



Australian Government

Australian Transport Safety Bureau

Landing gear retraction deactivation and return involving a Boeing 787, VH-ZNH

near Sydney Airport, New South Wales, 21 June 2021

ATSB Transport Safety Report
Aviation Occurrence Investigation (Short)
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Addendum

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Safety summary

What happened

On 21 June 2021, a Boeing Company 787-9, registered VH-ZNH and operated by Qantas Airways, was prepared for a scheduled passenger flight from Sydney, New South Wales, to Perth, Western Australia. During initial climb, the flight crew selected the landing gear lever to UP. Shortly after, they received a warning, indicating that neither main landing gear had retracted to the 'up and locked' position. Despite consulting the aircraft's electronic checklist, the flight crew were unable to resolve the retraction issue. The landing gear lever was then selected to DOWN, with positive gear extension indications, and the aircraft returned to Sydney for an uneventful landing.

What the ATSB found

The ATSB found that two of the five downlock pins, one in each main landing gear, had not been removed following towing of the aircraft to the domestic terminal aircraft bay. In addition, these gear pins were not identified during subsequent external inspections, prior to the departure. When the flight crew selected the landing gear to retract, the nose gear successfully retracted and locked in the up position. However, the two installed pins prevented any movement of the main landing gear. There was no damage to the main landing gear.

What has been done as a result

Following the occurrence, the operator distributed memos to engineering, flight and ramp crew, highlighting the quantity and location of the gear pins on the Boeing 787, and the importance of following the documented ramp, pre-flight and dispatch procedures.

The memo to engineering also emphasised the importance of checking the pin location, rather than relying on streamers for identification. In addition, training packages for engineering, ramp and flight crew were updated with additional detail. Further, the operator advised they were working to relocate the gear pin stowage to the flight deck, in line with other aircraft types, to enable ease of access to visually verify pin removal and stowage.

Safety message

'Remove before flight' streamers are a reminder to remove covers, or lockout devices, prior to flight. Failure to remove these devices and covers can prevent the functionality of certain aircraft systems. The streamers are subject to varying environmental conditions that can reduce their visibility.

Expectation can also affect identification of these warning devices. Put simply, the likelihood of detecting 'remove before flight' streamers is significantly reduced if they are not expected to be there. The same principle can also prevent the discovery of damaged and/or missing components.

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

Pre-flight ground operations

On the morning of 21 June 2021, a Boeing Company 787-9 (787), registered VH-ZNH (ZNH) and operated by Qantas Airways, was being prepared for a scheduled passenger flight from Sydney, New South Wales, to Perth, Western Australia. At about 0745 Eastern Standard Time,¹ ZNH was towed, by Qantas Engineering (engineering), from the aircraft parking location to domestic terminal bay 11. The tow crew on the ground consisted of the person in charge (PIC), two wing walkers and the tow-motor driver.² On board the aircraft was a 787 licenced aircraft maintenance engineer (LAME), in the role of flight deck operator (FDO)³ and an aircraft maintenance engineer (AME), who was undergoing informal general familiarisation training.

Upon arrival at bay 11, chocks were placed at the aircraft wheels and the tow-motor was unhitched, to allow it to be used for another tow. The PIC removed the nose gear downlock pin (gear pin), then walked to the rear of the aircraft and removed one gear pin from the right main gear. At the same time, one of the wing walkers removed a gear pin from the left main gear.

The PIC and wing walker had not towed a 787 before and, as such, contacted the LAME via the aircraft intercom system, to enquire where the pins were stowed on this aircraft type. The AME, under instruction from the LAME, advised the PIC that the pins were stored in the electrical equipment centre (EEC) located just aft of the nose gear. The AME then relayed that the PIC could leave the removed pins on the nose gear and the LAME would stow them when the aerobridge⁴ arrived and they could exit the aircraft.

Despite the offer to leave the pins on the nose gear, the PIC identified a short ladder nearby and opened the EEC. The ladder was of insufficient height to see into the pin stowage location, so the PIC felt around and physically identified pin stowage holes. After stowing the three gear pins, the PIC closed the EEC, returned the ladder and departed, with the wing walker, to conduct another tow.

