



Australian Government

Australian Transport Safety Bureau

Taxiing excursion involving Fokker F100, VH-FKD

Laverton Airport, Western Australia, on 28 September 2021

ATSB Transport Safety Report

Aviation Occurrence Investigation (Short)

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Addendum

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Safety summary

What happened

On the afternoon of 28 September 2021, a Fokker F100 aircraft, registered VH-FKD, departed Perth airport for a scheduled passenger flight to Laverton, Western Australia, with two flight crew, three cabin crew, and 75 passengers.

The aircraft landed uneventfully at Laverton, and the captain took control of the aircraft to taxi towards the end of the runway and complete the routine backtrack manoeuvre. The aircraft was positioned on the left-side at the end of the runway consistent with operator guidance, and the captain commenced a right turn by rotating the nose-wheel handwheel (tiller). The captain was unable to achieve full tiller rotation, even when using the force of both hands, and attempted to tighten the turn by applying the right inboard brake, and asymmetric thrust, but this did not have the desired effect. The crew decided to continue the turn, resulting in the aircraft nose-wheel briefly leaving the side of the runway, and onto the runway strip. The aircraft then returned to the runway and taxied to the terminal.

A post-flight inspection identified damaged insulation in the nose-wheel area and a torn universal joint boot on the tiller shaft.

What the ATSB found

The ATSB found that a torn boot on a universal joint probably restricted the operation of the aircraft's nose-wheel steering system, preventing the aircraft from completing the turn on the runway. The flight crew decided to continue the turn, resulting in the nose-wheel leaving the runway surface, increasing the risk of damage to the aircraft.

What has been done as a result

The operator has commenced a fleet wide inspection of the tiller assembly universal joint boots which is expected to be completed by February 2022.

Safety message

The risk in this incident could have been reduced by availing options such as having airport staff inspecting the runway strip surface before turning onto it. When flight crews encounter such an unexpected event and there is sufficient time to assess available options, they should utilise available resources to determine the safest course of action.

The investigation

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 investigation was conducted in order to produce a short investigation report, and allow for greater industry awareness of findings that affect safety and potential learning opportunities.

The occurrence

At 1436 Western Standard Time (WST)¹ on 28 September 2021, a Fokker F100 aircraft, registered VH-FKD (Figure 1), operated by Alliance Airlines, departed Perth Airport for a scheduled passenger flight to Laverton, Western Australia, with 75 passengers on board. The crew comprised the first officer (pilot flying)², the captain (pilot monitoring) and three cabin crew.

Figure 1: VH-FKD



Source: Supplied

Following an uneventful landing at about 1536, the captain took control of the aircraft to taxi towards the end of the runway and complete the routine backtrack manoeuvre³ (Figure 2). The aircraft was positioned on the left-side at the end of the runway consistent with operator guidance, and the captain commenced a right turn by rotating the nose-wheel handwheel (tiller). The captain was unable to achieve full tiller rotation, even when using the force of both hands, and attempted to tighten the turn by applying the right inboard brake, and asymmetric thrust, but this did not have the desired effect. During the turn, the aircraft nose-wheel briefly left the side of the runway, and onto the runway strip⁴ – the ground area adjacent to the runway – before returning to the runway and taxiing to the terminal (Figure 3).

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

² Pilot Flying (PF) and Pilot Monitoring (PM): procedurally assigned roles with specifically assigned duties at specific stages of a flight. The PF does most of the flying, except in defined circumstances; such as planning for descent, approach and landing. The PM carries out support duties and monitors the PF's actions and the aircraft's flight path.

³ An airport ground procedure which involves the use of any portion of a runway as a taxiway for an aircraft to taxi in the opposite direction from which it will take off or has landed.

⁴ The defined area surrounding each side of the runway, and including the runway, intended both to reduce the risk of damage to aircraft inadvertently running off the runway and to protect aircraft flying over it during take-off, landing, or missed approach.

Figure 2: Laverton Airport



Source: Google Earth, annotated by ATSB

Figure 3: Nose-wheel tyre marks



Source: Operator, annotated by ATSB

After disembarking, the captain inspected the aircraft and nose-wheel, which appeared undamaged, and requested engineering support be flown into Laverton for a more detailed inspection. There were no injuries to passengers or crew, and subsequent inspection identified no damage to the aircraft.

