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Australian Transport Safety Bureau

Incorrect configuration involving Bombardier DHC-8-402, VH-QOY

near Sydney, New South Wales, on 12 July 2021

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Addendum

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Safety summary

What happened

On 12 July 2021, a Bombardier DHC-8-402 (Q400), VH-QOY was being operated by QantasLink from Sydney to Albury, New South Wales and return. After take-off, the flight crew inadvertently omitted to retract the landing gear and did not identify this omission when completing the after-take-off checklist.

The cabin crew alerted the flight crew that the landing gear was still extended, and the flight crew retracted the landing gear when the aircraft was at about 15,900 ft. The aircraft had exceeded the maximum altitude with landing gear extended (15,000 ft).

What the ATSB found

The ATSB found that both pilots were heavily focused on aircraft performance after take-off, so the positive rate and subsequent gear-up calls were not made. Neither pilot identified these omissions.

When completing the after-take-off checklist, the pilot monitoring provided the 'landing gear' challenge and the pilot flying incorrectly called 'up, no lights' in response. Both pilots observed that the 3 green landing gear lights were illuminated but neither recognised that this was problematic for this stage of flight. It is likely that both pilots had a strong expectancy that the landing gear had been retracted after take-off.

What has been done as a result

QantasLink advised that both flight crew underwent additional training focused on threat and error management techniques. The occurrence was also included in a safety article, which discussed omissions, threat and error management and situational awareness.

QantasLink advised it had also initiated a program of focused risk monitoring for its operational ramp-up out of the COVID-19 pandemic. Metrics included human factors and performance, crewmember wellbeing, flight data and a return-to-work training program.

Safety message

This occurrence demonstrates how diverted attention or focus may result in errors of omission, especially where a task may be reliant on standard verbal cues. Highly-repetitive, routine tasks may result in pilots developing strong expectations that a task has been completed, even if it has not been, and make it difficult for pilots to identify an omitted action. Accordingly, it is essential that when flight crews are completing checklists, they focus on confirming that the relevant conditions have been met.

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

On the afternoon of 12 July 2021, a Bombardier DHC-8-402 (Q400), registered VH-QOY, was being operated by QantasLink on a scheduled passenger flight from Sydney to Albury, New South Wales, and return. The aircraft was crewed by 2 pilots and 2 cabin crew with 22 passengers on board.

The flight crew agreed that a take-off from intersection G on runway 34 left would be a more efficient option due to the planned light weight of the aircraft. The operator's performance software calculations confirmed this assessment, and determined the use of flap 10 would be required if using that intersection. The flight crew stated that, although a flap 10 take-off was a normal operation, a flap 5 departure was the routine departure configuration.

The flight crew agreed that the first officer (FO) would be pilot flying (PF) and the captain would be pilot monitoring (PM) for the first sector.[1] The FO decided that they would hand fly the aircraft up to 5,000 ft in order to refresh and maintain their handling skills.

During the take-off briefing, the flight crew noted that flap 10 had a lower maximum flap extended speed of 181 kt (compared to 200 kt for flap 5). The crew discussed that, as they expected an increase in aircraft performance due to the light weight of the aircraft and normal take-off power, there was an increased potential for exceeding the flap speed limit. When reviewing the maintenance log, the captain also noted that there was a deferred requirement for maintenance action related to propeller balance.

At about 1527 Eastern Standard Time,[2] the aircraft took off. The captain recalled being very focused on the correct pitch attitude for take-off and monitoring the airspeed in relation to the flap speed limit. The captain stated that, although the FO adopted the correct pitch attitude on this occasion, they had previously observed some FOs pitch higher than stated in the operator's procedures.

The captain explained that, by the time their scan was complete, the aircraft was at approximately 400 ft and fast approaching the first standard instrument departure turn at 600 ft. Their focus then switched towards this turn and anticipation of what the FO may require at that time. Although the captain confirmed that the aircraft had achieved a positive rate of climb, they inadvertently did not make the required 'positive rate' call to confirm to the FO that the aircraft was safely climbing.