Unavailability of an aerobridge operator resulted in the LAME and AME being unable to leave the aircraft for about 20 minutes. When the aerobridge was manoeuvred into place, at about 0810, the LAME and AME exited the aircraft via the associated stairs. The LAME noted that the nose gear pin had been removed. The LAME reported that they then looked down toward the main gear and did not identify any streamers associated with the gear pins (see the section titled *Landing gear downlock pins*).

As there were no gear pins on the nose gear, the LAME directed the AME to confirm the gear pins had been stowed in the EEC, utilising the same nearby ladder previously used by the PIC. The ladder height was again insufficient to allow the AME to see into the pin stowage area, but they were able to physically feel the presence of the pins. After closing the EEC panel and returning

¹ Eastern Standard Time (EST): Coordinated Universal Time (UTC) + 10 hours.

² The PIC coordinates the tow with the ground crew via voice and hand signals, and with the flight deck via the aircraft intercom system. The wing walkers walk at each wing tip, monitor for clearance and can alert the PIC of impending danger, via hand signals or air horn.

³ The Flight Deck Operator (FDO), is a LAME who is licenced on the aircraft type and is required to ensure correct aircraft configuration throughout the tow duration.

⁴ Aerobridge – a moveable, elevated platform corridor connecting the aircraft to the terminal building.

the ladder, the LAME and AME waited at the aircraft until a car arrived, at about 0819, to take them to the engineering office. The LAME signed for the removal and stowage of the landing gear pins on the electronic and paper technical logs (tech log). The LAME then returned the paper tech log to the aircraft at about 0842.

The flight crew, who arrived at the aircraft at about 0900, consisted of the captain, the first officer and a second captain, who was filling the role of relief pilot.⁵ The flight crew reviewed the tech log and noted the endorsement that the gear pins had been removed and stowed. As the third crew member, the relief pilot conducted the external inspection, between 0938 and 0945.

The relief pilot reported conducting the external inspection as per the flight crew operations manual (FCOM), with no anomalies identified, before returning to the flight deck to assist with the remainder of the pre-flight preparations. The pre-flight, including landing gear system checks, were completed, with nil anomalies identified.

Aircraft dispatch for the 787 was conducted by two Swissport⁶ ground crew, a supervisor and a crew member undergoing training, who arrived at ZNH about 1020. Once all ground services had been completed, the supervisor conducted the final external inspection prior to pushback. The supervisor reported checking all doors and panels were closed and secured, and no streamers were identified. The aircraft was pushed back at about 1025.

Occurrence flight

ZNH was cleared to depart via runway 16R,⁷ initially heading to the south of the airport before making a westerly turn onto the planned route. The captain was the pilot flying (PF) and the first officer was the pilot monitoring (PM),⁸ with the second captain (relief pilot) seated in the flight deck for take-off.

At about 1032, shortly after take-off and with the aircraft established in a positive climb, the PM positioned the landing gear selector to UP. Ten seconds after selecting the landing gear up, the crew received a GEAR DISAGREE caution on the Engine Indication and Crew Alerting System (EICAS) and an associated aural alert. The flight crew observed indications that the nose landing gear had retracted however, both main landing gear continued to display a grey crosshatch symbol, indicating that they remained 'in transit' (see the section titled *Landing gear operation*).

The flight crew configured the aircraft for safe operation with the landing gear extended in accordance with the operator's procedures. The PF then requested the PM commence the GEAR DISAGREE EICAS procedure through the aircraft's electronic checklist. The flight crew advised air traffic control (ATC) of a landing gear problem and then levelled the aircraft at an altitude of about 9,000 ft, away from the airport and over water, to troubleshoot the issue.

The PF, who reported experiencing a degree of startle upon receiving the initial GEAR DISAGREE EICAS message, asked the PM to read out the electronic checklist procedure again, to confirm it was fully understood.

On completion of the GEAR DISAGREE checklist, the main landing gear continued to indicate 'in transit'. The flight crew discussed cycling the landing gear, selecting DOWN and then UP, to troubleshoot the issue however, due their proximity to the airport, they decided to return to Sydney.