Context

Captain

The captain held an Air Transport Pilot Licence (Aeroplane), and had 9,248 hours of flying experience, of which over 6,337 hours were on the Fokker F100. The captain made the following comments and observations about the incident.

- The crew did not notice any nose-wheel steering issue while taxiing at Perth, but no tight turns were required.
- Halfway through the turn at Laverton, the captain realised the aircraft would not make the turn on the runway but decided to continue for two reasons:
 - The airport had a single runway and no ground support equipment for the aircraft, so stopping on the runway would prohibit other aircraft from landing.
 - The ground next to the runway was compact dirt (based on knowledge of previous runway excursion incidents there).
- The tiller resistance felt normal up until it could not be turned further, and then felt like pushing against a hard rubber wall. The two left turns (after the backtrack turn) during taxi back to the terminal felt normal.
- The wind at the time of the runway excursion – south-south-east at about 8 kts – did not affect the aircraft’s turning ability as they successfully conducted tight turns in other Fokker F100 aircraft in stronger wind conditions.

Aircraft

The Fokker F100 aircraft was a regional jet produced by the Netherlands-based manufacturer, Fokker, until 1997. The Australian F100 fleet is currently the largest in the world, comprising some 66 aircraft operated by four high capacity or charter operators. The majority of the national fleet service the fly-in fly-out mining and resource industry.

Nose-wheel steering system

The aircraft’s nose-wheel steering system comprised various shafts, pulleys, and cables, which direct hydraulic pressure to turn the nose-wheel when the tiller is rotated, or when the rudder pedals are pushed. The rudder pedals provide a very limited turning angle, so the tiller is used when making most turns, and is located on the left side (captain’s side) of the aircraft cockpit (Figure 4). The tiller is connected to the steering system via a shaft fitted with two universal joints (upper and lower). The universal joints are covered by protective boots.⁵

Figure 4: Fokker 100 cockpit (exemplar)



Source: Joel Baverstock, annotated by ATSB

⁵ The protective boot is intended to keep contaminants, such as dirt, out of the greased universal joint.

Post-flight repairs

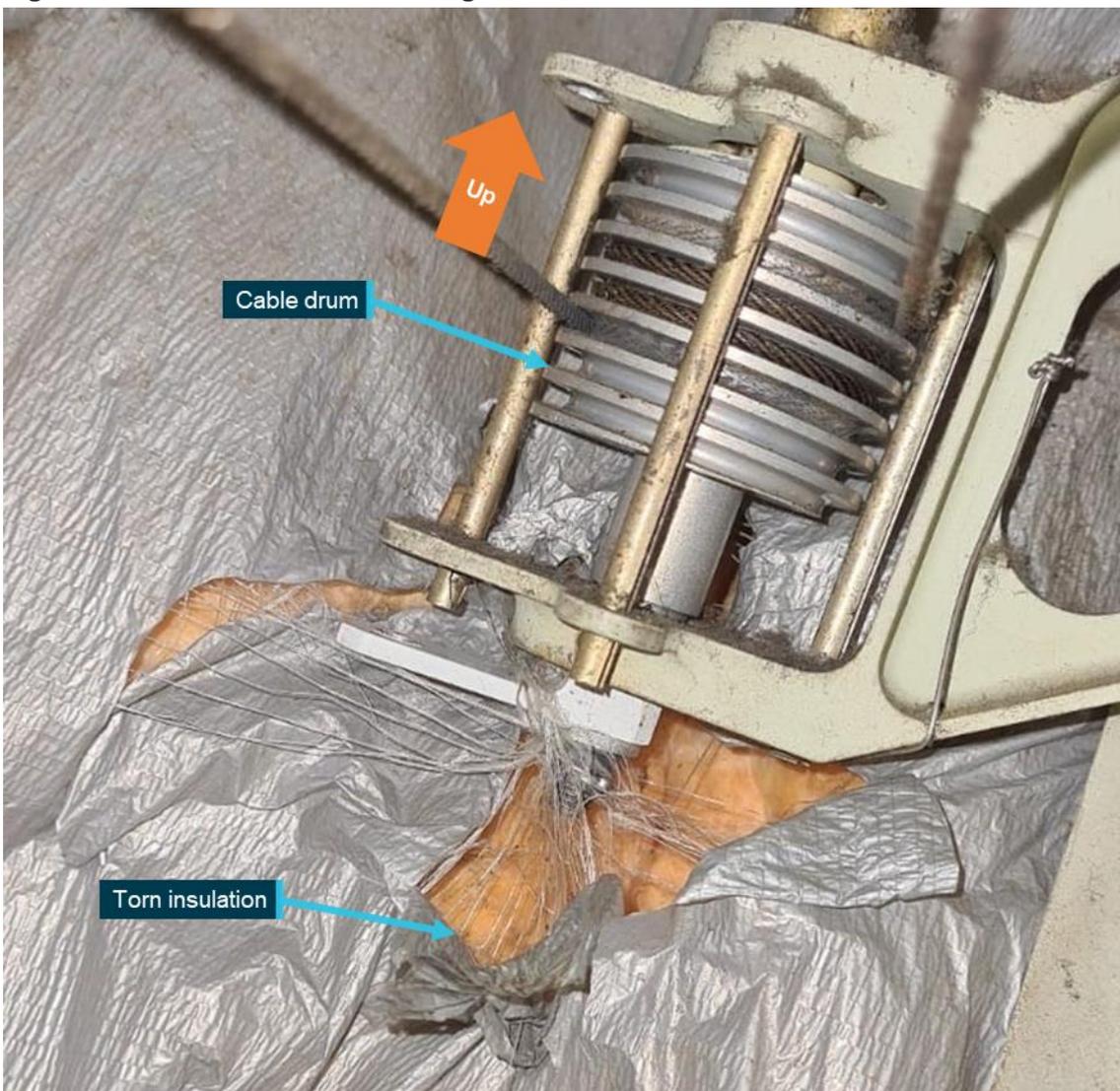
The post-flight examination of the steering system at Laverton identified a correctly secured, but torn insulation blanket, which was contacting the nosewheel cable drum (Figure 5). A torn protective boot on the upper universal joint was also found (Figure 6). The insulation blanket was taped at the torn section and re-secured away from the cable drum, and the torn boot was removed. A taxi test was then successfully carried out before the return flight to Perth.

