Australian Government
Australian Transport Safety Bureau

Undetected engine thrust reverser deactivation involving Fokker F100, VH-NHA

Karratha Airport, Western Australia, on 27 December 2017

ATSB Transport Safety Report
Aviation Occurrence Investigation
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Addendum

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Safety summary

What happened

On the morning of 27 December 2017, a Network Aviation Fokker F100 aircraft, registered VH-NHA was on final approach to Karratha Airport, Western Australia. The aircraft was operating as a scheduled passenger flight from Perth.

After a normal descent and touchdown, the captain selected both engine thrust reversers. The right engine thrust reverser did not activate. The aircraft decelerated using normal braking and taxied to the gate without further incident. There was no damage to the aircraft or injuries as a result of the incident. The captain reported the thrust reverser issue to maintenance personnel for investigation.

What the ATSB found

During maintenance the previous day in Perth, the right engine thrust reverser 'minimum equipment list' (in-service) lockout bolt had been installed instead of the maintenance lockout bolt. The maintenance bolt had a red warning flag and needed to be booked out from the tool store. Using the in-service bolt rendered ineffective the visual checks (warning flag) and procedural tooling check that were in place to ensure the bolt's removal. Consequently, the aircraft was released to service with the bolt installed.

What's been done as a result

The aircraft's maintenance organisation advised that in response to this incident it has taken safety action to highlight to maintenance staff the importance to follow the safety instructions and warnings contained in the aircraft maintenance manual. Further, the procedures for maintenance activities including task assessments, tooling and task procedures, have been reinforced.

Safety message

This investigation highlights the risk of varying procedures when performing maintenance tasks. It is important that, in all parts of the maintenance system, there is an awareness of human factors associated with completion of the task. An understanding of the demands associated with a task may help identify informal work practices that can then be aligned with the formal procedures (see Civil Aviation Safety Authority publication *Safety Behaviours: Human Factors Resource Guide for Engineers*).

The occurrence

What happened

On the morning of 27 December 2017, a Network Aviation Fokker F100 aircraft, registered VH-NHA (NHA) was on final approach to Karratha Airport, Western Australia. The aircraft was operating as a scheduled passenger flight from Perth, with three flight crew, three cabin crew, and 64 passengers.

At about 1039 Western Standard Time,[1] air traffic control cleared NHA to land. After a normal descent and touchdown, the captain (pilot flying) selected both engine thrust reversers. [2] The left engine thrust reverser activated but the right engine thrust reverser did not. This was followed by an alert tone and a message on the multifunction display that the thrust reverser had not operated.

The flight crew continued with the landing and the aircraft decelerated to a taxi speed using normal braking. The captain moved the thrust reverser controls to the stowed position, the aircraft taxied to the gate without further incident and the passengers disembarked.

The flight crew reported the thrust reverser issue to engineering personnel for investigation. The subsequent engineering inspection found that the right engine thrust reverser had the 'minimum equipment list' (in-service) lockout bolt installed, effectively deactivating the reverser. The lockout bolt (Figure 1) was removed, normal operation of the thrust reverser was confirmed, and the aircraft returned to service.

There was no damage to the aircraft or injuries as a result of the incident.

Figure 1: In-service thrust reverser lockout bolt and lock tab

Source: Operator, annotated by ATSB.

[1] Western Standard Time (WST): Coordinated Universal Time (UTC) + 8 hours.

[2] The purpose of the engine thrust reversers is to decelerate the aircraft on the ground, either routinely or during an emergency.

Previous maintenance

Maintenance on the aircraft's right engine was carried out in Perth on 26 December, the day before the incident flight, by a licensed aircraft maintenance engineer (engineer).The engineer began his scheduled day shift at about 0400.

The engineer initially progressed a maintenance task on another Fokker F100 to a stage where he was waiting on the availability of parts. In the interim, at about 0900, he was allocated another task to inspect both engines' emergency fuel shut-off cables on two Fokker F100 aircraft, including NHA.