⁵ The relief pilot, in this instance, was on board to allow the first officer a rest period during the flight. This was to ensure the first officer remained within flight and duty requirements for their return flight to Sydney later that day. The two captains were ending their duty in Perth.

⁶ Swissport provided ground services and cargo handling to Qantas, and other airlines, within Australia and globally.

⁷ Runway numbering: the number represents the magnetic heading closest to the runway (runway 16 at Sydney Airport is oriented 168° magnetic) and R indicates the right most of two parallel runways.

⁸ 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.

The flight crew reported that guidance for the continued management of the abnormal gear indication from the electronic checklist and Quick Reference Handbook was limited to noting airspeed and fuel duration considerations, and therefore decided to extend the gear via the normal gear selection. They further agreed to select landing gear down earlier in the approach than they normally would, to allow sufficient time to assess and resolve any abnormalities, noting the substantial fuel endurance available, if required. The landing gear lever was then selected to 'DOWN' and the crew received a positive 'green' indication on the EICAS that confirmed all of the landing gear was 'down and locked'.

The flight crew reported that ATC asked if they wanted emergency services to be on standby for the landing however, they advised that this was not required. This decision was based on the aircraft's landing gear now indicating normal extension. At 1106, ZNH touched down on runway 16R, for an uneventful landing. The aircraft was taxied to bay 11, and engineering subsequently identified that two landing gear pins were still installed, one in each main gear.

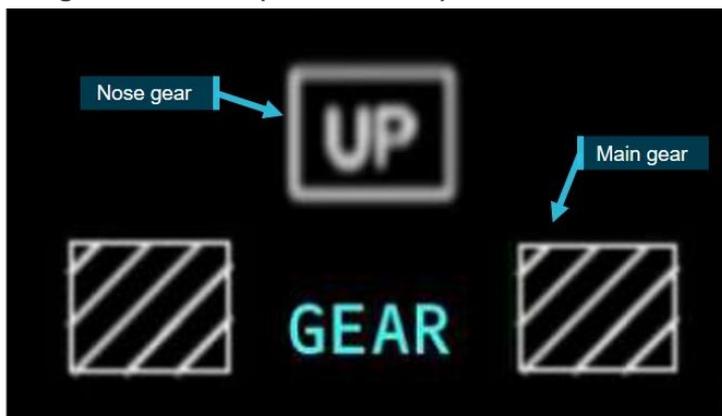
Context

Landing gear operation

The gear retraction sequence commences when the landing gear lever is placed in the UP position. The EICAS landing gear position indication changes from a green DOWN indication to a white crosshatch in-transit indication. When the landing gear has retracted, and is being held in place by uplocks, the landing gear hydraulic system is automatically depressurised. At this point, no landing gear indications are displayed on the EICAS.

The normal transit time for gear retraction is approximately 10 seconds. If any landing gear is not up and locked after about 40 seconds, the EICAS caution message GEAR DISAGREE is displayed. The EICAS gear position indication then displays an expanded non-normal format. The flight crew can then see which gear is UP, in-transit, or DOWN (if the gear never unlocked from the down position). In this instance, the flight crew were presented with an UP indication for the nose gear and in-transit indications for each of the main gear (Figure 1).

Figure 1: EICAS expanded message indication, showing nose gear up and locked, and main gear 'in-transit' (crosshatched)



