Cessna 310J, N1158V

AAIB Bulletin No: 9/2003	Ref: EW/C2003/04/01	Category: 1.2
Aircraft Type and Registration:	Cessna 310J, N1158V	
No & Type of Engines:	2 Continental IO-470U piston engines	
Year of Manufacture:	1965	
Date & Time (UTC):	7 April 2003 at 1815 hrs	
Location:	In a field close to Sandtoft Airfield, Humberside	
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:	United Kingdom Private Pilot's Licence	
Commander's Age:	59 years	
Commander's Flying Experience:	302 hours (of which 84 hours were on type)	
	Last 90 days - 6.5 hours	
	Last 28 days - 5.5 hours	
Information Source:	AAIB Field Investigation	

Synopsis

During the take-off run the aircraft main cabin door, located at the front right of the cockpit area, opened. The aircraft climbed to an estimated height of 400 feet and made a normally banked turn through 90° to the left. It was then seen to roll back to a wings level attitude consistent with entering the circuit pattern. Shortly after the completion of that manoeuvre and whilst flying very slowly, the aircraft entered a steeply banked turn to the left, which then appeared to be corrected back to wings level but, immediately, the right wing was seen to drop. The aircraft then entered a spin to the right and impacted the ground in a vertical attitude, fatally injuring the pilot. It was concluded that the pilot had probably been trying to close the door when he lost control of the aircraft.

History of the Flight

The pilot/owner had arrived earlier in the day at Sandtoft Airfield where he kept his aircraft in a hanger at the south-western end of Runway 05. He was seen in the hanger with his aircraft but it was not known if he was working on it or simply carrying out the pre-flight inspection. At 1745 hrs a friend, who had flown with the pilot on numerous occasions, returned from a flight to Southend, landing on Runway 23. The surface wind indicated by the windsock was across the runway and the friend thought that there had been a slight tailwind as he landed. Sandtoft has a single asphalt runway orientated 05/23, 886 metres long by 18 metres wide, with holding points Charlie at the south-west corner of 05 and Alpha at the north-eastern end of 05, adjacent to the tower. The airfield had closed at

1700 hrs and the Air Ground Radio Service was no longer available but private flying was still allowed to take place.

The pilot was seen by a number of witnesses to taxi his aircraft from the hanger to holding point Charlie, before entering and taxiing along Runway 05. As the friend thought he was possibly checking the windsock for the surface wind direction and speed, he switched on the radio in the tower, established communications with the pilot and then passed him the indicated wind. He recalled that this was variable in direction, between south-east and east, at about 10 kt gusting to 15 kt. He also advised the pilot that the wind favoured Runway 05, which the pilot acknowledged. He continued to taxi along the runway and then turned off at holding point Alpha, making a 180° turn to the left to stop facing the runway at holding point Alpha.

The pilot then contacted his friend on the radio and indicated that he was going for a 30 minute local flight. He invited the friend to join him but the friend declined as he had a prior commitment. The pilot acknowledged this with some humour and mild disappointment and then backtracked Runway 05 returning to holding point Charlie in order to clear the runway for another aircraft to land. He was seen and heard to complete his power checks and, when the landing aircraft was clear of the runway, he taxied forward and lined up on Runway 05. The aircraft's landing lights were on and it was seen to accelerate normally along the runway, lifting off at the usual position. A security guard in the tower recorded the takeoff with a video camera, until it disappeared behind some trees whilst climbing away. Two witnesses sat in their car near the control tower watched the takeoff and noticed, as the aircraft passed them, that the main door on the right side of the aircraft had come open and was moving in the slipstream. This was also shown on the video recording. Another witness, a pilot who was travelling along the adjacent motorway, could see that the aircraft's speed was very low and he became concerned about this and its low height.

The aircraft continued to climb away and was seen to make a normal climbing turn to the left, but at a lower height than was usual. It was seen to roll wings level, on what would have been the crosswind leg of a left-hand circuit, which was the correct circuit direction for that runway. Almost immediately it entered a steeply banked turn with a rapid rate of roll, a wing dropped and the nose pointed vertically down. The suddenness of the wing drop, and the distances the witnesses were from the aircraft, meant that some thought it was the left wing and others thought it was the right wing which had dropped. It was also noted that the aircraft was flying very slowly. One witness thought that the steep left turn was corrected to wings level with a normal rate of roll and that it was the right wing which then dropped. The aircraft entered a near vertical dive from about 400 feet and struck the ground nose first, fatally injuring the pilot. The aircraft immediately caught fire and this was extinguished by the local fire service, who attended within 15 minutes of the accident.

