20°C. The pilot had filled the fuel tank with MOGAS to about half-full in preparation for the next flight. After a short break, the pre-flight checks for the next flight were carried out without incident and the aircraft was lined up on Runway 27. Full power was applied, the engine responded and the aircraft accelerated before taking off. However, at about 150 ft agl the engine stopped suddenly. The pilot decided to continue tracking down the runway centreline, with the intention of either landing on the remaining runway available or landing in a field beyond a dyke that ran perpendicular to the end of the runway. The pilot trimmed the aircraft for the maximum glide distance but it hit an area of sink which led to a rapid descent and landing back on the runway. There were only 25 metres of the runway length remaining, and, with insufficient distance to stop, the aircraft entered the dyke and came to rest. Both the

pilot and the passenger were uninjured and were able to exit the trike before climbing up the bank of the dyke.

After the aircraft was recovered, the owner carried out a full examination of the fuel system and the engine and found no defects that would have led to the engine stopping in flight. He then carried out a test of the engine using the fuel that had remained in the aircraft following the accident; the engine performed normally.

The owner assessed that the reason for the engine stopping in flight was most probably vapour lock. The fuel tank on G-MNKX was of a metal construction and painted black. In addition the fuel used was MOGAS, which is more susceptible to both carburettor icing and vapour lock than AVGAS, due to its higher vapour pressure.

The Civil Aviation Authority Safety Sense Leaflet 04 contains recommended practices with regard to the use of MOGAS in aircraft and states:

> *'...Prior to take-off, the temperature of the fuel in the aircraft tank(s) must be less than 20°C...'*

ACCIDENT

Aircraft Type and Registration:	SZD-48-1 Jantar Sandard 2, G-CFHV
No & Type of Engines:	None
Year of Manufacture:	1980
Date & Time (UTC):	31 May 2009 at 1400 hrs
Location:	Long Mynd Airfield, Shropshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Glider destroyed
Commander's Licence:	BGA Bronze certificate
Commander's Age:	49 years
Commander's Flying Experience:	53 hours (of which 2 were on type) Last 90 days - 38 hours Last 28 days - 11 hours
Information Source:	AAIB Field Investigation

Synopsis

During the early phase of a winch launch, the glider stalled, entered an autorotation and impacted the ground. The investigation found no evidence of any pre-existing mechanical defects with the glider and concluded that the pilot, who was fatally injured, probably applied a greater pitch control input than was appropriate during the launch.

History of the flight

Runway 36L was in use on the day of the accident. There was no significant cloud and the visibility was excellent. The surface wind was forecast as being from the north at around 10 kt, but during the day the wind direction veered to north-easterly and increased to 15 kt.

At 1515 hrs, the duty instructor at the gliding club was launched by winch in a two-seat K21 glider. He described the flying conditions during the launch as "unremarkable". Around the same time, the pilot of the Jantar, who had earlier been granted permission from the duty instructor to fly the glider, performed a positive control check and positioned the aircraft to be the next in line to launch. He was then seen to perform his pre-flight checks and, after the cable was returned to the launch point, it was attached to his aircraft.

The retrieve winch driver used a radio to advise the launch winch driver that the next launch would be a Standard Jantar. The winch driver had launched this

glider type several hundred times before and when he was given the signal to launch, he applied the standard amount of power for this glider type.

Witnesses at the launch point describe the glider commencing its launch normally, although one witness observed a slight right wing drop which was quickly recovered. After the glider became airborne, it stayed low for a slightly longer period than normal, prior to pitching up very sharply. All of the witnesses considered that it was in a steeper than normal pitch attitude at around 100 ft above the ground, when its left wing was seen to drop. The glider continued rotating to the left, descending rapidly, before disappearing from view behind a rise in the ground; several people heard the impact.

The winch driver reported that he saw the glider in plan form earlier than he expected, and then saw it arc towards the west. When he realised that the glider was not going to recover, he applied the winch brake and shut off the winch. He observed the glider hitting the ground at a point which appeared to him to be about 100 yards from the launch point. He then got in a vehicle with the 'crash kit' and drove to the accident.

Several people, including a doctor, reached the glider within minutes of the accident but it was apparent that the pilot had suffered fatal injuries.

Pilot experience and training records

The pilot had been gliding for about a year. He flew regularly and had recently achieved his BGA Bronze qualification. In May 2009, he purchased a share in the glider involved in the accident and had flown it three times prior to the accident. On the day before the accident, he flew a navigational training sortie with an instructor in a two seat DG505 glider; the instructor recorded that his performance had been satisfactory. He also flew three times in a single seat Discus glider.