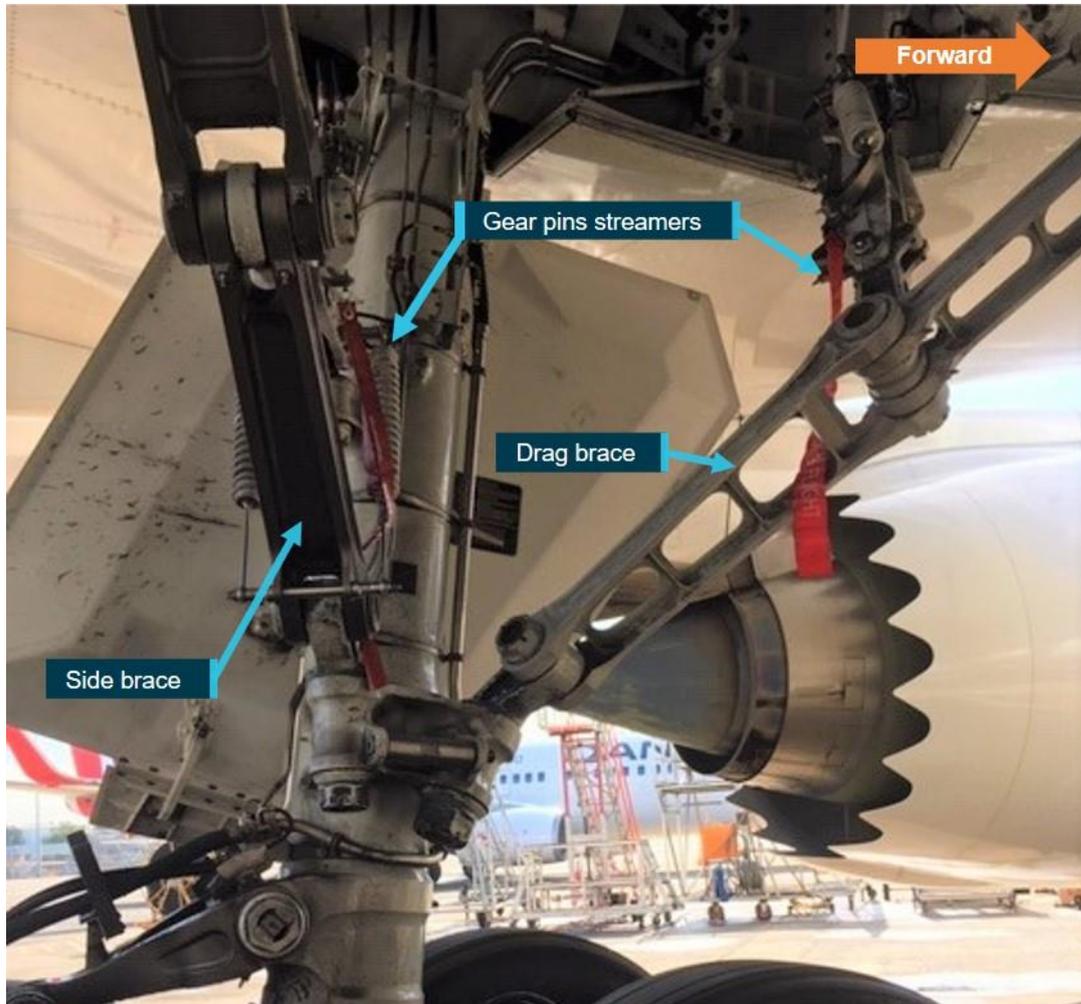
Source: Supplied, annotated by ATSB

The EICAS checklist 'objective' for GEAR DISAGREE included for the flight crew 'to extend the gear using an alternate gear extension'. The checklist also had a note to not exceed the 'gear extended speed limit' and that flight with the gear extended would increase fuel consumption. The flight crew reported that, as the nose gear retracted without issue, they did not suspect normal gear operation was affected. Therefore, they elected to attempt normal gear extension, before considering alternate procedures. The normal gear extension was completed without issue.

Landing gear downlock pins

The landing gear downlock pins (gear pins) were installed to prevent inadvertent gear retraction during maintenance or towing operations. The 787 has five gear pins, one for the nose gear and two for each main landing gear (Figure 2).

Figure 2: Typical left main gear showing pins and streamers installed.



Source: Supplied, annotated by ATSB

The gear pin is a quick release style and has a ‘REMOVE BEFORE FLIGHT’ streamer attached via a split ring. The aircraft maintenance manual (AMM) contained procedures for installation and removal of the gear pins. The main gear pins are located above head height and the AMM procedures recommend a 1.83m (6 ft) ladder, be utilised for installation and removal.