Medical information

The post mortem examination of the pilot revealed no evidence of any natural disease, alcohol, drugs or toxic substance which may have caused or contributed to the accident. It was considered to be a non-survivable accident resulting in multiple injuries, consistent with sudden deceleration, as the aircraft impacted the ground.

Pilot's experience

The pilot commenced flying training in June 1997 and he was issued with his United Kingdom Private Pilot's Licence on 15 June 1998. He commenced multi-engine training on a Cessna 310 in December 1999, successfully completing his rating in January 2000. His most recent Certificate of revalidation was completed on 30 March 2003. The pilot had recently conducted a Licence Proficiency Check (LPC).

Aircraft Description

The Cessna 310J is a twin engined, low-wing monoplane fitted with a retractable tricycle landing gear. It is equipped with wing tip (main) fuel tanks and auxiliary tanks located internally in each wing, outboard of the wing mounted engines. All the flying controls are conventional and operated

by cable, pulley, push rods and bellcranks. The split flaps are controlled electrically via a motor driving a chain and cable. The Cessna 310J engines are six cylinder horizontally opposed, air cooled units driving two bladed variable pitch McCauley propellers. These engines can produce up to 260 Hp at 2,650 RPM.

Cabin entry door

The aircraft is fitted with a single entry cabin door forward on the right side of the aircraft. The door is hinged at its forward edge, and is further locked at three points. Two rotating handles, one external and one internal, operate the door opening, closing and locking mechanism. Additionally, to assist closing the door, a pull handle is provided on the inside of the door at the mid position just below the window. On initially shutting the door, a 'yale' type latch on the rear edge of the door, engages with a keeper on the aft doorframe. With the external handle positioned out of its faired fitting and rotated upward, the door is in the unlocked state and the internal handle is in 'OPEN'. As the internal door handle is rotated toward 'CLOSE', the external door handle rotates into a faired aperture in the door. Movement of the handle also causes a bayonet in the lower part of the door to engage with a hole on the lower edge of the doorframe and an upper door catch moves forward to engage with a pin in the upper doorframe. When the internal handle is then moved to 'LOCK', the 'yale' type latch moves further aft into the keeper, the bayonet moves further downward into the lower door frame and the upper catch moves downward to positively latch on to the pin in the upper frame. The internal handle is now retained in 'LOCK' and the door is secured at four points and, as such, becomes part of the aircraft structure.

Autopilot (AP)

N1158V had recently been fitted with a STEC system 30 autopilot which was able to control the aircraft in two axis, pitch and roll. The four roll modes of this autopilot are: stabiliser mode (ST), which keeps the wings level or to a selected roll attitude; heading mode, which steers the aircraft to the selected heading on the directional gyro; Low track mode for VOR navigation and High track mode for localiser approaches. The pitch mode is primarily for altitude hold, where the aircraft is held at its current altitude whenever the mode is selected. The pitch mode also provides an indication of an out of trim situation through the use of lights on the turn co-ordinator instrument. The roll commands are all computed within the turn co-ordinator instrument, which was mounted on the left cockpit panel, and incorporates the roll computer, rate gyro and the indicator lights for the autopilot system. The roll commands from the roll computer drive a roll servomotor which, through attaching cables, directly moves the control cables for the ailerons. In a similar way, the pitch commands are computed in a separate pitch computer using information from an accelerometer and an absolute pressure sensor. These pitch commands are fed to a pitch servomotor that is directly connected to the elevator cables. The pilot is able to override the servomotors, by the application of sufficient force on the control yoke, which causes a clutch in the servomotors to slip. The application of such a force does not disconnect the autopilot. Autopilot mode selection and disconnect on N1158V was possible from a remote selection switch mounted on the control yoke. Additional mode selection was possible via a switch on the turn co-ordinator. Power to the autopilot was controlled from a power switch on the left instrument panel.