A detailed examination of the pilot's training records showed no evidence of any recurring problems with winch launches, or with any other aspect of his flying.

Pathology

A post-mortem examination of the pilot was carried out by a specialist aviation pathologist. His report concluded that the pilot died of multiple severe injuries, consistent with having been sustained in a non-survivable glider accident. The post-mortem examination revealed no evidence of natural disease and toxicological analysis of the pilot's blood concluded that the pilot was not under the influence of alcohol or any other drugs.

Aircraft information

The Jantar Standard 2 is a high performance sailplane of Standard Class, see Figure 1. The cantilever shoulder wings have single glass fibre main spars, no ribs and are covered with foam core moulded skins. The wings have simple ailerons and airbrakes in the upper and lower surfaces of each wing. There is provision for water ballast, but this facility was not used on the accident aircraft. The glass fibre fuselage has a steel tube central frame, and the rear portion is stiffened by half-frames and ribs. The seat back is adjustable to accommodate pilots of varying sizes. The cantilever T-tail is of similar construction to the wings and has a spring trim in the elevator. There is a retractable monowheel with disc brake and a semi-recessed tail wheel.

Although less benign than the training aircraft used at the gliding club, it was not considered by the club instructors to have any significantly adverse handling characteristics. It has a 1g stalling speed of 34.5 kt, and a maximum lift/drag ratio of 39 at 51 kt. The Jantar Standard 2 first flew in December 1977.

Figure 1

Jantar Standard 2 G-CFHV

Weight and balance

The glider's most recent annual inspection confirmed that the configuration of the aircraft accurately reflected the mass and balance statement. Although the pilot was towards the upper range of both weight and height, he was within the published limits for the aircraft.

Winch information

The gliding club at Long Mynd uses a retrieve winch system for launching gliders. This uses two winches, one located at each end of the takeoff run, but with their cables connected together. The more powerful winch is used to launch the glider; the retrieve winch is then used to recover the end of the cable back to the launch point ready to be connected to the next glider. The launch winch at Long Mynd was operated by a professional winch driver who had worked at the club for around 16 years. The retrieve winch was operated by a club member, who had received the appropriate training.

The launch winch was inspected after the accident with no defects being identified.

Wreckage site

The wreckage was contained within a small area some 345 m from the threshold of Runway 36L and 120 m left of the extended centreline. Several large divots had been created by the right wing as it hit the ground and broke up, along with a depression made by the leading edge. The divot created by the wingtip was the largest and showed evidence that the wing had rotated about this point during the impact. The nose section had created a shallow hole containing remnants of the fuselage structure, the nature of which showed evidence of the glider rotating to the left as it struck the ground. The left wing leading edge created a small depression adjacent to the nose impact mark. The main fuselage wreckage was located a short distance in front of the ground marks. The right wing was detached and lying adjacent and parallel to the fuselage, with the wingtip towards the tail. The left wing was also detached and lying on the right side of, and at an acute angle to, the fuselage, with the wingtip pointing towards the runway. The canopy and instrument panel had been completely removed from the aircraft and were located next to the left wing. The fuselage came to rest upright, and there was significant disruption to the nose and cockpit area.

Wreckage examination

Each wing had remained in one piece but the left wing spar had failed at the point where it tapered to form a joining section with the right wing spar, allowing the wings to separate from the fuselage. The fittings locking the two spars together at the central join were still securely in place. The right wing was heavily disrupted from the ground impact, particularly at the wing tip. The right wing aileron had detached and its control tubes were distorted and had failed at the wing root. The spoiler was in the retracted position. The left wing was almost undamaged, with only a small depression along the leading edge. The aileron control connection had failed at the wing root and movement of the aileron was restricted. The spoiler was in the deployed position.

The wings were disassembled and the aileron and spoiler control systems were found intact and restricted only by the distortion resulting from the ground impact. The aileron control mechanism within the fuselage was also connected and operating correctly. The right wing aileron had detached from its mount during the ground impact. The left wing spoiler deployed as a consequence of the wing detaching from the fuselage during the ground impact sequence. The pilot's seat back had detached from its adjustable mounting.

The rudder pedal mechanism was intact, but badly distorted, and the control cables to the rudder were still connected. The rudder itself had become detached at the top hinge position, but its control tubes were still in position and free to move. The pilot's seat was intact, but the left lap strap had failed at the point where it attached to the fuselage. The left wing location spigot arm had deformed at the central weld and the arm was bent 90° forward from its normal position. The fuselage structure aft of the cockpit was undamaged, with the horizontal stabiliser still attached. The elevators were connected and free to move. The total energy probe had sheared off at the point where it was mounted on the leading edge of the vertical stabiliser.