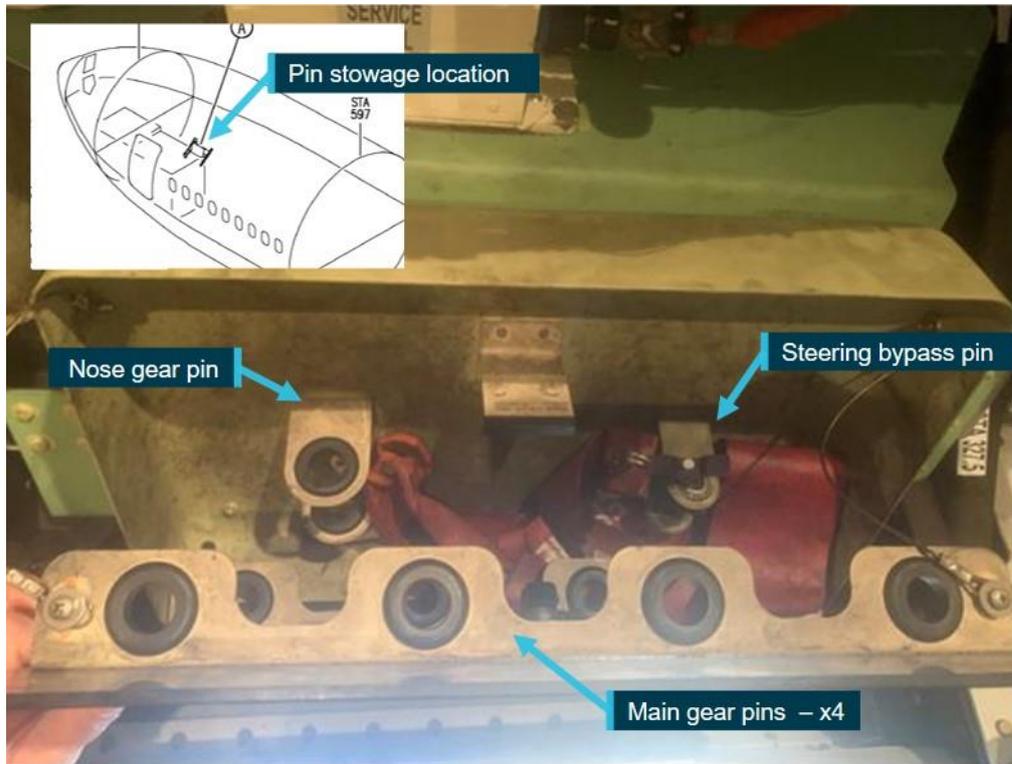
If the aircraft was required to be operated with the landing gear locked in the extended position, for example for maintenance purposes, the gear pins were to be secured as per the AMM. In that instance, a bolt and nut were to be installed on the end of the pin, with a large washer located between the bolt and the pin quick-release, to ensure retention of the pin in the landing gear.

The gear pin stowage box was located in the EEC, just aft of the nose gear, and was attached to the aircraft structure (Figure 3). The hinged door, which had receptacles for the four main gear pins, tilted outwards from the top and included a lanyard to limit swing. The box portion contained two receptacles, one for the nose gear pin and one for the steering bypass pin.⁹ Qantas

⁹ When the steering bypass pin is inserted, the steering hydraulics on the landing gear are bypassed. This allows the aircraft to be moved by tow-motor, without having to deactivate the entire aircraft hydraulics.

engineering personnel reported that a ‘tall ladder’ was required to be able to see into the stowage box.

Figure 3: Gear pin stowage box showing hinged door with four main gear pin receptacles



Source: Supplied, annotated by ATSB

Airbus A330s and Boeing 737s were the aircraft types that Sydney Qantas engineering were most familiar with. These aircraft types have a total of 3 gear pins, one in the nose and one in each of the main gear. In addition, the gear pins on these aircraft types are stowed in the flight deck, readily accessible to flight and ground crew.

Gear pin streamers

Boeing advised that gear pins are classified as ground support equipment (GSE) and therefore not included in the type design of the aircraft. As a result, there is no minimum specifications, nor do they direct a maintenance or cleaning program.

Ground and flight crew described the streamers, of various aircraft types, as being different lengths and various states of cleanliness, which could reduce visibility in certain environmental and light conditions. Due to their installed location, the landing gear pin streamers were subject to contamination from oil, grease and grime. In addition, the streamers were known to wrap around the gear on occasion, particularly in wet and/or windy conditions.