Accident Site

The aircraft had impacted the ground in a near vertical (90º) attitude. The right wing contacted the ground first, followed by the fuselage, and the tail had detached and fallen forward over the cockpit. Both wing tip fuel tanks and the auxiliary tanks had ruptured and as a result a significant post-crash fire consumed most of the aircraft. The landing gear was found extended and the flaps were set around 10º, later confirmed by the position of the flap drive chain. The left control yoke was found in the full left aileron position and the right control yoke shaft was found bent up over the instrument panel in the elevator full up position. The left yoke shaft had fractured in bending at a point which also indicated that full up elevator was being applied at the time of impact. Both engines were found still attached to the wings but buried in the ground up to the depth of the forward cylinders.

The cabin entry door was found lying to the right side of the main fuselage. The door had been damaged by fire but had not been subjected to any physical distortion, unlike the rest of the aircraft. The lower doorframe on the main fuselage was still visible and this had been severely disrupted by the impact.

The pilot was found in the wreckage in a prone position, lying across the instrument panel, throttle quadrant and the right seat, but with his legs still in the left foot well. The post crash fire had burned away his harness, but the metal buckle by his right thigh was retrieved with the lap strap and diagonal fittings still attached.

Detailed Wreckage Examination

The aircraft was recovered to the AAIB at Farnborough for a detailed examination.

It was not possible to determine if the engines were turning at the point of impact due to lack of damage to the propellers. Both engines were found sitting in pools of oil, indicating that each engine had contained a satisfactory oil quantity prior to impact, and it was possible to turn both engines freely using their propellers. Further detailed engine examination, as far as was practicable, did not reveal any defects with either unit prior to impact. Evidence from the video recording taken of the aircraft as it took off on the accident flight, indicated that that both engines appeared to have been operating normally during the taxi, takeoff and initial climb. Therefore, the possibility of an engine failure was considered remote as a causal factor in the accident.

Some of the autopilot components were recovered from the wreckage but impact damage and the subsequent ground fire precluded any meaningful analysis of their pre-accident condition or status. The turn co-ordinator had been completely destroyed. It was established that both servomotors were correctly connected to their respective control operating cables.

The cabin entry door was recovered in one piece, and was closely inspected. The bayonet at the lower edge of the door and the upper door catch were both found in the unlatched positions and the external door handle was found pointing upwards and out of the faired position, a position consistent with the door not being secure. The cable connection between the internal door handle, the 'yale' type latch, the lower bayonet operating mechanism and the upper door catch mechanism was continuous, and these three door latches were all found in the open position. No pre-impact defects were found with this door operating mechanism.

The checklist, a laminated set of flip cards, used by the pilot was found, incomplete, in the wreckage. This had been partially burnt and the 'before take-off checks' section had been destroyed.

Aircraft controllability

Manufacturers opinion

The aircraft manufacturer had no records of conducting intentional flight tests of the Model 310 with the entry door unlatched. They did, however, know of experiences when the door had come open in flight, but without event. They expected that in normal flight the door would open several inches, depending on airspeed, and remain in that position as long as the aeroplane remained in steady flight. If the aeroplane were to be subjected to manoeuvres such as yaw or roll, the position of the door would be expected to change due to the change in local aerodynamic pressures. The open door itself was not thought to cause unstable flight characteristics but, due to aerodynamic loads, it is likely to be difficult to close the door in flight.

The manufacturer had conducted several flights on the Cessna 400 series aeroplanes to evaluate the effect of open nose or engine nacelle baggage doors, and to evaluate the effect of an aft cabin stair-door being open, but none of the tests resulted in adverse flight characteristics.

Door opening incidents

Two incidents of doors opening in flight on Cessna 310 aircraft were identified by the investigation and the pilot on each occasion had provided a full and open account of the occurrence.

The first incident involved an aircraft departing from Shobdon with a pilot in the left seat and a passenger in the right front seat. The aircraft was well within the MAUW limits and there was no significant weather. The wind was light. On rotation at 95 kt, the door opened between three to six inches at its trailing edge, and the cockpit became very noisy with wind and engine noise. The aircraft had a tendency to pull (yaw) to the right but the rudder and aileron control inputs required to correct this were light and significantly less that those required to control the aircraft following an engine failure. The major cockpit workload for the pilot on this occasion, was in reassuring the passenger. At about 1,000 feet agl, the pilot attempted to close the door but could neither open it further (in an attempt to slam it shut) nor close it fully, due to the effects of airflow on the outside of the door. He radioed his intention to land and completed a visual circuit with the normal configuration (106 kt approach clean, 95 kt VAT with landing flap, 80 kt at touchdown). The tendency of the aircraft to yaw was particularly noticeable in the flare, but it remained quite controllable. On the runway, he secured the door, backtracked the runway and departed.

