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ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation AO-2010-032
Final

Loss of control, VH-FPP
Jandakot Aerodrome, Western Australia
12 May 2010

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Abstract

On 12 May 2010, an instructor and student were conducting circuit training in an Eagle Aircraft Australia X-TS 150 aircraft, registered VH-FPP, at Jandakot Aerodrome, Western Australia. Soon after lift-off the engine started to run rough and lost power. The instructor took over control and, maintaining between 50 and 100 ft above ground level, turned the aircraft towards another runway. Near the end of that runway the aircraft pitched nose-up, stalled and collided with the ground, seriously damaging the aircraft and injuring the occupants.

There was no evidence found of an aircraft defect or anomaly likely to have significantly affected engine power. The investigation found that the decision by the instructor to turn downwind significantly increased the aircraft's energy and therefore the risk of aircraft damage and occupant injury in the case of a forced landing.

FACTUAL INFORMATION

Sequence of events

On 12 May 2010, an Eagle Aircraft Australia X-TS 150, registered VH-FPP was being operated on a dual training flight under the visual flight rules by a flight school based at Jandakot Aerodrome, Western Australia. In the morning, one of the flight school's instructors completed two flights in the aircraft without incident. The instructor and a student were then scheduled to practice simulated engine failures in the circuit. The plan was to conduct a number of normal circuits before beginning the practice emergencies.

At about 1320 Western Standard Time[1], the student taxied the aircraft for runway 24 Left (24L). After completing one or two normal circuits without incident, the student was conducting a touch-and-go[2] on 24L (Figure 1).

The instructor recounted that the student conducted a smooth landing and applied engine power when they were about halfway along the runway. Consistent with witness and air traffic controller observations, the instructor reported that at about 100 ft above ground level (AGL), the engine started running roughly and lost power. The student recalled that the engine began running roughly immediately after the aircraft became airborne.

The instructor took over control of the aircraft, lowered the nose to the best glide speed of 80 kts and advised the aerodrome controller of the problem. The controller cleared the aircraft to land on any runway and advised that the most into-wind runway was runway 30.

1 The 24-hour clock is used in this report to describe the local time of day, Western Standard Time (WST), as particular events occurred. Western Standard Time was Coordinated Universal Time (UTC) + 8 hours.

2 Practice landing in which the aeroplane is permitted to touch down on the runway briefly before another take-off is commenced.