The FO reported that they were also very focused on airspeed and maintaining runway centreline. As a result, the FO did not identify that the positive rate call had not been made. The FO also did not make the 'gear up' call, the next standard call in the flight crew's after take-off procedural flow.

At this time both of the flight crew were still very focused on the aircraft's performance, and neither pilot identified that the landing gear had not been retracted.

After passing 600 ft, the FO turned the aircraft onto the assigned heading (230°) and soon after the crew commenced the acceleration drills. At about 1,100 ft, the FO asked for the flaps to be raised, which the captain actioned. The crew selected an airspeed of 210 kt for the climb.

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1 Pilot flying (PF) and pilot monitoring (PM) are 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 aircraft flight path.

2 Eastern Standard Time (EST) was Coordinated Universal Time (UTC) + 10 hours.

The FO recalled that, while still hand flying the aircraft, they called for the 'after take-off' checklist. The first item on the checklist was landing gear. Both pilots were required to look at the item to confirm the correct state (landing gear handle up and no lights illuminated). The captain recalled that they stated 'landing gear' and the FO responded 'up, no lights'. Neither pilot detected that the landing gear was still down.

The captain later reported that, when completing the checklist, they saw the 3 green lights for the landing gear but did not recognise that the green lights indicated an abnormal situation for that stage of flight. At the time they thought it was a safe indication, and they noted that during the landing phase 3 green lights was the correct indication for the equivalent checklist item. The FO later reported that they could not specifically recall what they saw on the landing gear panel at that time.

The FO recalled that they engaged the autopilot when the after-take-off checklist was completed. Recorded flight data showed that the autopilot was engaged at 1530, when the aircraft was approaching 3,400 ft.

Following the after-take-off checklist, both pilots noted that the aircraft was noisier than normal with a vibration also noticeable. They also recalled that there did not seem to be a problem with the aircraft's performance during the climb. The captain stated that the noise and vibration were uniform and not problematic but were somewhat distracting. The FO recalled thinking the flap and/or gear may still be extended. The FO recalled looking at the landing gear panel at this time and noticing the 3 green lights, but they did not recognise that this was an abnormal indication at that stage of flight. They recalled consciously looking for red lights that may indicate a problem and not seeing any.

The captain advised the FO that the noise and vibration was probably related to the propeller balance maintenance log entry. The captain suggested reducing climb speed, as this would normally reduce such noise and vibration. The FO agreed with this action, although they recalled thinking that the noise was not what they would have expected from a propeller balance issue. At 1531, as the aircraft was climbing through 6,000 ft, the crew selected a speed of 185 kt. This action reduced the noise and vibration, which appeared to reinforce the crew's assessment of the source of the problem.

Later during the climb, the FO provided the after-take-off public address announcement to the passengers.[3] The cabin crew then contacted the flight crew, asking if it was normal for the landing gear to still be extended at that time. The flight crew immediately looked at the landing gear panel and identified that the handle was down with 3 green lights illuminated, indicating that the landing gear was still extended.

The flight crew confirmed that the aircraft 's speed was below the maximum landing gear operating speed (200 kt) and then, at 1536, they retracted the landing gear. They believed no landing gear speed limits had been exceeded, but when they retracted the landing gear the aircraft was at about 15,900 ft. This was above the 15,000 ft altitude limit for flight with gear extended.

Upon raising the landing gear, the flight crew noted that the unusual noise and vibration stopped. The captain later reported that, in hindsight, the unusual but uniform noise and vibration were not consistent with what would normally be expected with a propellor balance problem, but they had not considered other explanations for the noise and vibration at the time it was noticed.

The aircraft continued climbing to the assigned level (FL 240). After reaching their cruise altitude, the flight crew contacted the operator's maintenance watch department to advice that they had exceeded the maximum landing gear extended altitude. The crew were subsequently directed to

[3] This announcement was required to be conducted after passing the transition altitude (10,000 ft) or when the aircraft was established in the cruise. The provision of the announcement cancelled the sterile flight deck with the cabin crew.

conduct a precautionary return to Sydney. The aircraft landed back in Sydney at 1630 without further incident.

