Flight control occurrence.

On 20 February 2014, Virgin Australia Regional Airlines was operating an ATR 72 aircraft, registered VH-FVR, on two scheduled passenger flights from Sydney, New South Wales (NSW) to Canberra, Australian Capital Territory and return. This was to be followed by a charter flight to Narrabri, NSW and return.

The applicable forecasts and reports did not anticipate any significant weather with the only concern to the flight crew being an expected crosswind of up to 30 kt for landing at Canberra. This was taken into account when the captain decided to be pilot flying for the first sector.

Pushback at Sydney was on time at about 1435 Eastern Daylight-saving Time but take-off was later than planned due to a long taxi and holding for traffic. The departure, climb and cruise were normal. For the descent into Canberra the crew selected a slower airspeed due to the possibility of turbulence. No significant turbulence was encountered until the normally-expected amount of mechanical turbulence on late final approach into Canberra.

The turnaround was conducted within the allocated time and the return flight to Sydney departed Canberra at 1612 with the first officer as the pilot flying. A steeper-than-usual climb was carried out to reduce exposure to turbulence. Other than expected turbulence during the first 1,500 ft, there was nothing significant during the climb to flight level (FL) 170.

During cruise the captain was in radio contact with the operator's personnel who requested that departure from Sydney for the next sector be brought forward by 5 minutes. The captain expressed his concerns about the limited time available for the turnaround to the first officer.

The crew conducted a routine brief for the anticipated arrival to runway 16 Right, which was expected to be standard except for commencement of descent 5 NM (9 km) earlier to compensate for a tailwind. The captain noted that they needed to be cognisant of managing airspeed during the descent as a result of the anticipated decreasing tailwind.

The first officer commenced descent with the autopilot engaged in vertical speed mode and a target airspeed of 235 kt (15 kt less than the maximum operating speed of 250 kt). The descent was stable and smooth.

On first contact with Sydney Approach the crew were assigned runway 16 Left. This was different to the briefed runway and required a change of instrument approach diagrams and navigational aid frequencies.

At the appropriate points the seatbelt sign was turned on and the transition-down checklist carried out. The checklist was held at the last item awaiting a report from the cabin that it was secure.

At 1640 and about 8,500 ft, the crew noticed the airspeed going up quickly and the speed trend excessively high. The first officer reduced engine power and used touch control steering to temporarily disconnect the autopilot before manually raising the nose to control the speed. The aircraft felt 'heavy', requiring the first officer's two hands on the controls to move from the then -4° pitch angle (aircraft nose-up/down). The first officer expected that the pitch correction would be sufficient to arrest the speed trend.

The captain was unsure if the first officer's control inputs were sufficient to avoid an overspeed so put one of his hands on the controls and disconnected the autopilot to raise the nose further. The captain believed he indicated his intention to take over control and while the first officer could not recall it being verbalised he was aware of the captain's actions. The first officer recalled that he took his hands off the controls, releasing touch control steering in the process. Shortly after, concerned about a high nose-up attitude, the first officer put his hands back on the controls. To both crew members, what happened next was unexpected and unclear.

Suddenly, the crew felt high positive G, the controls felt different and spongy, and cockpit warnings activated. The crew then verified that the aircraft was under control at a stable attitude and speed. It was level or in a slight descent at an airspeed of about 230 kt.

One of the cockpit warnings was 'pitch disconnect', indicating the left and right elevator control systems had been decoupled. This allowed for independent movement of the elevators via the captain and first officer control columns.

The crew consulted the pitch disconnect checklist and worked to identify which control column was free and working normally. Although both controls were free, it was decided that the captain would be pilot flying. During this process an intermediate airspeed around 200-210 kt was selected before reducing the airspeed to below the 180 kt specified in the checklist.

At some point the cabin crew called the cockpit and advised that the senior cabin crew member had injured her leg and that it might be broken. In the next contact with air traffic control the crew asked for an ambulance to be available after landing. The crew also made a PAN call and requested runway 16 Right to minimise taxi time on the ground. Air traffic control agreed to that request.

The captain flew the approach to runway 16 Right manually with airspeeds, power settings and configurations that were typical of any day-visual approach and landing. After landing and a slight delay the crew taxied the aircraft to the assigned bay

After shutdown the crew completed cockpit tasks including reconnection of the two elevator control systems and the captain checked on the condition of the cabin crew member. Airport firefighters provided first aid until an ambulance arrived at the bay 10 minutes after the aircraft parked. The cabin crew member was transported by ambulance to a hospital. The Australian Transport Safety Bureau (ATSB) was advised initially of a turbulence-related event and, based on the nature of the injuries sustained by the flight attendant, commenced an investigation.