Figure 1: Flight path derivation

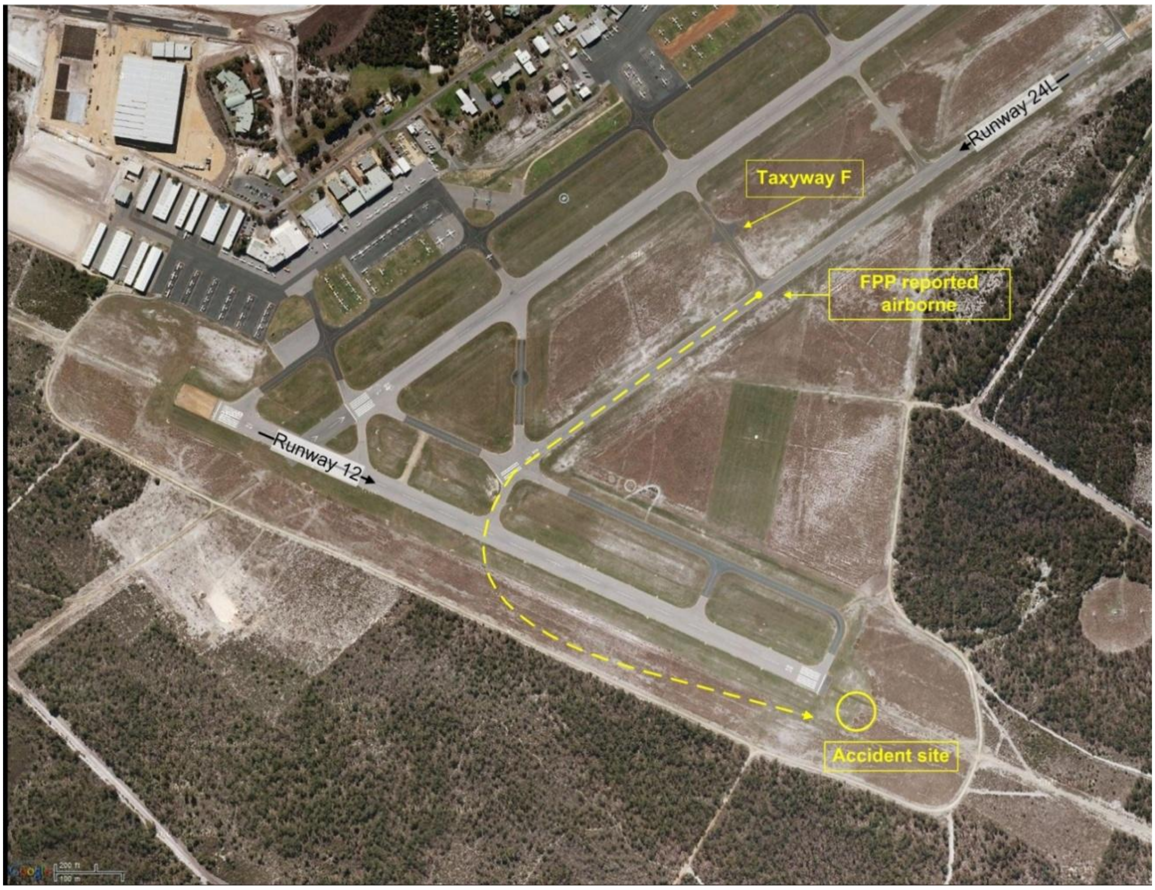

Image courtesy of Google

At the end of runway 24L the instructor turned the aircraft left through about 120°. The instructor recalled that the decision to turn left was made prior to the radio call to the controller because of the parallel runway to the right of the aircraft. Another reason given for the left turn was that the trees in the area ahead of the aircraft would have prevented a survivable landing at 80 kts and the intention was to land on runway 12. However, there was not enough room to land at that speed and the instructor initiated a further turn.

The instructor reported that she decided to level the wings and land on the runway 12 overshoot area and that it was at this point that the student panicked and pulled back on the controls. The aircraft pitched nose-up, entered an aerodynamic stall and rolled left into a steep nose-down descent.

The student recalled handing over control to the instructor, hearing the call to the controller, and the left turn. He recalled feeling calm and thinking that the lesson was going to be cancelled. The student's next memory is of the ground rapidly approaching with the aircraft at a steep angle and bracing for a crash. The student had no recollection of making any control inputs after handing over control to the instructor immediately after lift-off, and he considered it most unlikely that he would have taken over control and stalled the aircraft.

The aircraft collided with the ground, seriously damaging the aircraft and injuring the occupants. Air traffic controllers witnessed the accident and activated the Airport Emergency Plan. At the time of the accident, a rescue helicopter returning from a training flight with two paramedics on board was approaching for a landing at Jandakot. The rescue helicopter pilot offered their services and was cleared to land near the accident site.

The paramedics immediately rendered first aid to the seriously injured occupants until emergency services arrived about 10 minutes later.

There were a number of witnesses, including air traffic controllers, who observed the aircraft fly from the intersection of taxiway F with runway 24L to the accident site. The height of the aircraft was reported to be between 50 and 70 ft AGL throughout the event.

The investigation derived the probable aircraft flight path based on information from the instructor, witnesses and the accident site (Figure 1). The investigation calculated that after the engine power loss was recognised, the aircraft was airborne for about 25 to 27 seconds and traversed about 1,000 m.

Pilot information

The instructor held an Australian Commercial Pilot (Aeroplane) Licence and a Grade 3 (Aeroplane) Flight Instructor Rating, both issued on 23 February 2009. The last recorded instructor standardisation and proficiency check was on 3 March 2010. The instructor reported having a total of 1,200 hours and about 300 hours instructional time, mostly on the Eagle aircraft type.