Context

Personnel information

Captain

The captain had 15,870 hours flight time, of which 12,280 hours was on DHC-8 aircraft. Their flying career included flying various single and multi-engine aircraft in general aviation prior to joining QantasLink. They had been a captain on the Q400 since 2013. Their last recurrent proficiency (simulator) check was conducted on 2–3 July 2021.

The captain reported having 6 hours sleep the previous night and 13 hours sleep in the previous 48 hours. They indicated that they did not feel tired or fatigued when they signed on for duty. The flight from Sydney to Albury was their first flight that day.

First officer

The first officer (FO) had about 1,470 hours flight time, with about 1,215 hours on the Q400. They had commenced their flying career with QantasLink. Their last recurrent proficiency (simulator) check was conducted on 29–30 June 2021.

FO reported having 8 hours sleep the previous night and 16 hours sleep in the previous 48 hours. However, the FO noted that their sleep the night before the flight was broken and they felt a little tired during the commute to work. This improved after drinking coffee and becoming more engaged with required tasks during the flight planning stage. The FO reported not feeling tired during the flight. The flight from Sydney to Albury was their first flight that day.

Recent flight experience

The operator stated that its recurrent proficiency checks from early 2020 to August 2021 included ‘a focus on the methodical actioning of checks and checklists to capture Flight Crew that may have not flown as regularly due to the impact of COVID19’.

The operator also advised that its flight crew had experienced a reduction in flight hours since March 2020 due to the impact of COVID on the aviation industry. Prior to March 2020, captains averaged 40–50 hours flight hours per month and FOs averaged 50–60 hours per month.

With regard to the crew of VH–QOY, the captain conducted 41 hours per month since March 2020 and the FO conducted 36 hours per month. Prior to the occurrence flight on 12 July 2021, the captain conducted 28 hours line flying (29 sectors) in the previous 30 days and 127 hours in the previous 90 days (excluding the proficiency check). Their last flight was on 7 July (5 days before). The FO conducted 20 hours line flying (22 sectors) in the previous 30 days and 47 hours in the previous 90 days (excluding the proficiency check). Their last flight was on 1 July (11 days before). Both pilots met the minimum regulatory requirements for currency.[4]

The operator noted that it had allocated safety pilots to join a flight crew in situations where a pilot had not flown for a significant period of time. A safety pilot had not been allocated, nor was it required, for the occurrence flight.

[4] Civil Aviation Safety Regulation Part 61 required that, within the previous 90 days of a flight, a pilot had conducted at least 3 take-offs and landings or completed a proficiency check. Additional requirements existed for the conduct of instrument approaches.

Aircraft information

General

The Bombardier DHC-8-402 (Q400) was a was a twin turbo propeller aircraft capable of carrying up to 80 passengers. VH-QOY was manufactured in 2010. The Q400 was normally operated with 2 flight crew and 2 cabin crew.

Landing gear system

The aircraft was equipped with a retractable tricycle landing gear. Operation of the landing gear was via a handle on the main instrument panel on the flight deck, in front of the FO's seat. The handle illuminated when the landing gear was transiting between positions, and 3 green lights on the landing gear advisory panel indicated the gear was down and locked (Figure 1). When the gear was fully retracted (in the 'up' position), there were no lights illuminated.

Figure 1: Landing gear handle and advisory panel

Source: QantasLink, annotated by the ATSB

Relevant aircraft limits included:

- maximum landing gear operating speed – 200 kt (the landing gear cannot be raised or extended when operating above this speed)
- maximum landing gear extended speed – 215 kt (the aircraft cannot be flown above this speed with the landing gear extended)
- maximum altitude with landing gear or flaps extended – 15,000 ft.

A review of the recorded data for the flight confirmed that neither of the landing gear speed limits were exceeded. However, the landing gear remained extended above 15,000 ft and was retracted at about 15,900 ft.

The operator advised that, although the maximum landing gear altitude limit was exceeded, the aircraft maintenance manual did not require an inspection of the landing gear. The manufacturer

confirmed that an inspection of the landing gear was not required. It stated that the 15,000 ft altitude limit was a practical value, not a limiting value. It was based on the normal envelope of landing gear operation. It advised that the aircraft had been demonstrated above 15,000 ft with the gear extended and confirmed the gear would operate normally above 15,000 ft. As such, no inspection was required.

