

Reims Cessna FRA150L, G-AZLL

AAIB Bulletin No: 5/99 Ref: EW/C99/2/1 Category: 1.3

Aircraft Type and Registration: Reims Cessna FRA150L, G-AZLL

No & Type of Engines: 1 Continental 0-240-E piston engine

Year of Manufacture: 1971

Date & Time (UTC): 4 February 1999 at 1200 hrs

Location: Turweston Aerodrome, Northamptonshire

Type of Flight: Public Transport (Training)

Persons on Board: Crew - 2 - Passengers - None

Injuries: Crew - 1 Fatal - Passengers - None
1 Serious

Nature of Damage: Aircraft destroyed

Commander's Licence: Commercial Pilot's Licence with Instructor Rating

Commander's Age: 28 years

Commander's Flying Experience: 470 hours (of which 93 were on type)
Last 90 days - 135 hours
Last 28 days - 45 hours

Information Source: AAIB Field Investigation

History of flight

The aircraft was refuelled to full tanks in the morning at Kidlington Airfield, Oxford, before departing for Turweston. On board were an instructor and student, the purpose of the flight being an introduction to circuits. The aircraft arrived at Turweston, carried out several circuits and then landed and parked on the apron. The pilots tied the aircraft down because of the strong wind conditions before taking a coffee break. Some 30 minutes later they departed, the intention being to return to Oxford, after carrying out some more circuits if weather conditions were good enough.

The pilots untied the aircraft and the student strapped himself in while the instructor walked the tail round to face the aircraft in the desired direction. The student recalled using his full harness because the instructor had said he demonstrate a practice Engine Failure After Take Off (EFATO) for the first time. It was the instructor's usual practice to use only the lap strap for himself. Prior to taxiing out the pilots were passed the following wind information; westerly 15 to 20 kt gusting 30 kt. G-AZLL broadcast on the Turweston radio frequency to say he was taking off from Runway 27

and shortly afterwards sent another message, "FAN STOP, I'LL CALL CLIMBING." The airfield duty manager who received the calls understood this to be a practice engine failure drill.

The student reports that he carried out the take off with the assistance of the instructor and soon after the instructor took control and simulated an engine failure by partially closing the throttle. He showed the student that he should be able to recognise this failure, if there was no bang or other obvious signs, by the reduction in airspeed and the sloppiness of the flying controls. While he was doing this he was checking the nose forward to maintain speed and he also selected some flap. The student next recalls a very sudden wing drop to his side from which the aircraft did not recover.

The airfield duty manager, who was also a fire officer, heard the engine noise varying and went outside the clubhouse to look. He saw G-AZLL flying very slowly, at a height estimated to be 200 to 250 feet, in level flight with some flap selected. He saw the aircraft waffle and soon after the left wing dropped. He turned away and ran towards the fire engine and sounded the siren. Other witnesses also described the aircraft as flying very slowly and waffling or wobbling before the wing dropped. They stated that there was a very rapid attitude change into a nose down spiral before the impact with the ground.

The airport fire engine was quickly on the scene and several other people ran over to assist. The instructor, seated in the right hand seat, had sustained fatal injuries and the student was seriously injured and trapped in the aircraft. The local emergency services arrived at the scene some minutes later and the student was freed and airlifted to hospital.

Meteorology

The area forecast for the southern region indicated a westerly airstream with a cold front moving across the area from the north later in the day. Visibility was expected to be 15 km with a broken cloudbase at 2,000 to 3,000 feet. There was also a strong wind warning to expect gusts to 30 kt in exposed areas and a SIGMET forecasting severe turbulence below FL 60 over land north of 51°North. (Turweston is at 52° North.) This information, except for the SIGMET, was available on the flying school notice board, further information including SIGMETS was available on the airfield. An aftercast provided by The Meteorological Office at Bracknell indicated that actual conditions were very similar to those forecast.

Pilot's experience

The instructor had completed a formal training course between June 1996 and July 1997 leading to the issue of a Commercial Pilot's Licence. He recorded no further flying until June 1998 at which time he commenced a Flying Instructor's Course. He completed this course in July 1998 and was issued with an Assistant Flying Instructor's (AFI) rating in September 1998. At the time of the accident he had 160 hours of instructional experience. The student had recently started training for his Private Pilot's Licence (PPL) and had recorded 9 hours flight time.

The aircraft

The aircraft was equipped with four-point harnesses, the two shoulder straps for each occupant having loops that passed around the tongue of the lap strap connector. The instructor's lap straps were still connected together, although without the shoulder straps being attached; the student's lap

straps had been disconnected. The student's shoulder harness straps had pulled through the roller locking mechanism but the instructor's shoulder harness had apparently not moved. The central lap strap connection to the cockpit floor, shared by the inboard portions of both occupants' lap straps, had pulled out.