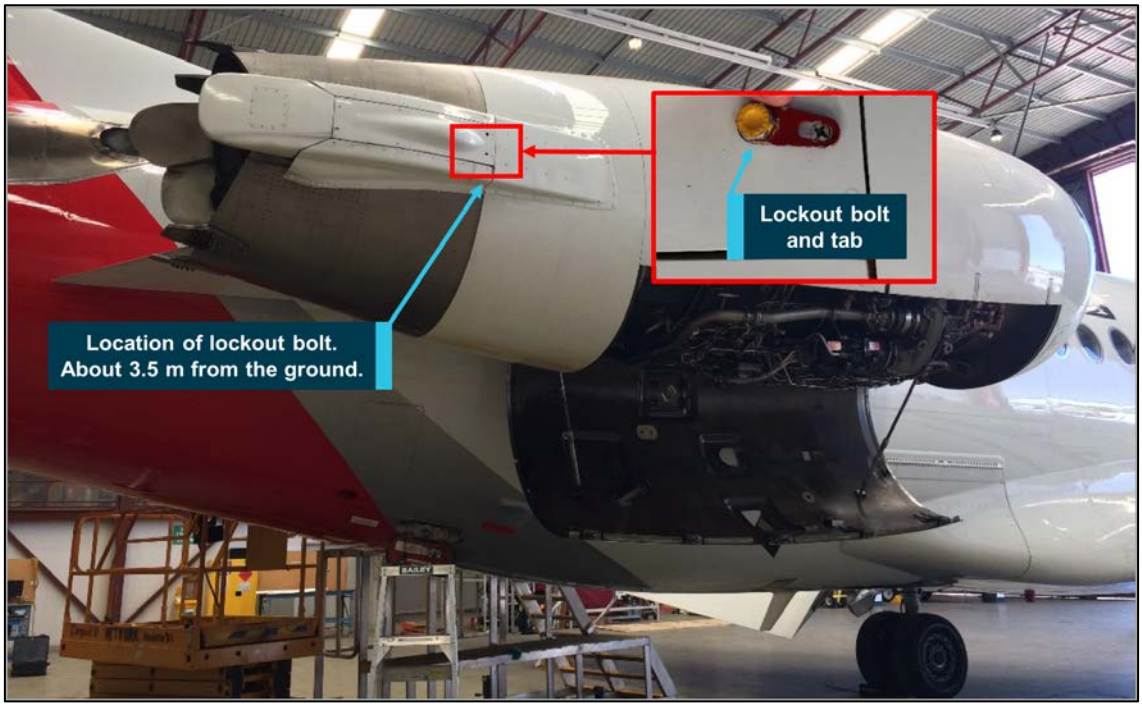
The Fokker F100 job instruction card specified using a rigging pin to de-activate the thrust reversers. Instead of using the rigging pin, the engineer decided to use the in-service lockout bolt from the aircraft's cockpit. The aircraft maintenance manual specified the use of a maintenance bolt. This bolt was available from the tool store and had a red warning flag about 0.5 m long (Figure 2). The in-service bolt did not have an attached warning flag, nor was it required to.

Figure 2: Maintenance lockout bolt

Source: Operator, annotated by ATSB.

The engineer completed the inspections on the first aircraft and returned the in-service bolt to the aircraft cockpit. He then began inspections on NHA, again using the lockout bolt from the cockpit. After completing the inspection on the left engine, he installed the bolt into the right engine. The installation position was about 3.5 m from the ground and required the engineer to use a stand to insert the bolt (Figure 3).

Figure 3: Photograph of right engine with an exemplar in-service thrust reverser lockout bolt



Source: Operator, annotated by ATSB.

The engineer completed the inspection but, due to a reported oversight, did not remove the bolt. He then completed the maintenance paperwork for both aircraft inspections.

At the release to service of NHA, a tooling inventory check was conducted. As the bolt installed in NHA's engine was not booked out on the store's computer, it did not show up during the check so the error went undetected.