Flight crew procedures

Landing gear retraction after take-off

The landing gear is normally retracted shortly after take-off. As per the operator's procedures, this was normally triggered by the pilot monitoring (PM) who, after take-off, observed the radio altimeter and vertical speed indicator to confirm that the aircraft had a positive rate of climb. They then called 'positive rate', which triggered the pilot flying (PF) to confirm this and then call 'gear up'. The PM then selected the landing gear handle up and confirmed the advisory lights were extinguished (Figure 2).

There was no hardware system to alert the flight crew that the gear has not been retracted after take-off, nor was such a system required to be installed.

Figure 2: Take-off procedure extract

After takeoff power is set:

Pilot Flying (PF)	Pilot Monitoring (PM)
Confirm 70 KIAS "Checked"	At 70 KIAS: "70 knots"
	At V_1: "V_1"
Confirm airspeed and rotate smoothly at approximately 3 degrees per second to 8° nose up to achieve lift-off. After lift-off continue rotation to a minimum pitch attitude of 10° to achieve V2 +10 at 35 ft.	At V_R: "Rotate"
Confirm positive rate on Rad Alt and VSI "Gear Up"	Observe positive rate on Rad Alt and VSI "Positive Rate" Select landing gear up and confirm advisory lights extinguish
Above 400 ft AGL if LNAV is required: "Select Nav" Confirm FMA call "LNAV"	Press NAV on FGCP and confirm annunciation

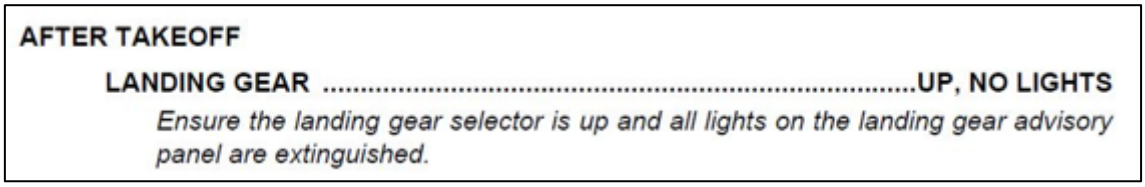
Source: QantasLink, annotated by the ATSB

After-take-off checklist

As per the operator's procedures, the PF called for the after-take-off checks (part of the normal checklist) at their discretion. This was normally done once the aircraft had been safely established in the climb. The checklist was preceded by checks that were completed from memory by the PM.

The checklist was a challenge and response type, with the first item being the landing gear. The PM 'challenges' the PF by calling 'landing gear' and both pilots were then required to observe the landing gear advisory panel to ensure that the handle was up and all lights were extinguished. Once verified, the PF 'responds' by calling 'up, no lights' (Figure 3).

Figure 3: After-take-off checklist extract



Source: QantasLink

The Q400 flight crew operating manual stated that:

> The purpose of the [normal] checklist is to confirm critical items have been actioned and/or confirmed appropriate for the phase of flight. Though the response is by one crew member it is the responsibility of both crew members to clearly communicate if an item has not been actioned or is incorrect.

Related occurrences

A review of the ATSB aviation occurrence database identified 7 other occurrences during January 2011 to December 2021 on commercial air transport flights involving Australian domestic airline operators where a flight crew inadvertently did not raise the landing gear after take-off. Details of these occurrences included:

