Australian Government
Australian Transport Safety Bureau

Turbulence event and cabin crew injury involving Boeing 737, VH-VYK

36 km south-east of Brisbane Airport, Queensland, on 4 May 2024

ATSB Transport Safety Report
Aviation Occurrence Investigation (Defined)
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Acknowledgement of Country and Traditional Owners

The Australian Transport Safety Bureau acknowledges the traditional owners of country throughout Australia, and their continuing connection to land, sea and community. We pay our respects to them and their cultures, and to elders both past and present.

Investigation summary

What happened

On 4 May 2024, a Boeing 737, operated by Qantas Airways Limited, departed Sydney, New South Wales for a scheduled passenger carriage flight to Brisbane, Queensland. In the latter stages of descent, the aircraft entered a band of approaching cloud. While the flight crew expected some turbulence associated with the entry to cloud, after passing 11,400 ft about 36 km south-east of Brisbane, the aircraft experienced unanticipated severe turbulence. Three cabin crew were unrestrained and suffered various injuries during the occurrence. Two received minor injuries, including a facial injury and concussion, whilst the third was seriously injured with a fractured ankle.

What the ATSB found

The ATSB found that the captain did not inform the cabin crew about the expected turbulence during descent, likely due to not being aware of its severity. This resulted in 3 unrestrained cabin crew being injured during severe turbulence.

Following the turbulence, the captain instructed all passengers and crew to return to their seats and fasten seatbelts. However, 2 cabin crew and 2 passengers remained unrestrained in the rear galley to assist the seriously injured crew member during landing. When the flight crew were informed of this, the captain repeated the instruction that everyone besides the injured crew member was to return to their seats for landing. Assuming the cabin would be secured after the repeated instruction, the flight crew proceeded with the landing, unaware that 4 crew and passengers remained unrestrained. Qantas 737 standard operating procedures relied on the customer service manager to inform the flight crew if the cabin crew had not secured the cabin for landing.

A crew member who had sustained a concussion returned to work before seeking medical treatment. The ATSB found that the operator did not have a procedure to ensure that crew were assessed for fitness for duty after a significant injury.

What has been done as a result

Qantas has updated the integrated operation control procedures for requesting medical assistance for cases where any crew member or passenger is significantly injured. Updated protocols now mandate that a doctor will immediately be required to assess the fitness of cabin crew members prior to commencing any further work-related duties. Additionally, the operator will arrange immediate medical assessment following any turbulence or unplanned aircraft movement classified as moderate or severe with injuries or unrestrained crew.

Safety message

Effective coordination and communication among all crew members is critical in managing turbulence and ensuring cabin safety. This coordination should extend beyond pre-flight briefings to include continuous communication throughout the flight, particularly during periods of increased workload and operational complexity.

Collaboration between the flight and cabin crew helps ensure the timely completion of service-related tasks while minimising the risk of injury during known or anticipated encounters with turbulence.

Flight crew rely on clear and timely communication from the cabin crew to maintain awareness of the condition in the cabin. When there is a different understanding of the state of the cabin, there is an increased risk delayed responses or misaligned decision-making which may lead to safety being compromised.

Aircraft are more likely to experience the effects of weather and wake turbulence during the descent, approach, and landing phases of flight, highlighting the importance of effective communication procedures to promote cabin safety and minimise the risk of injury to passengers and crew.

Contents

The occurrence

On 4 May 2024, a Boeing 737, registered VH-VYK, being operated by Qantas Airways Limited as QF520, departed Sydney, New South Wales on a scheduled flight to Brisbane, Queensland. The aircraft departed Sydney at 1202 local time and was scheduled to arrive in Brisbane at 1335. On board was the flight crew, comprised of the captain and first officer (FO), a customer service manager (CSM) supported by 3 cabin crew members, and 143 passengers.

Prior to departing Sydney for Brisbane, the captain recalled briefing the CSM about leaving the seatbelt sign on for the departure from Sydney due to weather, however neither the captain nor the CSM could recall any specific details regarding the weather conditions in Brisbane.

Descent into Brisbane

At about 1300, the flight crew commenced their descent into Brisbane while approaching Lismore, New South Wales. As the aircraft continued descent towards Coolangatta, Queensland, the captain visually observed cloud over Moreton and Stradbroke islands, but recalled no weather radar indications that identified precipitation normally associated with increased turbulence.