The ASI and associated static and pitot system were heavily disrupted during the ground impact. So the calibration of the ASI system could not be assessed. However, each of the individual components operated correctly when tested, and there was no evidence of blockage in any of the associated tubing.

Maintenance history

The aircraft had undergone an annual inspection one month prior to the accident. This included a satisfactory calibration test of the ASI. The daily inspection for the day of the accident had been signed off in the Daily Inspection book, with no defects recorded. The entry also recorded that a positive control check[1] had been carried out prior to the accident launch. Another member of the syndicate who had flown the glider the previous day recorded no defects and the aircraft had remained assembled overnight.

Engineering analysis

The disposition and analysis of the wreckage was consistent with the aircraft having entered autorotation following a left wing drop shortly after takeoff. There was no evidence to suggest that the flying controls had become detached or restricted prior to impact with the ground, or that an asymmetric deployment of the spoilers had occurred, or that the ASI was reading incorrectly. Although the seat position could not be confirmed due to

Footnote

[1] A positive control check involves a second person, with the requisite experience, applying resistance to the relevant flying control surface while the pilot applies a control input. This confirms continuity of the control systems, particularly after reassembly of the glider following transportation or stowage.

the impact damage, given the pilot's height it is probable that he flew with the seat back in the fully rear position. Therefore, it is unlikely that rearward movement of the seat back in-flight could have caused the pilot to inadvertently pull back on the control column at a critical time.

In summary, all damage seen during the examination of the wreckage was consistent with being caused during the accident.

Winch launch accidents

An analysis of winch launch accidents reveals that fatal injuries mostly resulted from the glider stalling during pitch rotation on takeoff, and from spins following winch power loss during the launch.

Stalls during rotation

A stall during the transition from takeoff to the main climb on a winch launch may result in the glider rolling uncontrollably. In some cases, the glider has hit the ground inverted, with the cable still attached. A stall during pitch rotation can result in one wing losing lift marginally before the other, causing it to drop. The stalled wing experiences an increasing angle of attack as it drops, keeping it stalled, while the rising wing experiences a reduced angle of attack, thus moving it away from stall and allowing it to produce lift. This induces a rapid roll moment and can lead to autorotation and an incipient spin.

The stall speed of a glider increases during rotation in pitch, as a larger angle of attack is required to achieve more lift from the wing. This higher lift is required in order to balance the other forces on the glider and to provide a vertical acceleration into the climb. There are three reasons for this:

- As the nose pitches up the lift force is inclined away from the vertical and must increase if the component of lift resolved in the vertical direction is to balance the weight of the glider.
- The pull force in the cable is large, typically 80% of the weight of the glider. At takeoff, this force is horizontal, providing the glider's initial horizontal acceleration, and has no effect on the required lift. However, as the nose pitches up during rotation, the lift force becomes increasingly opposed to the pull force. The lift must therefore increase if it is to balance this pull force and stop the horizontal acceleration.
- At the end of rotation the glider is climbing at an airspeed of perhaps 55 kt, which corresponds to a vertical velocity of about 35 kt. The vertical velocity of the glider must therefore increase during rotation from zero at takeoff to about 35 kt. This requires a force which comes from an increase in lift generated by the wing.

The forces on a glider during rotation may be modelled and the load factor (g) estimated for different rotation rates, pull forces in the cable, climb angles and other variables. This modelling shows the stall speed during rotation is very dependant on the rate of rotation, ie, the higher the rate of rotation, the shorter the time in which the glider has to be accelerated vertically from 0 to 35 kt. As this requires a greater lift force from the wings, there is an associated increase in the stall speed.

The dependence of stall speed on rate of rotation for a Jantar Standard 2 (with an unaccelerated stalling speed of 34.5 kt and maximum lift to drag ratio of 39), at climb angles of 10° and 25°, with a cable pull of 80% of the weight of the glider, is indicated in Figure 2.