The flaps could be selected to a maximum of 40° by holding down an electric switch on the instrument panel for approximately 9 seconds. In practice most pilots achieved the required setting by counting elapsed time whilst the switch was activated. If released this switch was designed to return to the neutral position. The actual flap position was shown by an indicator on the left front door post, or could be assessed by looking out through either side window. A flap position of 40° on the Cessna 150 creates considerable drag and requires a high power setting and low nose attitude to maintain flying speed. Upon selection of 40° of flap the speed would decay very quickly if no corrective action was taken. Such a setting would normally be used only for short field landings. There are several recorded instances on this type of aircraft of uncommanded flap deployment, and overrun from the selected position, due to intermittent sticking of flap switches. No such fault could be reproduced after this accident.

The stall warning horn was of the reed type, designed to give a steady signal some 5 to 8 kt before the stall. The horn had been heard to operate by the student at some time on the day of the accident but he could not recall when. The manufacturer quotes an indicated speed of 31 kt at the stall with 40° flap. Previous evaluations of Cessna 150 stalling characteristics have shown the behaviour to be docile, except in the configuration of high power and high drag when a rapid nose down pitch and roll to port to near vertical can be expected.

Engineering investigation

The aircraft had crashed into a level grassed area a few yards to the left of the upwind end of Runway 27. The impact had been at a relatively low speed with the wings level and the nose approximately 40° below the horizon. The propeller had been under low power and had stopped in half a revolution, with the buried blade showing moderate rearwards bending. The fuselage had rotated forwards after impact until the top of the tail fin had struck the ground; this had left the majority of the aircraft inverted.

The flap actuator was found extended in the 40° position. The actuator comprised an electrically operated screw jack with limit microswitches to cut off power at the 'up' and the 40° flap positions. Each microswitch had three spade type push-on electrical connectors; one connector on the down microswitch was found disconnected. Work was last carried out in this area in October 1997 when the 'up' flap limit switch was adjusted.

An external power supply was applied to the flap circuit, which was tested under a variety of conditions. With the wire disconnected, the flaps would not move in either direction. However, when the connector was replaced the flaps functioned correctly. It was not possible to cause an undemanded flap selection with the disconnected wire during the test.

Visibility of the flap actuator area within the wing, normally gained through the underwing access panel, was poor. However, with the upper wing skin removed it was possible to see that the six wires attached to the limit microswitches emerged from a loose bundle of wires and connectors approximately nine inches away from the flap actuator (see photograph). The bundle was not attached to the wing structure and had only been restrained by the disconnected lead, which was the

shortest of the six wires. The end fitting on the disconnected lead had been damaged at some time and this may have reduced its ability to grip the terminal post on the limit microswitch.

In summary, the flaps were found in the 40° position and no engineering explanation could be found for the selection that led to this position. A wire, which was found disconnected from the down limit microswitch, had the effect of preventing flap movement in either direction. It was not possible to determine whether the disconnection had occurred before, during, or after the accident. The separated wire had been predisposed to disconnection because its end connector was damaged and it was shorter than other wires in the bunch. It therefore took the strain imposed by the movement of the loose bundle of wires and connectors to which it was attached.

Survivability

The instructor was fatally injured at the time of the impact and the student sustained serious injuries. The deformation of the cockpit was substantial, and the instructor, who was wearing only the lapstrap portion of his harness, had been thrown forward from his seat. The lack of upper torso restraint probably contributed to his injuries. When found the student was suspended in his harness, in a semi-inverted position, with the shoulder straps pulled through the adjustment fittings to the end of their travel.

Discussion

The weather conditions on the day including a forecast for strong winds and turbulence would have made training for an inexperienced student pilot of limited value. That this was recognised was indicated by the pilots' decision to return to base.

The instructor was relatively inexperienced but he was operating as part of a flying training organisation. The Assistant Flying Instructor (AFI) rating is issued to new instructors with the intention that they should operate in a supervised environment. The Air Navigation Order Schedule 8 states that there must be a supervising Flying Instructor (FI) present at the airfield from which training is to begin and this was so in the case of this accident.

Given the gusty conditions it was possible for the aircraft to have experienced relatively large changes in airspeed and roll attitude while flying slowly. It seems likely that with the flap reaching 40°, and the bumpy conditions, that there was a sudden and critical loss of airspeed leading to a stall with a wing drop and subsequent incipient spin. The fact that the engine was at an intermediate power setting, though probably not full power, could have caused the stall behaviour to be more severe than normal.

An EFATO practice would normally be carried out during the climb once above a height of around 500 feet. The nose would be lowered to attain the correct airspeed and a suitable landing area selected, the exercise would then be discontinued and the aircraft recovered to climbing flight. For this EFATO practice the instructor was probably attempting to demonstrate to the student that in some cases it might be possible to land back onto the same runway. In order to make this an effective demonstration he may have selected some flap during the manoeuvre. It could not be determined whether the instructor was aware of the flap position achieved but it seems unlikely that he intended to deploy the full 40° flap because there was no intention to actually land. Inexperience or distraction may have led to the instructor failing to maintain sufficient airspeed for the

conditions since with 40° of flap an unusually low nose attitude is required. There was no indication that either pilot had recognised a problem with the flaps prior to the accident and it is therefore likely that the down limit switch wire became disconnected at the time of the impact or later.

It was not possible to determine whether the stall warning horn sounded on this occasion but the onset of the stall may have been quick, because of the high drag, and therefore the warning time short.