- Soon after take-off, a DHC-8 struck a bird, which resulted in the flight crew inadvertently not announcing the 'gear up' call and retracting the landing gear at the normal time. The after-take-off checklist was completed but the crew did not identify that the landing gear was still down. The crew subsequently detected the problem and realised the aircraft had exceeded the maximum landing gear extended speed.
- Soon after take-off, an auxiliary power unit caution light on a DHC-8 illuminated, which distracted the flight crew's attention and they did not raise the landing gear at the normal time. The after-take-off checklist was completed but the crew did not identify that the landing gear was still down. On climbing through the transition altitude (10,000 ft), they noted the aircraft had poor climb performance and identified the problem. The landing gear was retracted when the aircraft was above the maximum landing gear operating speed.
- Soon after take-off, the flight crew of a DHC-8 were distracted by another aircraft in the circuit, which turned unexpectedly towards them. The crew omitted the 'gear up' call and did not raise the landing gear at the normal time. The problem was subsequently identified, and no speed limits were exceeded.
- Shortly after take-off, the PF of a Saab 340 made the operator's standard 'positive rate, gear up' call. The PM did not recall hearing this call, which meant that the landing gear was inadvertently not retracted and the PM did not make the standard call in response ('selected'). The crew detected their error when conducting the climb checklist (after the aircraft passed through 3,800 ft). They instinctively retracted the gear; however, at that time the aircraft was above the maximum landing gear retraction speed. Factors that influenced this omission and its non-detection included both crew focusing on departure procedures and the local weather, and the crew likely expecting that the landing gear was retracted as normal. In addition, the PM was experiencing a level of fatigue (AO-2014-189).
- The flight crew of an A320 incorrectly calculated the aircraft's take-off speeds, which resulted in the airspeed exceeding the flap limit speed soon after take-off and the crew did not retract the landing gear after achieving a positive rate of climb. While troubleshooting a buffeting sound, the PF found that the landing gear was still extended and called 'gear up', and the landing gear

was retracted when the aircraft was above the maximum landing gear retraction speed (AO-2018-067).

- The flight crew of an A320 were following another A320 on departure and the crew elected to conduct a TOGA take-off to avoid wake turbulence. After take-off, the crew omitted the 'gear up' call and did not raise the landing gear. The problem was identified after the flaps were retracted, and the landing gear was retracted when the aircraft was above the maximum landing gear retraction speed.
- Soon after take-off, the PM of a DHC-8 delayed the 'positive rate' due to distractions associated with radio noise. Following the call, the PF made the 'gear up' call, but the PM retracted the flaps instead, and the crew did not identify the error at that time. After reaching 7,000 ft, the crew commenced the after-take-off checklist and identified that the landing gear was still down. The landing gear was retracted when the aircraft was above the maximum landing gear operating speed.

In addition to the 8 occurrences where the landing gear was not retracted soon after take-off (including the 12 July 2021 occurrence), there were also 6 other occurrences where a flight crew inadvertently raised the flaps instead of the landing gear after take-off. These occurrences generally did not result in the landing gear remaining extended for a significant period of time.

Overall, for these 2 types of incorrect configuration after take-off, 11 occurrences took place between January 2011 and March 2020 and 3 took place between April 2020 and December 2021. Between April 2020 and December 2021, the number of domestic airline departures in Australia was significantly reduced (by 55%) compared to previous years. Although the rate of the incorrect landing gear configuration after take-off occurrences was 1.9 per million departures from January 2011 to March 2020 and 6.1 per million departures during April 2020 to December 2021, this difference was not statistically significant.[5]

The ATSB also reviewed the Aviation Safety Reporting System (ASRS) database for occurrences in the United States between January 2011 and October 2021 where an airline flight crew did not retract the landing gear after take-off. There were 8 reports. Some key details included:

- In most cases, the flight crew reported some form of distraction or additional workload after take-off.
- In most cases, the flight crew also reported noise, vibration or buffeting and in some cases decreased climb performance and/or increased fuel burn associated with the landing gear being down.
- In 2 cases, the flight crews reported detecting the problem when the after-take-off checklist was completed, whereas in 5 cases the crew reported the after-take-off checklist was completed but they did not detect the problem.
- Several crews reported being unable to identify the reason for the problem even after extensive troubleshooting, including 3 cases where the landing gear being down was only detected when the crew went to select the landing gear down for landing. One pilot noted that during troubleshooting everything 'appeared normal and all symbols were green'. Another pilot noted that this type of occurrence (not raising the landing gear) was so rare that their crew, which was very experienced, did not even consider it when troubleshooting.

[5] Calculated using Fisher's exact test (p = 0.09). [Note: the number of departures for December 2021 was not available and was estimated using previous months. Figures will be adjusted if required in the final report.]