The second incident was with only the pilot on board and, again, the aircraft was well within the MAUW. There was no significant weather and the wind was approximately 12 kt, mostly down the runway. The door came ajar on departure from Blackbushe but the aircraft was climbed to a safe altitude of about 6,000 feet, outside controlled airspace. With the airspeed reduced to stalling speed (72 kt in the landing configuration at MAUW, ref. Pilot's Operating Handbook) the pilot, as with the previous occasion, could not close the door and so he returned to Blackbushe. The tendency to yaw was described as similar to the first incident, but the landing was described as being no more difficult than a crosswind landing.

On both occasions the pilots described the increase in noise and the movement of the door as it opened, as alarming, which generated a desire to correct the situation by closing the door.

Cessna Pilot Safety and Warning Supplements

Supplement number 18 of the Pilot Safety and Warning Supplements, covers Inadvertent Opening of Cabin/Emergency Exit Doors (unpressurised) and offers the following advice:

> *'If a cabin or emergency exit door should inadvertently open during unpressurized flight, the primary concern should be directed toward maintaining control of the airplane. Then, if a determination is made to close the door in flight, establish a safe altitude, trim the airplane at a reduced airspeed, and attempt to close the door. To facilitate closing the door, slide the adjacent seat aft slightly to obtain a better grasp of the door handle. The door handle must be in the close position prior to pulling the door closed, followed by rotating the handle to the locked position. Under no circumstances should the pilot leave his/her seat, or unfasten the restraint system to secure the door.*
>
> *If a cabin door reopens when latched closed, the flight should be terminated as soon as practical and repairs made.'*

Figure 1 illustrates the location of the handle with respect to the pilot in the left seat.

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It is not known if the pilot of the accident aircraft had read this document. This is separate from the Owners Manual, the document that contains all the information required for the operation of the aircraft. There are, however, no procedures included in the emergency section of the Owners Manual to cover an inadvertent cabin door opening in flight, but a comprehensive checklist sets out all the normal aircraft checks to be completed and at what point they should be undertaken. Item 11 of the 13 'Before Take Off' checks states *'Cabin doors and windows - Closed and locked'*. This follows the engine and propeller power and functional checks.

Ergonomics Assessment

A specialist organisation was tasked to undertake an ergonomic assessment of the Cessna 310 cockpit as it related to the operation of the cabin door and the flight controls. The persons involved established a basic understanding of the aircraft operation and were given access to the manuals. They conducted ground assessments, including door opening and closing, as well as stretching movements towards the door from the seated position in the left seat, in order to establish secondary effects. A familiarisation flight was also carried out. Measurements were taken of the cockpit and controls, which enabled them to construct a 3D computer model of the cockpit environment, using a dedicated Computer Aided Design (CAD) human modelling tool, known as 'Jack'. The 'Jack' mannequin was adjusted to be representative of the deceased pilot in terms of height and reach.

For the purposes of the assessment, the control yoke was set in the centre of its pitch up/down range of motion. The pilots seat was set at what was estimated to be the correct adjustment, in terms of fore

and aft travel, and the cabin door was set at 30° open to represent the worst case described by the witnesses. The normal seating position is illustrated in Figure 2.