Figure 1: Aircraft taxiing onto the bay

Post-occurrence maintenance

Two aircraft maintenance engineers working for the company that provided contract maintenance services to the operator were in attendance at the aircraft. The crew advised the engineers that they weren't sure what had happened but that the pitch controls had disconnected, with a possible overspeed. From the onboard equipment, the engineers were able to establish that there had not been an overspeed but a vertical load factor of 3.34 g was recorded that exceeded the acceptable limit for the aircraft weight. One of the engineers took the opportunity to conduct a preliminary walk-around visual inspection and did not observe any aircraft damage. The flight crew entered the pitch disconnect in the aircraft's technical log and, after a request from the engineers for more information, added that the aircraft had sustained moderate turbulence.

The aircraft was removed from further service that day and towed to a distant parking area to allow for the resulting maintenance inspection to be carried out. The two engineers on duty, one of whom was the senior base engineer, had come in early at 0600 to work on a grounded aircraft. Given this start time and the resulting already long day, the engineers considered that they needed assistance to complete their remaining tasks, which now included an inspection of VH-FVR. An engineer on his rostered day off agreed to come into work to assist with the inspection.

This engineer arrived at work at about 1900 and, after a discussion with the duty engineers, understood that the aircraft operator (maintenance watch) had received the data from the aircraft's quick access recorder and requested a turbulence inspection after a pitch disconnect in moderate turbulence. He also understood at the time that one of the duty engineers had done quite a detailed walk-around of the aircraft in daylight and found no signs of defects.

The aircraft manufacturer's job card for a turbulence inspection specified a general visual inspection of the fuselage, stabilisers and wings with more detailed inspections if any anomalies were found. A detailed inspection of the wing attachment fittings was also required irrespective of the results of the general visual inspection.

Over the course of the evening the non-rostered engineer and one of the duty engineers worked on disassembling some of the aircraft interior to access the wing attachment fittings. The duty engineers left at 2200, leaving the non-rostered engineer to complete the task. At about 2300 the engineer borrowed a nearby stand to provide a platform at about wing height. While on the stand positioned behind the left wing near the fuselage, the engineer inspected the upper surface of the wing, rear fuselage and tail by torchlight. The engineer finished work shortly after and returned to work at 0600 the next morning.

No defects were identified from any of the inspections and the aircraft was returned to service the next day.

Suspected birdstrike

Subsequent to the occurrence on 20 February, the aircraft was operated on 13 sectors, the last of which was a scheduled passenger flight from Sydney to Albury, NSW on 25 February 2014. On descent into Albury the aircraft passed in close proximity to birds, which alerted the captain to the possibility of a birdstrike. There were no indications that a bird had struck the aircraft but on the ground, the aircraft's pitch trim system fluctuated abnormally.

The captain conducted a walk-around inspection with an expectation of bird damage to the left side of the aircraft. The only abnormality found was a deformity to a fairing at the top leading edge of the vertical stabiliser, which might have been the result of a birdstrike. The captain advised maintenance watch who dispatched an engineer to inspect the aircraft.

The engineer used scissor lift equipment to inspect the tailplane and confirmed that the fairing might have been damaged by a bird but that there was also significant structural damage on top of the tailplane. The aircraft was grounded and the ATSB advised.

Later information from the operator suggested that the damage to the tailplane might have been a result of the occurrence involving VH-FVR on 20 February 2014. On this basis, the ATSB combined its investigation into the aircraft damage identified in Albury with its investigation into the earlier flight control occurrence.

The flight crew of the earlier pitch-disconnect flight and the engineers involved in the post-flight maintenance were interviewed and the damage to the aircraft was inspected at Albury. The ATSB downloaded data for the pitch-disconnect flight and subsequent flights from the flight data recorder and data for the pitch-disconnect flight and last flight from the cockpit voice recorders that were installed in the aircraft for those flights.

Initial examination

An initial examination of the recorded data showed that when the airspeed approached 240 kt, at about 8,500 ft during the descent into Sydney on 20 February, the first officer used touch control steering and manually pitched the aircraft up. The airspeed increased again and then both the first officer and captain pulled on the control column. Shortly after, when the vertical load factor was increasing through 1.8 g, the first officer began to push the control column. The differential force on the control column that resulted from the captain and first officer applying an opposing force exceeded the differential force required to generate a pitch disconnect. Each pilot was then controlling the elevator on their side of the aircraft in opposite directions for a brief period before the first officer released his control column.