Safety analysis

Landing gear not retracted after take-off

After taking off from Sydney, the flight crew did not raise the landing gear. Ultimately the problem was not identified until the aircraft had reached 15,000 ft. No landing gear speed limits were exceeded. Although the 15,000 ft maximum altitude for operating with the landing gear extended was exceeded, this had no subsequent effect on the serviceability of the aircraft. Nevertheless, the occurrence was of some concern as the flight crew did not identify the incorrect configuration for an extended period of time.

Conducting a take-off is a specialised task that is acquired through comprehensive training and significant experience; it involves conducting routine, frequently-practiced tasks in a largely automatic manner with occasional conscious checks on performance. Errors, known as slips and lapses, will occasionally occur when conducting such skill-based tasks (Reason 1990). Omitting a step or an action is one of the most common forms of error (Reason 2002), and they are often associated with interruptions, distractions or attention being diverted to other tasks. Accordingly, occurrences where flight crew forget to raise the landing gear after take-off almost always involve some form of distraction or diverted attention.

In this case, both pilots were heavily focused on the aircraft's speed soon during the initial climb. Additionally, the captain was focused on the aircraft's pitch attitude, having previously observed other pilots pitch higher than the operator's procedures stated in similar situations, and the workload of the first officer (FO) was increased while hand flying the aircraft.

The confirmation of positive rate and subsequent call was a frequently-practiced action for the crew and therefore one normally conducted automatically, with little conscious oversight. Their diverted focus of attention was probably sufficient to result in the omission of the positive-rate call and neither pilot identifying that it had not been made.

Not calling 'positive rate' removed the standard verbal cue for the FO to call 'gear up', increasing the likelihood that the gear-up call would not be made. At this time, both pilots were still focused on aircraft performance but also shifting their focus to the increasing workload of the standard instrument departure.

Misidentification of landing gear status

Errors of omission are often difficult to detect by the people who make them (Sarter and Harrison 2000), and the absence of something (such as an action) is harder to detect than the presence of something (Wickens and others 2013). Trying to recall from memory whether actions have already been completed is also vulnerable to source memory confusion, such that the current situation is confused with the memory of many previous occasions when the action was successfully done (Dismukes and others 2007). Accordingly checklists, like the challenge and response after-take-off checklist, perform a vital role in ensuring omissions in a flight crew's procedural flow are captured (Barshi and others 2016).

When actioning the after-take-off checklist on this occasion, the 'landing gear' item was called by the captain (as pilot monitoring) but neither pilot identified the problem. The captain observed that the 3 green landing gear lights were illuminated, but did not identify it as being problematic for that stage of flight. Although the FO could not recall what they saw at that stage, they also recalled seeing the 3 green lights later in the flight and not thinking it was problematic.

Expectations strongly influence where a person will search for information and what they will search for (Wickens and McCarley 2008), and they also influence the perception of information (Wickens and others 2013). Pilots frequently conduct the task of raising the landing gear and, in almost all cases, it is done successfully. Consequently, the pilots on this occasion had a strong expectancy that the landing gear had been retracted, and they probably conducted the after-take-off checklist with a high degree of automaticity, rather than consciously looking for what was required (that is, no green lights). Although the 3 green lights provided a clearly visible indication

that the landing gear was still down, green lights are often associated with something being in a safe state; therefore this cue can be interpreted incorrectly in this phase of flight if the flight crew's attention is not focussed on exactly what they are looking for.

This type of occurrence is very rare but, when it occurs, a flight crew's further troubleshooting of symptoms associated with the landing gear still being down is often not effective. In this case, both pilots reported observing noise and vibration from the aircraft. After some discussion, the crew associated the noise and vibration with the propeller balance maintenance log entry. In an effort to reduce the noise and vibration, the crew reduced the climb speed. This reduced the abnormal indications and seemingly confirmed that the propeller balance was the source of the problem, consistent with the effects of confirmation bias.

Awareness displayed by cabin crew

The cabin crew displayed a high level of vigilance regarding the aircraft state. Their willingness to bring this to the attention of the flight crew allowed the flight crew to identify the problem and retract the landing gear as soon as possible and highlights the strength of timely communications between crew members.