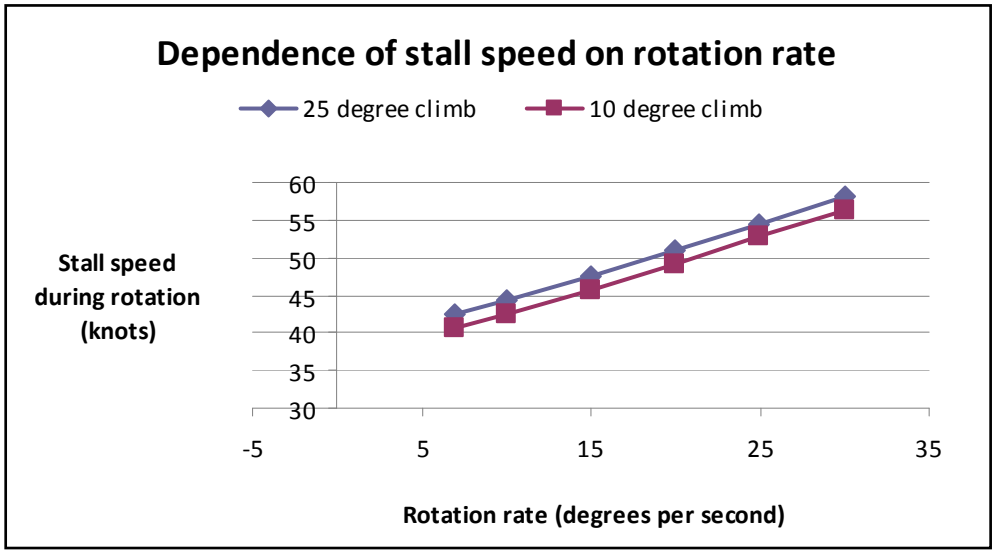


Figure 2

Relationship of stall speed with rate of rotation

At the 10° climb angle, the stalling speed increases from 41 kt at a rotation rate of 7° per second, to 56 kt, at a rotation rate of 30° per second. The corresponding stall speeds at a 25° climb angle are 43 kt and 58 kt.

BGA Safe Winch Launch Initiative

The BGA, who assisted the AAIB with this investigation, had previously conducted an analysis of their accident database. They found that a significant percentage of glider accidents occurred during winch launches. To address this they developed the Safe Winch Launch Initiative.

The initiative consisted of an educational campaign, within the BGA community, to make glider pilots more aware of the hazards associated with winch launching and this, initially, resulted in a reduction in the accident rate.

Conclusion

The examination of the wreckage found no reason to suggest that a technical fault was a causal factor in this accident. The investigation concluded that the pilot probably applied a larger control input than was appropriate as the glider rotated, resulting in the rapid rate of pitch rotation. The stall and loss of control was unrecoverable given the height available.

ACCIDENT

Aircraft Type and Registration:	VPM M16 Tandem Trainer gyroplane, G-IJMC
No & Type of Engines:	1 Subaru EA81 piston engine
Year of Manufacture:	1994
Date & Time (UTC):	23 July 2009 at 1637 hrs
Location:	Wroxhills Wood, Goring, Oxfordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - 1 (Minor) Passengers - 1 (Minor)
Nature of Damage:	Extensive damage to airframe and rotor
Commander's Licence:	Private Pilot's Licence
Commander's Age:	49 years
Commander's Flying Experience:	153 hours (of which 148 were on type) Last 90 days - 9 hours Last 28 days - 2 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

Whilst conducting a local flight, the pilot of the gyrocopter experienced a loss of engine power. He attempted a forced landing in a nearby field, but a combination of the downward slope of the field, a gust of wind and his flare technique resulted in a hard landing which broke off the nosewheel. A rotor blade then hit the sloping ground and the aircraft rolled over, causing extensive damage to the airframe.

History of the flight

The pilot was on his second trip of the day flying along the River Thames, to allow his passenger to take photographs of friends' boats. Whilst attempting to climb from 600 ft to 800 ft, the pilot noticed that the engine speed would not increase above 4,000 rpm. He leaned backwards to operate the rear throttle control and managed to achieve an engine speed of 4,200 rpm, which was just sufficient to maintain level flight. As he was visual with the runway at Chiltern Park, he elected to try to reach the airfield, although it was still some 4 km away.

As the flight continued, the pilot experienced a further loss of power from the engine and made a PAN call to RAF Benson. The pilot then turned the aircraft into wind and began a forced descent and landing in the nearest suitable field, although he realised that it had a pronounced downward slope in the direction of his approach. The pilot reports that he may have flared too much prior to touchdown and the combination of an untimely gust of wind and the downward slope of the field resulted in the aircraft "dropping in" from a height of 4 ft onto the ground.

As a consequence of the landing the nosewheel broke off and a rotor blade hit the ground to the left of the rear of the aircraft. The aircraft then rolled onto its side before coming to rest.

Engineering findings

The pilot noted that there was no coolant from the engine present on the accident site and that the engine displayed evidence of overheat. A more detailed inspection revealed that the head gasket around one of the cylinders had failed, along with a section of the cylinder wall. This resulted in a loss of coolant from the engine and the subsequent overheat and loss of power.