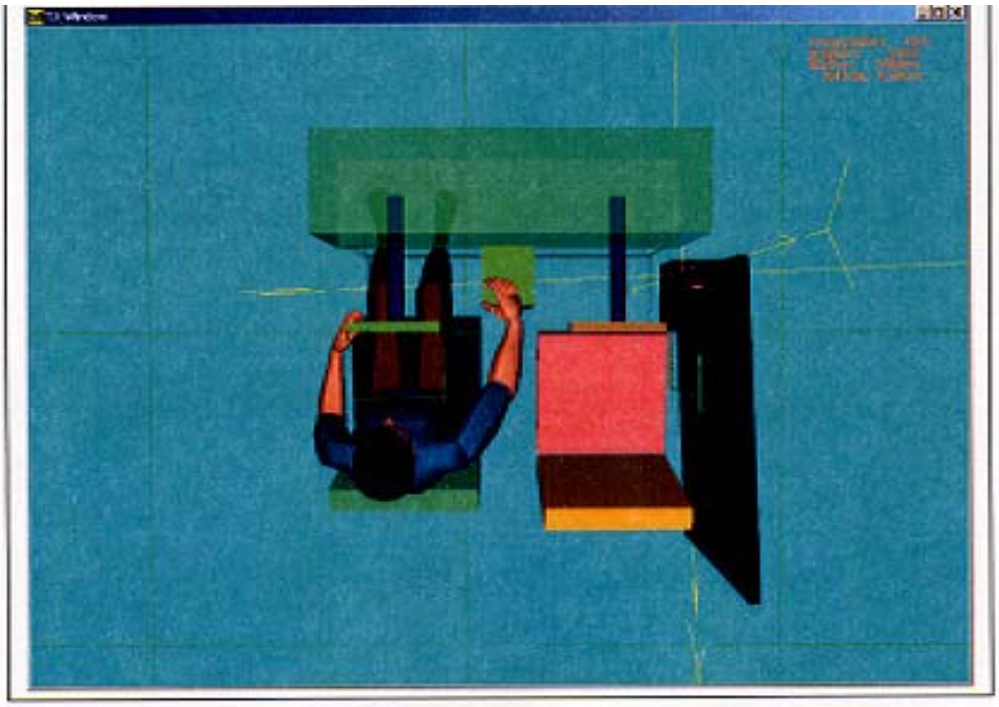
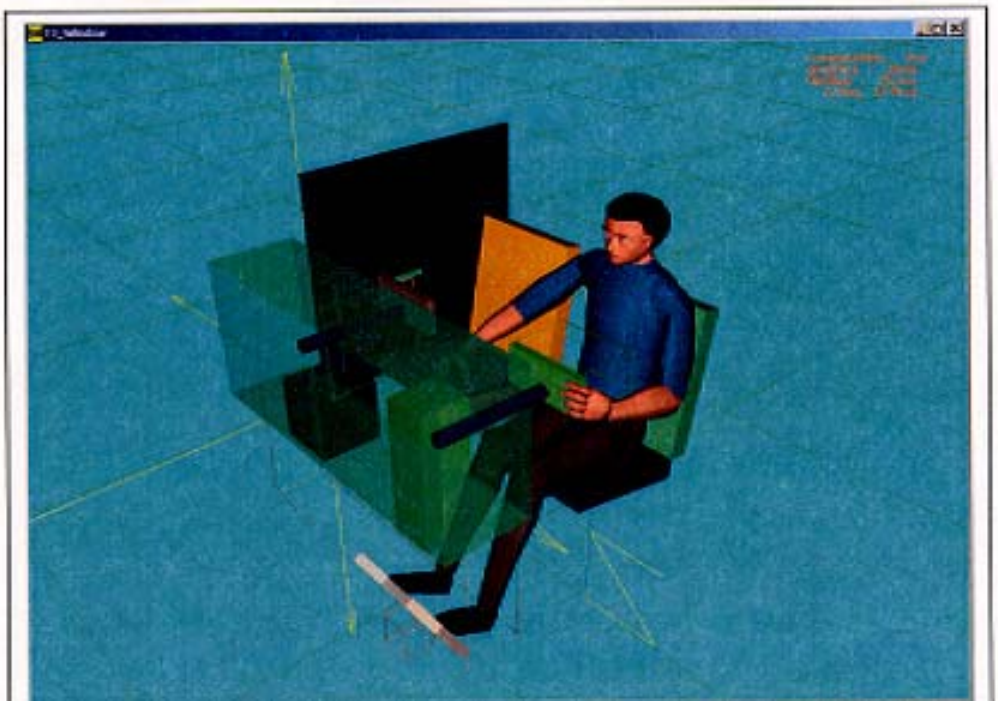


Figure 2: The pilot in the normal seating position left hand on the control yoke, right hand on the throttles and both feet on the rudder pedals.



The evaluation was primarily to establish what involuntary control inputs may result from the pilots actions when trying to close the door in flight, but it also considered the problems created by the control yoke and throttle quadrant, as well as the door locking procedure.

The summary of the findings of the assessment were as follows:

Door

It was considered that it was difficult to tell from the door locking handle when the door was fully locked. Whilst the lock had indicating arrows for the direction of movement to lock or unlock the door there were no absolute markings to identify the locked position.