As part of the maintenance on NHA, the engineer remembered conducting a circuit breaker task that involved activating the engine and auxiliary power unit (APU) circuit breakers. That task required the use of specified warning labels in the cockpit marked 'do not operate the engine controls' and 'do not start the APU' warnings. The engineer did not recall using these warning labels.

Subsequently the aircraft was released to service with the lockout bolt installed. The installed bolt was not identified during the dispatch engineer's and the flight crew's pre-departure inspections.

Similar occurrences

AO-2018-064[3]

In September 2018, the engine thrust reversers on a Jetstar A320 aircraft did not activate following landing at Sydney Airport, New South Wales. The ATSB investigation of that occurrence found that the thrust reverser lockout pins on both engines were not removed after maintenance at the Brisbane Airport, Queensland facility before the flight.

In that case, the aircraft maintenance lockout pins (fitted with warning flags) were also substituted with in-service pins without flags. Further, the functional check of the thrust reversers following reactivation as per the operator's task card for that planned maintenance was not carried out. The investigation also found that operational pressure to expedite the maintenance probably influenced the deviation from procedures.

[3] Available at www.atsb.gov.au

AO-2017-117[4]
In December 2017, the left engine thrust reverser on a Jetstar A320 aircraft did not activate after landing at Gold Coast Airport, Queensland. The ATSB investigation found that the thrust reverser lockout pin was not removed after maintenance at the Adelaide Airport, South Australia facility before the flight.

The aircraft maintenance lockout pin in this case had a 1 m long red warning flag that was difficult to see in the prevailing low-light conditions. Further, the lockout pin was not booked out of the tool store nor was its installation recorded in the technical log.

Safety analysis

The right engine thrust reverser did not activate after VH-NHA landed at the Karratha Airport, because its in-service lockout bolt was installed. The engineer who installed the bolt during the maintenance in Perth before the flight had mistakenly not removed the bolt after the maintenance was completed. The presence of the bolt was missed for a number of reasons.

The engineer used the lockout bolt during the maintenance task to safely isolate the thrust reverser mechanism. However, he used the bolt from the cockpit because it was conveniently located. Therefore, the risk controls associated with using the specified maintenance lockout bolt were rendered ineffective.

Specifically, there was no warning flag to alert the engineer, dispatch engineer and flight crew that the lockout bolt was still installed. Further, the tooling check that would have identified that the bolt had not been removed was circumvented. Additionally, there were no warning labels in the cockpit to warn the flight crew that the bolt may be installed. Consequently, the aircraft was returned to service with the thrust reverser deactivated, but that was not identified prior to flight.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The lockout bolt on the right engine thrust reverser was not removed after maintenance, resulting in the aircraft returning to service with it deactivated.
- The engineer used the in-service lockout bolt from the cockpit instead of the maintenance lockout bolt. As a result, the risk controls associated with using the maintenance bolt (red warning flag and tool store check-out procedure) were rendered ineffective.

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.

Network Aviation

The aircraft maintenance organisation, Network Aviation, advised the ATSB that it has taken safety actions that include highlighting to maintenance staff the importance of following the safety instructions and warnings contained in the aircraft maintenance manual. Further, the procedures for maintenance activities including task assessments, tooling and task procedures have been reinforced.

[4] Available at www.atsb.gov.au

General details

Occurrence details

Date and time:	27 December 2017– 1042 WST	
Occurrence category:	Incident	
Primary occurrence type:	Technical / Powerplant / Propulsion / Engine failure or malfunction	
Location:	Karratha Airport, Western Australia	
	Latitude: 20° 42.73' S	Longitude: 116° 46.4' E

VH-NHA

Manufacturer and model:	Fokker Aircraft B.V. F28MK0100	
Registration:	VH-NHA	
Operator:	Network Aviation	
Serial number:	11490	
Type of operation:	Air Transport High Capacity - Passenger	
Departure:	Perth Airport, Western Australia	
Destination:	Karratha Airport, Western Australia	
Persons on board:	Crew – 6	Passengers – 64
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	None	

About the ATSB

The 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; 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 the ATSB's 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 operations involving the travelling public.

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.

Purpose of safety investigations

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