ACCIDENT

Aircraft Type and Registration:	X'Air Falcon, G-CCVJ
No & Type of Engines:	1 Verner 133M piston engine
Year of Manufacture:	2004
Date & Time (UTC):	27 September 2009 at 1356 hrs
Location:	Newtownards Aerodrome, County Down, Northern Ireland
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Left main wheel axle fractured
Commander's Licence:	National Private Pilot's Licence
Commander's Age:	48 years
Commander's Flying Experience:	68 hours (of which 1 was on type) Last 90 days - 8 hours Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

The approach to Runway 26 appeared normal, until the flare, after which the aircraft landed heavily. This resulted in a fracture of the axle supporting the left mainwheel, causing the aircraft to turn to the left before coming to rest on the grass to the left of the runway.

The pilot states that, in his opinion, the aircraft suffered sink on the approach, possibly due to wind effects from nearby Scrabo Hill, and that this led to the rapid descent of the aircraft at the commencement of the flare. The wind at the time was from 250° at 17 kt.

ACCIDENT

Aircraft Type and Registration:	Zenair CH 601UL Zodiac, G-CDAK
No & Type of Engines:	1 Rotax 912-S piston engine
Year of Manufacture:	2004
Date & Time (UTC):	19 September 2009 at 1403 hrs
Location:	Shobdon Airfield, Herefordshire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Minor damage to landing gear and right flap
Commander's Licence:	Private Pilot's Licence
Commander's Age:	77 years
Commander's Flying Experience:	1,410 hours (of which 1 was on type) Last 90 days - 33 hours Last 28 days - 6 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The pilot reported that the aircraft veered to the left after touchdown and struck an aerodrome PAPI light before coming to rest in a drainage ditch beside the runway. He and his passenger were uninjured. The aircraft suffered minor damage to its landing gear and right flap. The pilot considered that he probably touched down with his left foot on the toe brake.

BULLETIN ADDENDUM

AAIB File:	EW/C2009/02/04
Aircraft Type and Registration:	Robinson R22 Beta, G-TTHC
Date & Time (UTC):	14 February 2009 at 1240 hrs
Location:	Near Sandtoft Aerodrome, Humberside
Information Source:	AAIB Field Investigation.

AAIB Bulletin No 10/2009, page 73 refers

In the section *Aircraft Information - General,* the last sentence of the first paragraph it was incorrectly stated that the gauge needle should be kept **in** the yellow arc. This should have read **out** of the yellow arc.

Therefore the sentence should read:

> In practice this is achieved by keeping the gauge needle out of the yellow arc.

FORMAL AIRCRAFT ACCIDENT REPORTS ISSUED BY THE AIR ACCIDENTS INVESTIGATION BRANCH

2008

3/2008 British Aerospace Jetstream 3202, G-BUVC
at Wick Aerodrome, Caithness, Scotland
on 3 October 2006.
Published February 2008.

4/2008 Airbus A320-214, G-BXKD
at Runway 09, Bristol Airport
on 15 November 2006.
Published February 2008.

5/2008 Boeing 737-300, OO-TND
at Nottingham East Midlands Airport
on 15 June 2006.
Published April 2008.

6/2008 Hawker Siddeley HS 748 Series 2A, G-BVOV
at Guernsey Airport, Channel Islands
on 8 March 2006.
Published August 2008.

7/2008 Aerospatiale SA365N, G-BLUN
near the North Morecambe gas platform, Morecambe Bay
on 27 December 2006.
Published October 2008.

2009

1/2009 Boeing 737-81Q, G-XLAC, Avions de Transport Regional ATR-72-202, G-BWDA, and Embraer EMB-145EU, G-EMBO
at Runway 27, Bristol International Airport
on 29 December 2006 and on 3 January 2007.
Published January 2009.

2/2009 Boeing 777-222, N786UA
at London Heathrow Airport
on 26 February 2007.
Published April 2009.

3/2009 Boeing 737-3Q8, G-THOF
on approach to Runway 26
Bournemouth Airport, Hampshire
on 23 September 2007.
Published May 2009.

4/2009 Airbus A319-111, G-EZAC
near Nantes, France
on 15 September 2006.
Published August 2009.

5/2009 BAe 146-200, EI-CZO
at London City Airport
on 20 February 2007.
Published September 2009.

6/2009 Hawker Hurricane Mk XII (IIB), G-HURR
1nm north-west of Shoreham Airport, West Sussex
on 15 September 2007.
Published October 2009.

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