Control Yoke

The right control yoke obstructed access to the door locking mechanism and, to a limited extent, the door pull handle. This obstruction would have been exacerbated if the pilot had been trying to continue the climb, as pulling the yoke back obstructs access even further (see Figure 1). The pilot may have tried to move the yoke forward, aft or turned it to the left, with the intention of gaining easier access to the handle. Any such action would have been extremely unwise, especially so, due to the lack of height in which to recover the aircraft if control was lost. The upper torso leaning towards the door causes the control yoke to turn through the path of least resistance as the left arm follows the torso. Essentially, if the pilot has begun turning the yoke either left or right, and then reaches over to the door, then he is likely to inadvertently continue pulling on the yoke further in that direction.

Throttles

The position of the throttles meant that it was not possible to shut the door using the left hand. Intuitively one would reach with the right hand initially, whilst keeping the left hand on the control yoke. On finding that he could not close the door at his climbing speed, the pilot may have reduced power in an attempt to lower the airspeed and airflow over the door. If the throttles had been moved with the left hand (with the right still holding the door handle), then both the yoke and the upper torso would obstruct the route to the throttle. This would complicate the task of moving the throttles and may have caused inadvertent operation of the yoke. A pilot who had attempted to close the door in flight considered that it would not be possible using one hand but would require both hands.

Rudder pedals

The assessment found some evidence of the possibility of inadvertent pressure on the rudder pedals whilst attempting to close the door. However, the majority of the force was exerted laterally as the pilot braced himself against the left-hand side of the footwell, whilst contacting the central pedestal with his right knee. Given the resulting yawing motion created by the open door, it is possible that the pilot made a specific effort whilst trying to close the door to maintain his feet on the rudder pedals. As the arm stretches towards the door handle, this causes the torso to bend and the pelvis to tilt towards the door. This pelvis tilt in turn moves the left leg towards the left side of the aircraft. The right knee braces against the central pedestal in opposition to the outstretched arm; thus forming a counter balance. This supports the postural behaviour observed during the physical assessment. The 'Jack' images, Figures 2 to 4, show that, whilst extended towards the door, the pilot was still able to depress the left rudder pedal, but that he was so extended that accurate control of foot movement would be seriously impaired, possibly resulting in exaggerated rudder pedal operation.

Figure 3: When the pilot reaches across the cockpit and pushes the door into the airflow, his left leg moves to the left with the result the left pedal goes forward. The left hand moves the control yoke down on the left side. This combination of control inputs probably caused the rapid roll to the left.

Visual cues

The assessment indicated that when reaching across to close the door from the left seat, forward visual cues were lost, thereby reducing the pilot's assessment of aircraft attitude in particular and his situational awareness in general.

Figure 4: The pilot when pulling the door closed transfers his weight to the right foot, which causes the right rudder pedal to move forward.

Analysis

In the absence of any evidence to indicate a technical problem with the door locking mechanism, reasons were considered as to why the door was not locked properly or inadvertently left open, and why the pilot apparently lost control of the aircraft.

One scenario, which was considered to be the one most strongly suggested by the available evidence, was that it was possible the pilot was expecting his friend in the tower to accompany him on the flight and, for the taxi along Runway 05 to where he intended to pick the friend up at holding point Alpha, he may not have fully secured the cabin door. When they flew together, the friend in the right seat customarily would perform the door closing and locking actions and the pilot would reach across to the locking handle and confirm it was in the fully forward, secured position. This was also the procedure that was adopted with the examiner during the pilot's recent LPC. The pilot was known to have a laminated flip card checklist, which was not recovered intact after the accident, the 'before takeoff' checks section of the checklist having been consumed in the fire. In the manufacturer's checklist, checking that the door was closed and locked was required to be done after the power checks; these were heard being carried out just prior to the takeoff. It is possible, therefore, that if the door check was required to be carried out at an earlier stage in the pilot's flip-card checklist, and not at the same point as that in the manufacturer's list, then the pilot may have overlooked the door locked check as he would not be used to performing this action following the power checks.

On the ground, closing and locking the door can be performed using one hand and requires the pilot/passenger to pull the door shut using the handle provided, which is centrally located at the bottom of the window. The Yale type latch at the rear section of the door then holds the door closed and the locking process is then carried out in the manner previously described. Depending on where the locking handle is in the arc of rotation, it is possible to cause the door to be held closed by the rear Yale type latch alone, but without the upper and lower latches fully engaged. During normal ground taxiing the door will remain closed but, when airspeed is increased for takeoff, the drop in air pressure over the wing and around the outer surface of the door is likely to cause it to distort outwards and unlatch.