The student began flight training at the flight school on 17 March 2010 and prior to the day of the accident, had recorded 9.8 flight hours over 10 training flights. Those flights included stalling and in the previous lesson, a simulated engine failure at circuit height with no reported difficulties. The student was reported to be progressing well and nearing the standard for a first solo flight.

Aircraft information

The aircraft was a two-seat, single-engine, all-composite aircraft with an unconventional stagger-wing design that incorporated a canard lifting surface in addition to the mainplane and tailplane (Figure 2).

Figure 2: VH-FPP

Image courtesy of the aircraft operator

The aircraft was manufactured in Australia in 1994 and at the time of the accident, had operated for 2,772 hours[3].

The aircraft was powered by a Teledyne Continental Motors IO-240-A: a four-cylinder, fuel-injected engine rated at 125 BHP driving a fixed pitch propeller. The overhauled engine had been installed in August 2009 and had operated for 294 hours. A review of the maintenance documentation showed that the last 100-hour inspection was performed in accordance with the Eagle Service Manual on 9 March 2010. Since that date the aircraft had flown for 97 hours.

Engine rough running had been endorsed on the maintenance release on 22 March 2010 and was cleared on the same day after a blocked fuel injector was cleaned. There were no uncleared endorsements.

It was reported that the aircraft had a low oil pressure indication on the day before the accident, but there was no reference to this in the maintenance documentation. The instructor reported that the oil pressure was indicating normally during the pre and after take-off checks.

Meteorological information

The aerodrome weather report (METAR) for Jandakot Aerodrome issued at 1330 recorded the wind from 280°[4] at 12 kts with a visibility of 10 km or more.

The aerodrome controller reported that the wind reported on the Automatic Terminal Information Service (ATIS) was 300° at 14 kts.

Aerodrome information

Jandakot Aerodrome was a certified aerodrome with two parallel runways that were generally oriented in the 060°/240° direction and one runway in the 120°/300° direction. Runway 24 L was 18 m wide and 1,150 m long. The declared take-off run available[5] (TORA) was 1,150 m and

3 The hours quoted in this section have been rounded to the nearest hour.

4 Wind direction rounded to the nearest 10° and related to True North.

5 The length of the runway declared available and suitable for the ground run of an aircraft taking off.

take-off distance available[6] (TODA) was 1,324 m. The minimum runway end safety area[7] (RESA) required for runway 24L was 30 m.

The aerodrome operator advised that the area surrounding the extended centreline of runway 24L had previously been cleared to maintain the obstacle-clear take-off gradient. That clearing and the 12/30 runway strip provided an obstacle-free area of about 500 m from the end of the runway.

Accident site and wreckage information

The initial impact with the ground was about 62 m from the end of runway 12 and 15 m to the south of the extended centreline. The propeller was embedded in the ground with the left canard nearby, while the remainder of the aircraft was located 11 m to the east (Figure 3).

Figure 3: Accident site looking east

The orientation of the propeller indicated that the aircraft's heading was 335° magnetic and attitude was 45° nose-down when the collision with the ground occurred. The nature of the damage to the left canard and the mainplane was consistent with a 45° bank to the left at the initial impact.

The forward fuselage area including the engine and instrument panel was disrupted, leaving the occupant seats exposed and the under-seat structure compromised. The seatbelts remained attached to the structure.

The emergency fuel pump switch was found in the ON position, as was the fuel selector. The master switch and magneto switches were found OFF. It was reported that during the emergency response following the accident, the switches were moved to reduce the fire risk.

A significant amount of putty-like substance was found in the gascolator[8] assembly that had been disrupted in the accident. It was later determined that emergency responders had applied the product to stop fuel leaking from the area.

The fuel system was examined with no evidence of any contamination. Continuity of flight controls was confirmed.

Specialist examinations

The engine was disassembled and examined at a Civil Aviation Safety Authority-approved engine overhaul facility under the supervision of the Australian Transport Safety Bureau (ATSB). There was no indication of low oil pressure and no mechanical defects or anomalies were identified.