During subsequent maintenance, the torn blanket and handwheel assembly were replaced. The aircraft operator made the following findings with respect to the incident.

- Based on torn insulation blanket’s inspection, the reinforcing strands of the blanket covering material were not considered to have sufficient strength to cause the tiller resistance felt by the captain.
- The torn boot was suspected to have been caught in the joint universal joint, causing the resistance in the right turn and was subsequently freed during the two left turns while taxiing taxi to the terminal.

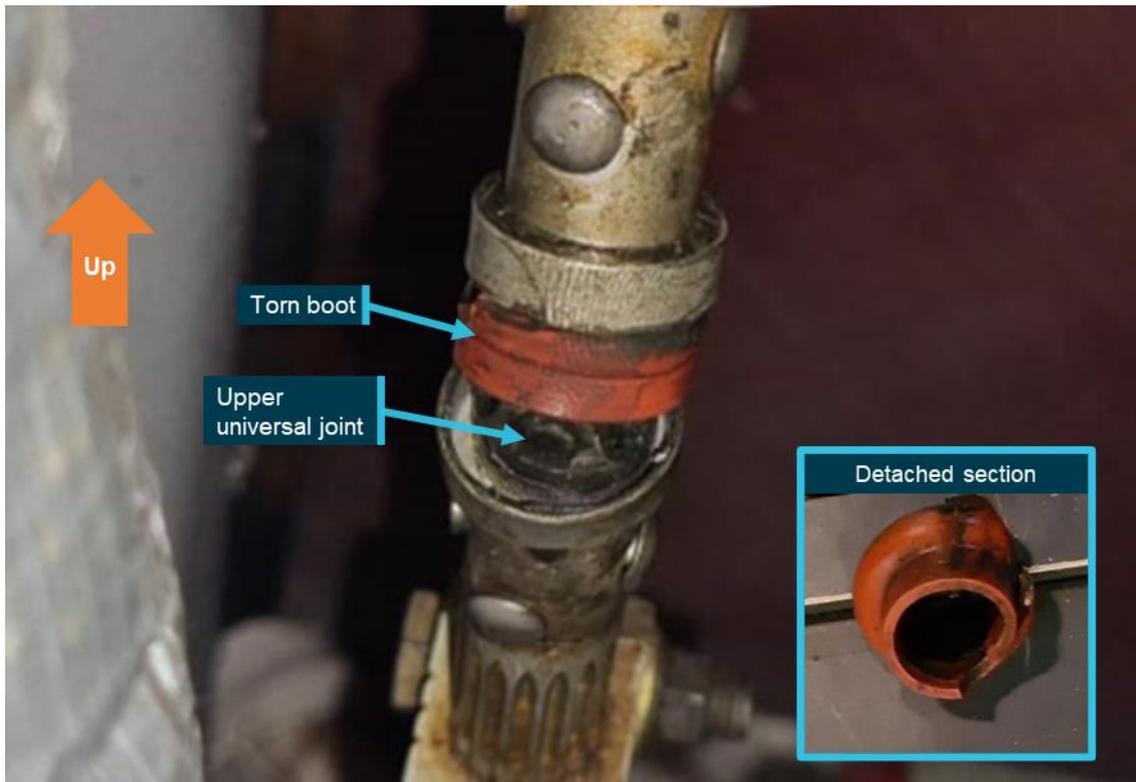
A fleet wide inspection of the handwheel assembly universal joint is expected to be completed by February 2022.