The aircraft manufacturer inspected the aircraft and found broken carbon plies, cracked joint sealant, and deformation in and around the area where the horizontal stabiliser attaches to the vertical stabiliser (Figures 2 and 3). There was also some minor damage to the rudder. The damage was assessed as being consistent with an overstress condition. Subject to further assessment and non-destructive testing, the aircraft manufacturer recommended replacement of the horizontal stabiliser, elevators, and vertical stabiliser.

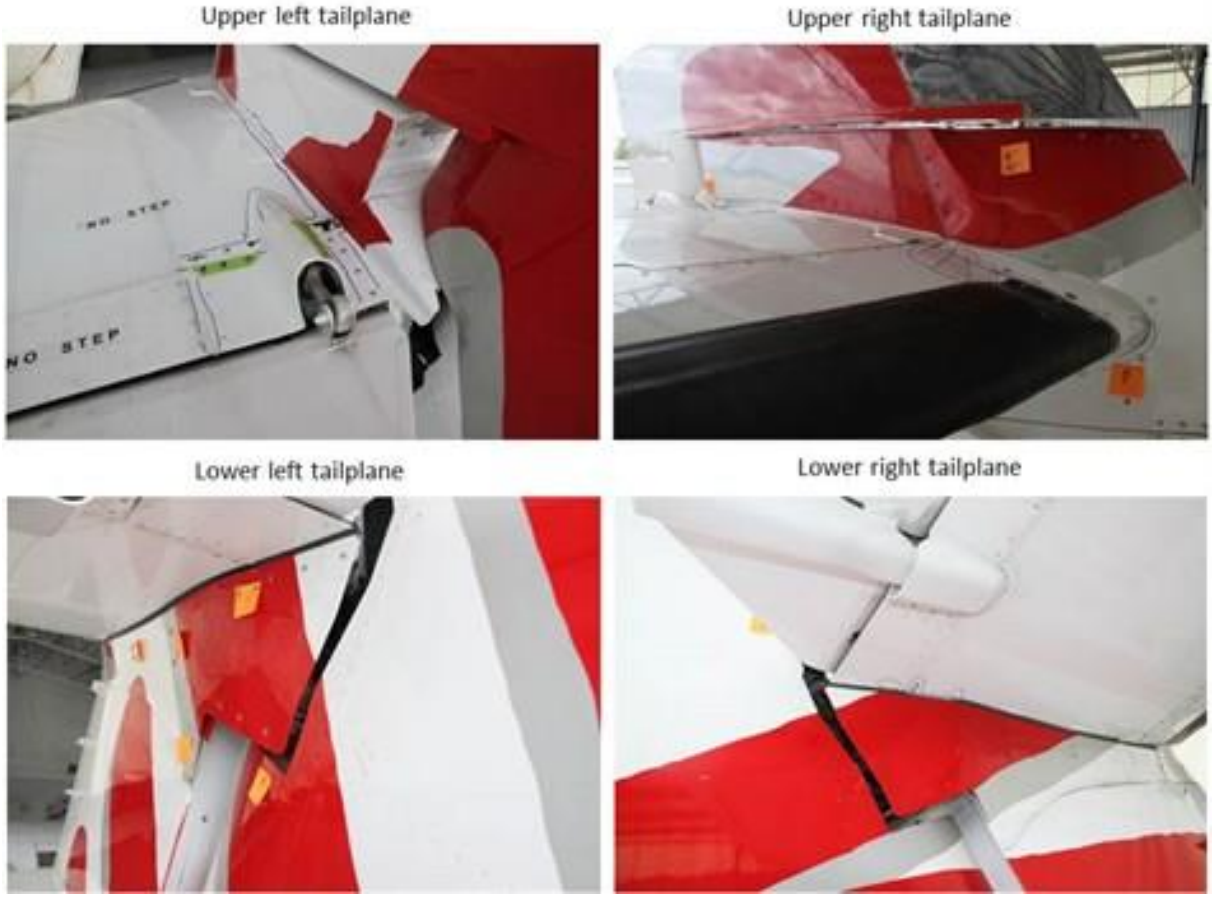

Figure 2: Tailplane external damage (indicated by marks and stickers)

Figure 3: Left tailplane attachments (fairing removed)

Ongoing investigation

The investigation is continuing and will include review of the:

- meteorological data
- data from the flight data recorder
- data from the cockpit voice recorder
- closed circuit TV footage
- aircraft operator's procedures and training
- aircraft maintenance records
- maintenance organisation's procedures and equipment
- arrangements between the aircraft operator and maintenance organisation
- aircraft manufacturer's maintenance instructions
- information as it becomes available during the repair process.