The engine ignition and fuel components were examined and tested at other facilities under the supervision of the ATSB. The fuel injectors were unobstructed and the only anomaly identified was a fuel leak from the emergency fuel pump drain. When fuel was allowed to flow through the pump with the pump OFF, the fuel exiting the pump was aerated. It was not clear if the fuel pump leak existed before the accident or if it would have had a significant effect on engine operation.

A sample of fuel drained from the aircraft's fuel tank was tested at an accredited laboratory. The sample met the standard (Def-Stan) 91-90 specification for Avgas 100/130 except for appearance. The test report stated that a filter could be employed to remove the particulates.

6 The length of take-off run available plus the length of any clearway available. In this case, the gradient applied was 2.86%.

7 The cleared and graded area adjacent to the end of a runway intended for use in the event of an aircraft undershooting or overrunning the runway.

8 A filter located at the lowest point of a fuel system that included a drain to allow the as-required removal of water and solid particles.

There was no evidence of particulates found in the fuel system.

Operational information

The Pilot's Operating Handbook and Approved Flight Manual (POH/AFM) specified the flaps-up wings-level stall speed[9] as 56 KCAS[10], which increased to 60 KCAS at 30° angle of bank. The manual described the stall handling characteristics as conventional and excellent with an expected altitude loss of up to 150 ft during stall recovery.

The POH/AFM (abbreviated) procedure for an engine failure after takeoff was:

- Airspeed 80 kts
- Emergency fuel pump ON

If the engine did not start, the procedure specified fuel and ignition be turned OFF, and for the wing flaps to be positioned as required with the declaration of an emergency if time permitted.

The amplified emergency procedures advised that:

> If failure of the engine driven fuel pump is suspected, as indicated by a loss of fuel pressure, the Emergency fuel pump should be activated,
>
> If altitude is insufficient to execute a 180° gliding turn, a landing should be performed straight ahead.
>
> It is better to control the aircraft to a landing in unsuitable terrain, than to lose control in a tight turn back to the runway with low airspeed.

The POH/AFM aircraft and system description stated that:

> If the Emergency fuel pump is activated in flight with the engine driven pump operating normally, excess fuel will be provided to the engine and leaning may be required to allow the engine to continue to function normally.

The instructor reported that she did not turn the fuel pump on due to the low height and need to focus on getting the aircraft on the ground.

9 Additional conditions applicable to the stall speed were: power off; centre of gravity at forward limit; maximum weight of 650 kg.

10 KCAS was knots calibrated airspeed.

Engine power loss after takeoff

Since the start of 2002, the ATSB has investigated four fatal accidents[11] involving single-engine aeroplanes where loss of control following engine power loss after takeoff was a contributing factor. In three of those accidents, the pilot attempted to continue the flight and manoeuvre the aircraft after partial or intermittent engine power loss.

The ATSB research and data analysis section is planning to produce a short educational booklet regarding single-engine partial engine failure accidents and lessons learned from those accidents. Anticipated for public release in the first quarter of calendar year 2011, that booklet will be available on the ATSB web site at www.atsb.gov.au

ANALYSIS

Engine power loss

It was clear from the pilot and witness information that the aircraft's engine sustained rough running and partial power loss soon after lift-off. However, the examination of the engine and associated aircraft systems did not identify any defect that was likely to have affected the operation of the aircraft to the extent described by the pilots and witnesses. There was also an adequate amount of fuel on board and no indication of pre-impact fuel contamination.

When and how the emergency fuel pump switch was turned ON (as found in the wreckage) could not be established. If the pump had been switched on in-flight with the engine driven fuel pump operative, it had the potential to exceed the engine driven fuel pump inlet pressure and inhibit engine power due to an excessively rich mixture. However, there was no evidence of excessively rich mixture and no indication that the pump was turned ON in flight.

The investigation considered injector contamination, similar to that recorded on 22 March 2010, but was unable to find any evidence of a contaminant in the injectors or fuel system. The investigation also considered fuel

11 ATSB investigation numbers 200204328, 200303633, 200600001, 200601688

aeration due to the emergency fuel pump leak as a potential factor, but was unable to establish the extent of any influence on engine performance.