Figure 5: Torn insulation surrounding cable drum



Source: Operator, annotated by ATSB

Figure 6: Torn protective boot



Source: Operator, annotated by ATSB

Past maintenance

The nose-wheel area containing the cable drum is located behind access panels and is subject to a general zone inspection every 10,000 flight hours or 10 years, and this includes an inspection of insulation blanket condition. The aircraft last underwent this inspection in 2015. This nose-wheel area is also accessed for various other scheduled component inspections, most of which were completed in 2019. No maintenance findings in relation to insulation blankets in the cable drum area were recorded during those inspections.

The nose-wheel steering system is subject to a functional check every 5,000 flight hours, which includes a test of the torque required to turn the tiller, and steering angle achieved when turning the tiller full left and right. This check was successfully performed on the aircraft in 2019.

Safety analysis

The maintenance findings and the captain's statement indicate that it's likely the torn boot reduced the universal joint's range of motion, restricting the operation of the aircraft's nose-wheel steering. This restriction reduced the aircraft's turning ability, preventing it from completing the turn on the runway. It could not be determined how or why the boot was torn.

Although runway strips are designed to reduce the risk of damage, there is no assurance that aircraft can safely manoeuvre on them. While the excursion onto the runway strip in this event did not result in aircraft damage, there was no assurance that the strip was clear of hazardous debris. However, had the aircraft remained on the runway, other aircraft would not have been able to land there safely, including delivery of ground support equipment to manoeuvre the aircraft along the runway. Nevertheless, options such as having the airport staff inspect the runway strip before turning on it were available.

Findings

ATSB investigation report findings focus on safety factors (that is, events and conditions that increase risk). Safety factors include 'contributing factors' and 'other factors that increased risk' (that is, factors that did not meet the definition of a contributing factor for this occurrence but were still considered important to include in the report for the purpose of increasing awareness and enhancing safety). In addition 'other findings' may be included to provide important information about topics other than safety factors.

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

From the evidence available, the following findings are made with respect to the taxiing excursion involving Fokker F100, VH-FKD, Laverton Airport, Western Australia, on 28 September 2021.

Contributing factors

- A torn boot on a universal joint probably restricted the operation of the aircraft's nose-wheel steering system, preventing the aircraft from completing the turn on the runway.
- The flight crew decided to continue the turn, resulting in the nose-wheel leaving the runway surface.

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- the captain
- Alliance Airlines
- Bureau of Meteorology.

Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section 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 following directly involved parties:

- Alliance Airlines, including the aircraft captain
- Civil Aviation Safety Authority.

Alliance Airlines provided a submission, which was reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	28 September 2021 - 1536 WST	
Occurrence class:	Incident	
Occurrence categories:	Runway excursion, Control issues	
Location:	Laverton Airport, Western Australia	
	Latitude: 28° 36.817' S	Longitude: 122° 25.433' E

Aircraft details

Manufacturer and model:	Fokker Aircraft F28 MK 0100	
Registration:	VH-FKD	
Operator:	Alliance Airlines	
Serial number:	11357	
Type of operation:	Air Transport High Capacity-Passenger – (Air Transport High Capacity)	
Activity:	Commercial air transport-Scheduled-Domestic	
Departure:	Perth Airport	
Destination:	Laverton Airport	
Persons on board:	Crew – 5	Passengers – 75
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	