Australian Government
Australian Transport Safety Bureau

Flight control system event involving a Fokker 100, VH-FZO

near Argyle aerodrome, Western Australia, 7 March 2014

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Aviation Occurrence Investigation
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Addendum

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Flight control system event involving a Fokker 100, VH-FZO

What happened

On 7 March 2014, at about 1000 Western Standard Time (WST), a Fokker 100 aircraft, registered VH-FZO, operated by Virgin Australia Regional Airlines, departed Perth on a scheduled passenger flight to Argyle, Western Australia. On board was a captain operating as the pilot in command under supervision (ICUS) and designated as the pilot flying (PF),[1] and a training captain who was the pilot in command of the flight, seated in the right seat, designated as the pilot monitoring (PM).

At about 1210, the training captain detected the aircraft commence an uncommanded descent. The primary flight director (PFD) displays were normal and there were no warnings or alerts.

The aircraft pitched down and the training captain reported that it was as if the flight directors were commanding the aircraft to descend and the autopilot was following, rather than an autopilot failure. Both thrust levers came back towards idle to maintain the selected speed during the descent. The PF changed the mode on the automatic flight control and augmentation system (AFCAS) to allow manual control of the descent, however the PM observed that the aircraft was continuing to descend and he pushed the altitude hold to arrest the descent. The rate of descent reached about 1,700 feet per minute (fpm) and the aircraft descended about 300 ft.

The PF then disconnected autopilot 1 and connected autopilot 2. The PM notified air traffic control of the altitude deviation and advised of a system malfunction. The aircraft continued to Argyle and the crew commenced descent to the aerodrome.

At about 1308, the crew conducted a visual approach to Argyle and established the aircraft on final for a straight in approach about 10 NM from the runway. When at about 1,000 ft above ground level (AGL) and about 3 NM from the runway threshold, the PF stated that the thrust levers were stuck. He assumed that the aircraft had entered Alpha Floor mode, and immediately held both auto-disconnect buttons and pushed the thrust levers forward to disconnect the thrust lock. The levers remained stuck and the PM then tried to move the thrust levers, also attempted to disconnect the autothrottle, and confirmed that the levers were stuck. The PFD showed that the thrust was in manual mode and the autothrottle had disconnected.

The PM noticed the airspeed trend indicator move below the target speed and advised the PF that he would take control of the thrust levers and the PF could continue to fly the approach. The PM applied force with both hands on the thrust levers and they jerked forwards, resulting in about a quarter of the normal available thrust. The resultant lever position obtained by this movement was appropriate for the phase of flight without any reduction in speed below the nominal approach speed. The increase in thrust caused the aircraft to pitch up slightly and the airspeed to increase to about 15 kt above the target speed. The PM directed the PF to get the aircraft back onto the normal profile and the PF extended full flap.

Just prior to touchdown, the PM extended the speed brake and, when at about 10 ft AGL, he applied sufficient force to move the thrust levers to the idle position. The aircraft landed smoothly and the PM applied reverse thrust to assist in slowing the aircraft down. The flight crew then resumed their normal duties until the aircraft was parked and the engines shut down.

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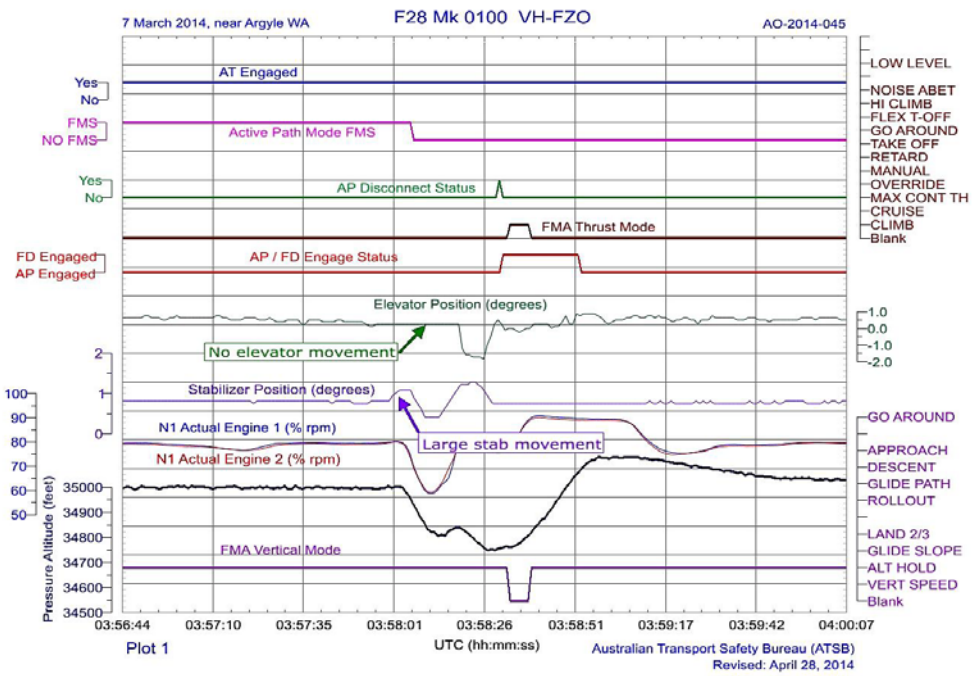
[1] The pilot flying (PF) does most of the flying, except in defined circumstances, such as during the planning and preparation for descent, approach and landing. Pilot monitoring (PM) duties include crosschecking the actions of the PF, monitoring the aircraft's progress and conducting the radio communications.