An image of one of the missed main landing gear pins, upon return to Sydney, showed it to be dull and frayed however, it's condition prior to the flight could not be determined (Figure 4).

Examination of ZNH's gear pin streamers noted degraded condition, particularly with respect to the normal intensity of the high-visibility colour.

Figure 4: Gear pin identified on landing (left) and VH-ZNH gear pins (right).



Source: Supplied, annotated by ATSB

CCTV footage showed that, when ZNH was towed into bay 11, prior to the flight, one streamer on each main landing gear was visible (Figure 5). It was these streamers that were identified and removed by the tow crew. The footage showed the wing walker and the PIC, climb the rear tyre of each main gear¹⁰ and remove a pin (with attached streamer) from the side braces. Streamers associated with the drag braces were not readily visible in the CCTV footage.

The footage also showed:

- evidence of recent rain when the aircraft was being towed to bay 11, but good light conditions
- some light rain at about the time the 787 LAME and AME, departed the flight deck, checked the EEC for the presence of pins and waited for a lift to the office
- the tow crew and AME used a 0.9 m (3 ft) 3-step ladder to access the EEC
- partly cloudy / sunny conditions when the relief pilot and dispatch crew conducted their respective external inspections, and during pushback.

¹⁰ It was reported that ladders are typically not utilised for installation or removal of gear pins.

Figure 5: VH-ZNH with visible main gear streamers



Source: Sydney Airport, annotated by ATSB

Procedures

Qantas engineering were responsible for aircraft towing operations, in accordance with the *Towing* section of the Qantas Engineering Procedures Manual. Section 7 *Post aircraft tow*, step 4 stated that it was either the tow crew PIC or the FDO's responsibility to 'remove and stow aircraft main and nose landing gear downlock pins'.

Swissport had been contracted by Qantas to carry out receipt and dispatch procedures for the 787, since its introduction in 2017. All other Qantas aircraft types had receipt and dispatch activities conducted by Qantas engineering at Sydney Airport. Qantas *Ramp Operations Manual* procedures were to be followed by Swissport staff, for receipt and dispatch of the 787. The aircraft dispatch procedure stated:

- Ensure the Steering By-pass pin is fitted
- Any landing gear downlock pins are also removed and stowed in the correct place
- Advise Engineering if Pitot covers are still present. Ensure they are removed prior to departure.

The section *manage pins and covers* identified:

There can be a total of five (5) downlock pins that can be fitted to the aircraft.

- One (1) nose gear downlock pin, and
- Up to Four (4) main gear downlock pins.

The ‘external inspection sequence’ included, ‘observe whether the main gear downlock pins have been removed’.

The flight crew were required to conduct their external inspection in accordance with the Qantas flight crew operations manual (FCOM) 787 *Amplified procedures – exterior inspection*. The section regarding the left and right main landing gear areas inspection included ‘gear pins – as needed’ (Figure 6)

Figure 6: FCOM external inspection of main gear areas

Tyres, brakes and wheels	Check
Verify that the wheel chocks are in place as needed.	
If the parking brake is set, the brake wear indicator pins must extend out of the guides.	
Gear strut, actuators, and doors	Check
Hydraulic lines and electrical wiring	Secure
Gear pins	As needed

Source: Supplied

Awareness of five gear pins

Qantas ground crew

As a result of the COVID-19 pandemic travel restrictions, voluntary redundancies were offered to affected personnel. A subsequent restructure of Qantas engineering took place in February 2021, which resulted in certain engineers being transitioned into new roles, on new aircraft types.

Only one of the Qantas ground crew that spoke with the ATSB,¹¹ the 787 LAME, advised they were aware that the 787 had five gear pins. In addition, it was the first time towing a 787 for all the ground crew except the 787 LAME. One of the wing walkers was a LAME on the 737, 747 and Airbus 330 (A330), while the PIC and the AME being trained by the 787 LAME, held category A licences¹² on the A330.

Fight crew

All flight crew recalled undergoing computer-based training on external inspection procedures during their initial ground school (in 2018 and 2019), and then conducting an external inspection under supervision from a training captain, during initial flight-line operations. Neither captain could specifically recall the number, nor exact location, of the main gear pins, from their training.