Reduced flying activity

Skill decay or skill degradation refers to the loss of trained or acquired skills or knowledge following periods of non-use (Arthur and others 1998). Skill decay increases as the retention interval (or time since learning) increases, and it also increases depending on the quantity and quality of the initial and recurrent training and the amount of on-the-job exposure (Arthur and others 1998, Sanli and others 2018, Vlasblom and others 2020).

Procedural skills involving the retrieval and application of step-by-step actions are more sensitive to skill decay than many other types of activities (Goodwin 2006, Stothard and Nicholson 2001, Wisher and others 1999). As recently noted by the European Union Aviation Safety Agency (EASA 2021):

> Procedural tasks that require specific procedural or declarative knowledge (e.g. checklists that require more items than prescribed on paper) may be more susceptible to skill decay than higher order cognitive tasks (e.g. decision making) or perceptual/psychomotor tasks. Cognitive shortcuts for procedures decay rapidly, requiring a significant increase in cognitive resources, in particular for procedures that are normally routine. By their prescriptive nature, procedures are easily subject to slips and lapses. Procedures must be viewed as highly sensitive to proficiency decay.

In this case, the FO had undertaken less than the operator's normal amount of flying since March 2020. In particular, the FO had conducted less than one third of their normal amount of flying in the previous 90 days and had not conducted any flights for 11 days. However, the operator was aware of the potential issues associated with reduced flight recency and had introduced measures to mitigate the risk. Both flight crew had recently undertaken a proficiency check. Overall, there was insufficient evidence to conclude that the FO's reduced flight recency contributed to the procedural errors made by the flight crew on this occasion.

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 incorrect configuration involving Bombardier DHC-8-402, registered VH-QOY, near Sydney Airport, New South Wales on 12 July 2021.

Contributing factors

- After take-off, the flight crew's attention was heavily focused on maintaining the aircraft's speed and pitch, resulting in the omission of the 'positive rate' call. This removed a trigger for the 'gear up 'call, which neither pilot identified, and subsequently the landing gear was not retracted after take-off.
- Although the landing gear handle was in the down position and 3 green lights were illuminated, the pilot flying incorrectly called 'up, no lights' when conducting the after-take-off checklist. The pilot monitoring did not identify the error. It is likely that both pilots had a strong expectancy that the landing gear had been retracted after take-off when completing the checklist.

Other findings

- The cabin crew observed that the landing gear remained extended longer than normal following take-off. They advised the flight crew, resulting in the landing gear being retracted.

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 QantasLink

QantasLink advised that both flight crew underwent additional simulator and human factors training, which was focused on threat and error management techniques.

QantasLink published an article describing this occurrence, which discussed omissions, threat and error management and situational awareness.

QantasLink advised it had also initiated a program of focused risk monitoring for its operational ramp-up out of the COVID-19 pandemic. Metrics included human factors and performance, crewmember wellbeing, flight data and a return-to-work training program.

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the flight crew of VH-QOY
- QantasLink
- Bombardier
- Airservices Australia.

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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:

- the flight crew of VH-QOY
- QantasLink (operator)
- the Civil Aviation Safety Authority
- Transportation Safety Board of Canada
- Bombardier.

Submissions were received from the operator and the captain. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

General details

Occurrence details

Date and time:	12 July 2021, 1630 EST	
Occurrence class:	Incident	
Occurrence categories:	Incorrect configuration, Diversion / Return	
Location:	Near Sydney Airport, New South Wales	
	Latitude: 33º 56.772' S	Longitude: 151º 10.632' E

Aircraft details

Manufacturer and model:	Bombardier Inc. DHC-8-402	
Registration:	VH-QOY	
Operator:	Sunstate Airlines (Qld) Pty. Limited (operating as QantasLink)	
Serial number:	4288	
Type of operation:	Air Transport High Capacity - Passenger - (Air Transport High Capacity)	
Activity:	Commercial air transport – Scheduled - Domestic	
Departure:	Sydney, New South Wales	
Destination:	Albury, New South Wales	
Actual destination:	Sydney, New South Wales	
Persons on board:	Crew – 4	Passengers – 22
Injuries:	Crew – nil	Passengers – nil
Aircraft damage:	None	