Overall, there was no evidence found of an aircraft defect or anomaly likely to have significantly affected engine power.

Loss of control

Near the end of runway 12, the aircraft was observed to pitch nose-up followed by a tight left turn and steep nose-down descent into the ground. That sequence was consistent with an aerodynamic stall induced by rearward movement of the elevator control. The aircraft was at 50 to 100 ft above ground level, when the nose was pitched up. The published maximum height loss during stall recovery was 150 ft.

The instructor reported that the student panicked and pulled on the controls, but the student reported that he felt calm during the event with no recollection of pulling on the controls. In that context it was not possible to establish how the critical control input was made. Such an inappropriate control input at a critical height and speed would almost certainly result in an unrecoverable stall and loss of control.

The loss of control was a key factor in the extent of aircraft damage and occupant injury sustained during the accident. As the amplified emergency procedures indicated, the prime concern of a pilot in an emergency should be to maintain control of the aircraft.

Safety considerations

A partial engine power loss soon after lift-off is a difficult situation to handle. A pilot is faced with the need to assess the engine power and performance available and make a decision in a short period of time to either land immediately or attempt to continue the flight.

Generally, a pilot in this situation requires a set of immediate responses in order to affect the safest course of action. A pilot should rehearse those responses before takeoff in readiness for such an event and carry out those actions in a timely way.

By the time the instructor assessed the engine power loss and assumed control, the distance remaining on the runway was probably insufficient for a normal landing. Given there was some engine power available, the instructor had the option of continuing straight ahead and landing on the overshoot area or making a turn. The instructor elected not to land straight ahead in part because she perceived the nature of the terrain in the overshoot area of runway 24L to be unsuitable for an emergency landing. While the aircraft performance was sufficient for a turn in this case, there was at least 500 m of obstacle-free area beyond the end of the runway that could have accommodated an emergency landing.

A right turn to position the aircraft for a landing along runway 30 would have placed the aircraft more into wind, reducing its ground speed by 12 to 14 kts and reducing the landing distance required. However, that would have meant crossing the departure end of runway 24R and the possibility of conflicting with traffic operating from that runway. Although the controller had offered any runway, the instructor reported that the parallel runway configuration had influenced her decision making.

The turn to the left put the aircraft downwind and increased the aircraft's ground speed by about 12 to 14 kts. That faster groundspeed increased the landing distance required to stop the aircraft. In this case, due to the aircraft stall and loss of control, the additional ground speed was not found to be contributory. However, at the higher speed it increased the energy involved in a collision with terrain and correspondingly increased the risk of aircraft damage and occupant injury.

FINDINGS

From the evidence available, the following findings are made with respect to the loss of control involving Eagle Aircraft Australia X-TS 150, registered VH-FPP at Jandakot Aerodrome, Western Australia on 12 May 2010 and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The aircraft engine sustained rough running and partial power loss soon after lift-off, resulting in substantially reduced performance.
- The aircraft was pitched nose-up, precipitating an aerodynamic stall, loss of control and steep

nose-down descent from a low altitude that did not permit recovery before colliding with terrain.

Other safety factors

- The decision by the instructor to turn downwind significantly increased the aircraft's energy and therefore the risk of aircraft damage and occupant injury in the case of a forced landing.

Other key findings

- There was no evidence found of an aircraft defect or anomaly likely to have significantly affected engine power.
- Prompt attention by the helicopter rescue crew greatly enhanced the survivability of both pilots.

SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included the:

- instructor and student pilot of VH-FPP (FPP)
- aircraft operator
- air traffic controllers
- on-airport witnesses
- emergency services
- Bureau of Meteorology
- manufacturer's Pilot's Operating Handbook.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the flight crew of FPP, the aircraft operator and the Civil Aviation Safety Authority. Submissions were received from the instructor and student pilot of FPP. The submissions were reviewed and, where considered appropriate, the text of the draft report was amended accordingly.