The first officer was aware of the five pins, due to their flying experience on the 767,¹³ which had a similar design of landing gear to the 787. The previous flying experience of the two captains was on aircraft types that had three gear pins. In addition, the second captain (relief pilot) and first officer advised they had never seen pins installed, as they were typically removed before the flight crew conduct their external inspection. Further, the flight crew reported their process was to look for the streamers during their external inspection, as opposed to sighting the actual pin locations.

¹¹ The ATSB did not interview the second wing walker or tow-motor driver as they were not directly involved with the gear pins removal and/or stowage.

¹² The category A licence gives the holder limited licensing privileges that are matched to the knowledge, competencies and assessments specified in the Civil Aviation Safety Regulations (CASR) Part 66 Manual of Standards for the category A licence.

¹³ The 767 is no longer operated by Qantas.

Swissport dispatch crew

The Swissport crew consisted of a trainer and trainee. The trainer had experience dispatching 787 aircraft for several airlines, they advised that they were aware of the five gear pins on the 787 and had occasionally seen gear pins and streamers installed, for example, when aircraft were under tow.

The Swissport trainee, while experienced in dispatching other aircraft types at another Australian airport, was undergoing Sydney familiarisation training. The trainee advised that ZNH was only the second 787 they had dispatched, the first being a few hours earlier that day. The trainee recalled being aware of the five pins, from their training however, had never seen the pins installed. Further, as the trainer had conducted the external inspections that day, the trainee had not specifically looked out for them.

Both Swissport crew reported their dispatch procedures were to check all ground equipment was clear and inspect the aircraft for security of doors and panels, and presence of any streamers. The Swissport crew would install the steering bypass pin when the tow-motor was connected, and then remove it when the tow-motor was disconnected, following pushback. The steering bypass pin was located near the nose gear pin. The trainer advised that, had the nose gear pin still been installed, it would have been an alert to check all the other gear pins had been removed. However, as the nose gear pin was not installed, the trainer concluded that all pins had been removed, as they had not encountered a situation where only some of the pins had been removed.

Procedure if gear pin streamers identified

Both the flight crew and Swissport dispatchers reported that, if they identified any streamers during their external inspection, they were to contact Qantas engineering, who would then remove the associated pin or cover. Further, all reported being aware of the possibility that streamers can become caught up in, or stuck to, the landing gear.

Similar occurrences

Boeing advised they had received reports from other operators of inadvertent departures with gear pins installed. As the gear pins are classified as GSE, this type of event was not required to be reported to Boeing and subsequently that were not able to give an accurate estimate of how often situations like this may have occurred. Further, Boeing advised that, from the reports they did have, they were not aware of any outcomes more serious than a 'return-to-base for a safe landing'.

The investigation identified two similar events involving Australian-operated 787s, in 2014 and 2021, noting this type of occurrence was not required to be reported to the ATSB. In 2014, the aircraft had been dispatched, and gear pin streamers were noted by the crew of another taxiing aircraft. The aircraft returned to bay and two gear pins were located, one in each main gear. In this occurrence, the gear pin streamers were noted to be 'dirty', short in length and 'not as visible as new' streamers.

On 19 June 2021, at about 2205 local time, two gear pin streamers were identified by the second officer during the flight crew external inspection. This was despite the tech log being endorsed that the pins had been removed and stowed. The second officer's report stated that, when inspecting the right main gear from the front, nothing abnormal was noted. The second officer then moved to the rear of the main gear and used their torch to check the gear pin location holes. At this point they observed a gear pin streamer wrapped up and stuck to the main gear leg.

The second officer reported that, due to the wet and windy conditions, the streamer had been caught up on the main gear and, in combination with low light, it was difficult to see. Before returning to the flight deck to notify engineering, the second officer identified a gear pin streamer on the left main gear. The pins were subsequently removed by engineering and the aircraft departed as scheduled.