What is apparent from the evidence is that the door on N1158V came open at a critical point of the flight, at or about the rotation point on the runway. In the previous incidents of doors opening, the increase in noise and the movement of the door were described as alarming, with a potentially overriding desire to correct the situation by closing the door.

From the evidence provided by the video recording and the witnesses, it was clear that the pilot was able to maintain control of the aircraft and continue the initial climb. He was seen to make a normal left turn, as if intending to follow the left-hand circuit pattern and land back at Sandtoft, but the turn was made at a point much earlier and lower in the circuit than would normally have been expected by this pilot. None of the witnesses could recall any audible change in engine power but the witness travelling along the motorway, who was a pilot, could see that the speed was very low and he was concerned by this and low height of the aircraft.

Having attained what the pilot probably thought was a reasonable height, he had two options for controlling the aircraft whilst he attempted to close the door. He could either hand fly the aircraft or engage the AP altitude and heading modes. It is reasonable to believe that he would have tried to maintain as lower airspeed as possible in order to minimise the effects of the airflow when attempting closing the door. It was not possible to establish if the AP had been engaged, but the pilot had demonstrated the effectiveness of the AP and his good working knowledge of it to the examiner following his recent LPC. Given his predicament, it is possible that the pilot attempted to use the AP to control the aircraft whilst he tried to close the door, but no evidence of this could be found.

From the ergonomics study it was established that, when reaching across to close the door, the forward visual cues were lost, thereby reducing the pilot's awareness of the aircraft attitude and his own situational awareness. The description of the rapid roll to the left by the witnesses would be consistent with the pilot inadvertently applying a large amount of left rudder as he attempted to reach for the door handle and/or applying left roll control input. The act of reaching to the right for the door handle was shown, by the study, to cause the pilots left leg to move out towards the left side of the

aircraft. If a conscious effort was being made to keep his feet on the rudder pedals, then this could have been translated into forward movement of the left rudder pedal, causing the rapid roll to the left. This effect would increase if the door was pushed into the airflow in order to allow it to be slammed. The scenario is illustrated at Figure 3, and this position is similar to that of the pilot as found in the wreckage.

The study also showed that when the door was pulled shut the tendency was for the left leg to relax its pressure, which was then transferred to the right foot. This had the potential of applying a force to the right rudder pedal, with the attendant possibility of causing the aircraft to roll to the right. The apparently normal rate of roll seen to return the aircraft to wings level, before the right wing dropped, was considered to be either such an application of right rudder when pulling the door closed, as shown in Figure 4, or AP driven, if engaged. At this stage the pilot would have had no external visual references. With reduced power on the engines, to limit the airspeed, and the aircraft manoeuvring in the manner indicated in the nose high attitude described by a witness, it is quite likely that the aircraft could stall and drop the right wing, as seen by the witnesses.

Had the AP been engaged with 'ALTITUDE HOLD' mode selected, the maintaining of selected altitude with reduced power would cause a loss of airspeed as the aircraft nose was continuously trimmed up and the control column moved to the fully aft position. When combined with the already low airspeed the manoeuvring would have caused the right wing to drop. The full aft control yoke position found in the wreckage is possibly indicative of the AP attempting to correct the loss of altitude due to the reduced power and low airspeed, or a final response of the pilot in the diving manoeuvre.

Conclusions

The accident occurred as a result of the pilot losing control of the aircraft, probably due to the loss of situational awareness and unintended control inputs, whilst attempting to close the open cabin door.

It was clear from the previous incidents that, although the open door in flight with the associated noise and movement is alarming, the aircraft could safely be flown using normal speeds, landing gear and flap configurations. This information was not provided within the Cessna Owners Manual but general advice on this was included in a Pilot Safety and Warning Supplement. It was not known if the pilot on the accident flight had familiarised himself with that document.

Whilst the hazard of making involuntary flight control inputs when reaching across the cockpit are highlighted in this report, it should be noted that such movements of the flight controls may be induced, for example, when reaching into the rear seat area, possibly to recover maps or spare headsets. Such actions should be thought through and not carried out at low heights or during critical phases of flight.