Figure 1: Flight data for VH-FZO



Source: ATSB

Flight data

The ATSB analysed the flight data and determined the following with regard to the stuck thrust lever (Figure 1):

- There is no thrust lever parameter from which to derive what position it was stuck. At 1,081 ft AGL, the autothrottle disconnected and the aircraft reverted to manual speed mode.
- The lowest airspeed in this section of the flight was 129 kt calibrated airspeed (CAS) at about 1,008 ft AGL. This then increased gently to 154 kt at about 687 ft AGL. The final approach was flown at between 140 kt and 125 kt in a generally descending trend. The V_{ref} speed was 120 kt and V_{app} 130 kt and therefore the approach was conducted within normal parameters.

In relation to the uncommanded descent:

- The data indicated that the uncommanded descent was caused by a stuck elevator.
- The recorded altitude deviation in the descent was 253 ft and maximum vertical speed about 1,400 fpm, based on pressure altitude changes.

Fokker also analysed the flight data in relation to the uncommanded descent and found that the elevator had become stuck for about 20 seconds. Immediately prior to the loss of altitude, autopilot 1 was engaged but there was no elevator movement. At the same moment there was stabilizer deflection. The elevator servo was unable to deflect the elevator, thus current continued to run through the elevator servo motor because the autopilot continuously tried to correct the flight path. The automatic trim function steered the stabilizer to minimize the current running through the elevator servo motor.

Engineering inspection

The aircraft was de-energised when engineers arrived and the right thrust lever remained stuck. An engineer used large force until the lever came free and suspected the servo was not disengaging. Engineers subsequently replaced the autothrottle No. 2 servo which rectified the fault. Following the incident flight, no fault was found with autopilot No. 1, which was assumed to have been the cause of the uncommanded descent.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Aircraft operator

As a result of this occurrence, Virgin Australia Regional Airlines (VARA) sent a memo to all flight crew regarding uncommanded pitch events. Immediately after the incident flight, engineers were unable to find any fault with the autopilot and the aircraft was returned to service. Two similar occurrences with autopilot No. 1 engaged were reported on the same aircraft via maintenance log entries on the 9 March and 12 March 2014. After the event on 12 March, engineers replaced the elevator No. 1 servo. The memo reminds flight crew that an Air Safety Incident Report should be lodged for a malfunction of an aircraft system and for a recurring aircraft fault.

A number of similar incidents have subsequently been reported across the VARA Fokker 100 fleet. VARA is reviewing whether this is a direct result of the memo distributed to company flight crew.

The Fokker 100s are fitted with six identical servos: two elevator servos, two aileron servos and two in the thrust control quadrant. In this incident flight, an elevator servo and a thrust lever servo failed in the same sector.

The VARA Fokker 100 fleet was inspected in accordance with the Fokker inspection regime, to determine whether the servos fitted were serviceable. An aircraft that was included in this inspection had a servo fail on a subsequent flight, indicating that the inspection had not predicted the failure. The same check is conducted as scheduled every 500 hours on each aircraft in the fleet.

VARA established that the replacement rate of the servos is about 9,600 cycles. They have immediately implemented a replacement life of 8,000 hours and will incrementally replace all six servos in all the aircraft in the fleet when this life has been exceeded.

VARA has asked Fokker whether the servos are all of the same batch number and the average number of cycles that the servos fail at worldwide. They have also requested that Fokker review the service life of the elevator servo as there is currently no limit.

A further memo has been issued to VARA flight crew advising pilots not to reengage the autopilot that was in use following and uncommanded pitch change, but to swap to the other autopilot for the remainder of the flight.

Aircraft manufacturer

Fokker released Service Bulletin 70/100, to upgrade to a new servomotor and servomount for the elevator position, to solve the pitch oscillations. The associated Service Experience Digest stated that the most probable cause of a temporary stuck elevator servo (elevator ‘stiction’) was ice accretion on the elevator servo-mount capstan or elevator servo-drive cables when the aircraft was flown into a humid environment such as cloud. A lubrication task was advised to prevent ‘stiction’.

Safety message

This incident provides an excellent example of how an experienced flight crew faced with a novel and unanticipated threat, were able to modify their roles and work together to safely complete the flight. Once on the ground, the crew reverted to their normal duties to ensure all operations and checks were completed normally until the aircraft engines were shut down.

General details

Occurrence details

Date and time:	11 March 2014 – 1210 WST	
Occurrence category:	Incident	
Primary occurrence type:	Flight control systems event	
Location:	near Argyle aerodrome, Western Australia	
	Latitude: 16° 38.22' S	Longitude: 128° 27.08' E

Aircraft details

Manufacturer and model:	Fokker B.V. F28 MK 0100	
Registration:	VH-FZO	
Operator:	Virgin Australia Regional Airlines	
Serial number:	11305	
Type of operation:	Air transport – passenger	
Persons on board:	Crew – 5	Passengers – 10
Injuries:	Crew – Nil	Passengers – Nil
Damage:	Nil	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in

order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.