Safety analysis

In this occurrence, multiple factors led to an aircraft departing configured such that the flight crew were unable to retract the main landing gear. Specifically:

- The tow crew used the visible streamers to identify what they incorrectly believed were the only three gear pins installed the aircraft.
- While the LAME was aware the 787 had five gear pins, they did not confirm all of them had been removed and stored before signing the tech log. Instead, the AME physically checked for the presence of pins without knowing the number to expect.
- The ladder used to access the gear pin stowage location was not of sufficient height to allow visual confirmation of pin stowage. Sighting of 'empty' pin stowage receptacles would have provided a clear indication that not all pins had been removed from the landing gear.
- The flight and dispatch crews conducted their external inspection with no expectation of finding streamers indicating gear pins were still installed. This was likely due to the tech log being endorsed and a belief that the gear pins had been removed by engineering personnel.
- There was probably reduced visibility of the streamers, due to their degraded condition and the likelihood they were stuck on the gear, from a combination of grime and the recent wet and windy conditions.

Research has demonstrated that people are more likely to detect targets (such as gear pin streamers) when they are expected and less likely to detect targets that are not expected (Wickens and McCarley 2008). In addition, bias can occur when prior knowledge, combined with an expected outcome, influences decision making.

The tow crew were expecting to see the gear pin streamers, as they had just completed moving the aircraft. The tow crew then identified, and removed, three main landing gear pins, which was consistent with the aircraft types they had experience on. In contrast, as the gear pins were typically removed prior to the flight and dispatch crew external inspections, they were not expecting to see any gear pin streamers.

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 finding is made with respect to the landing gear indication and return involving Boeing 787, VH-ZNH, near Sydney Airport, New South Wales, on 21 July 2021.

Contributing factor

- Two of the five landing gear pins were not removed as per the operator's procedures, nor identified by engineering, flight crew or dispatch during pre-departure checks. This resulted in the aircraft departing without the functionality to retract the main landing gear.

Safety actions

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.

Safety action by Qantas Airways Ltd

Following the occurrence, Qantas considered the viability of a maintenance program for 'remove before flight' streamers. However, it was determined that enhanced training and procedures would have greater benefit in reducing the risk of a similar occurrence. In response to an internal investigation, Qantas has advised the ATSB of the following actions:

- Release of memos to engineering, flight and ramp crew, highlighting quantity (five) and location (images) of gear pins on the 787, and the importance of following the documented procedures. The memo to engineering also emphasised the importance of checking the pin location, rather than relying on streamers. The memo to flight crew and ramp emphasised that engineering were to be contacted if any gear pins were identified, before continuing with the external inspection.
- Updated training packages for engineering, ramp and flight crew.
- Relocation of the pin stowage from the electrical equipment centre (EEC) to the flight deck, in line with other aircraft types, to enable ease of access to verify pin stowage.

Sources and submissions

Sources of information

The sources of information during the investigation included:

- Qantas engineering personnel involved in the tow
- Qantas flight crew
- Swissport dispatch crew
- Qantas Airways
- Boeing

References

Wickens, C.D. and McCarley, J.S (2008). Applied attention theory. Boca Raton, FL: CRC Press.

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:

- Qantas, including the involved engineering and flight crew
- Swissport, including dispatch crew
- Boeing and the United States National Transportation Safety Board.

Submissions were received from:

- Boeing
- Qantas

The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	21 June 2021 11:00 Eastern Standard Time
Occurrence class:	Incident
Occurrence categories:	Aircraft preparation, Warning devices, Landing gear / Indication, Diversion / Return, Other Ground operations
Location:	near Sydney Aerodrome
	Latitude: 33° 56.772' S Longitude: 151° 10.632' E

Aircraft details

Manufacturer and model:	THE BOEING COMPANY 787-9
Registration:	VH-ZNH
Operator:	QANTAS AIRWAYS LIMITED
Serial number:	36241
Type of operation:	Air Transport High Capacity-Passenger - (Air Transport High Capacity)
Activity:	Commercial air transport-Scheduled-Domestic
Departure:	Sydney Aerodrome
Destination:	Perth Aerodrome
Actual destination:	Sydney Aerodrome
Persons on board:	Crew - 13 Passengers 106
Injuries:	Crew - 0 (fatal) 0 (Serious) 0 (Minor), Passengers - 0 (fatal) 0 (Serious) 0 (Minor)
Aircraft damage:	Nil