After passing 30,000 ft above mean sea level (AMSL) at 1303, the captain, who was pilot monitoring, recalled performing the 'prepare cabin' public announcement (PA), and the cabin crew commenced securing the cabin for landing. About 6 minutes later, the captain contacted the CSM to enquire about the amount of time the cabin crew required to complete their cabin preparations. At about 15,000 ft AMSL, the aircraft entered a thick layer of stratiform[1] cloud with minimal turbulence observed initially by either the flight or the cabin crew. The CSM advised the captain the preparations would take about 2 minutes. About 2 minutes later, the captain turned on the seatbelt sign and announced the 'seatbelts PA'.

Immediately after the captain turned on the seatbelt sign, the CSM and the 2 cabin crew members in the aft galley completed their duties as per the procedures. The CSM made a PA while standing in the forward galley, then checked and locked their assigned lavatory. The 2 cabin crew members in the rear galley got out of their jump seats to verify that the lavatories were vacant before locking them.

At about this time, the captain observed a cumulus[2] cloud embedded in the stratiform layers. However, there was no radar return consistent with increased turbulence, and the cloud did not appear to be overly concerning in terms of turbulence risk from their shape or size.

After descending below 12,000 ft AMSL at 1311, the aircraft encountered a severe turbulence event less than one minute after the seatbelt sign was illuminated, while 3

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1 Stratiform: clouds that exhibit extensive horizontal development (in contrast to the vertical development of cumuliform clouds).

2 Cumulus: a principal cloud type, forming in the low levels of the troposphere, characterised by flat bases and dome or cauliflower-shaped upper surfaces. Small, separate cumulus are associated with fair weather but may grow into towering cumulus or cumulonimbus.

cabin crew were unrestrained. The CSM recalled observing the right 2 primary (R2P) cabin crew member at the rear galley rising off the floor and colliding with the aircraft's ceiling. They immediately fell back to the floor, landing on their right ankle. The R2P felt a crushing sensation as they landed on their ankle and experienced intense pain and was unable to move.

Events in the cabin

The CSM contacted the captain to inform them that the R2P was injured and that some passengers were standing. The captain responded with instructions that all passengers and cabin crew must remain seated. Following this interaction, the CSM made a public announcement to remind passengers to stay seated and to request assistance from the cabin crew if needed. The captain contacted the operator’s Brisbane airport coordinator to advise that there was an injured cabin crew member and medical assistance would be required on arrival in Brisbane. Queensland Ambulance service records showed that a request for an ambulance was received at 1315.

Although being instructed to remain seated, the CSM immediately moved to the rear of the aircraft to assist the injured R2P in the aft galley. There, they observed the injured R2P lying on the floor while a passenger was holding their leg. Another passenger, who identified themselves as a doctor, offered to assist with providing first aid. Meanwhile, another cabin crew member, the left two primary (L2P), was supporting the R2P’s head.

At this point, the CSM advised the L2P and the passengers that the captain had instructed everyone to return to their seats. However, they were unwilling to leave the R2P unattended. The CSM instructed the L2P to advise the captain of the situation. The CSM then retrieved the physician's kit from the front of the cabin. At this point, the passenger seated in 3F advised the CSM that they were a travelling cabin crew member and were able to assist.

The L2P contacted the captain to advise that all the occupants located in the rear galley were still unrestrained. However, the captain did not recall receiving requests for additional time to address the situation. The captain reiterated that all uninjured occupants must return to their seats as the aircraft was in the final stages of the approach and would be landing soon.

The CSM subsequently returned to the rear galley with the physician’s kit and the off-duty cabin crew from 3F, who subsequently relieved the passenger who was holding the R2P’s leg. While the CSM was attempting to provide first aid and preparing a splint with the assistance of the travelling doctor, a passenger seated in 30D yelled, ‘we’re about to land’. Shortly after at 1322, the aircraft landed in Brisbane with 4 unrestrained passengers and cabin crew in the rear galley. The flight crew taxied the aircraft to its assigned gate, arriving at 1328, with paramedics in attendance at 1338.

Context

Flight crew information

Captain

The captain held an Airline Transport Pilot (aeroplane) Licence with an instrument rating and a Class 1 aviation medical certificate. They had 23,177 flight hours, including 15,005 hours on the Boeing 737, and had logged 165 hours on the 737 in the last 90 days.

The captain reported sleeping 7 hours the night before the occurrence. They were awake for 8 hours and 45 minutes at the time of the occurrence and reported feeling 'responsive, but not at peak'.

First officer

The first officer held an Airline Transport Pilot (aeroplane) Licence with an instrument rating and a Class 1 aviation medical certificate. They had 10,163 flight hours, including 1,717 hours on the Boeing 737, and had logged 152 hours on the 737 in the last 90 days.

The first officer reported sleeping 7 hours the night before the occurrence. They were awake for 8 hours and 45 minutes at the time of the occurrence and reported feeling 'somewhat fresh'.

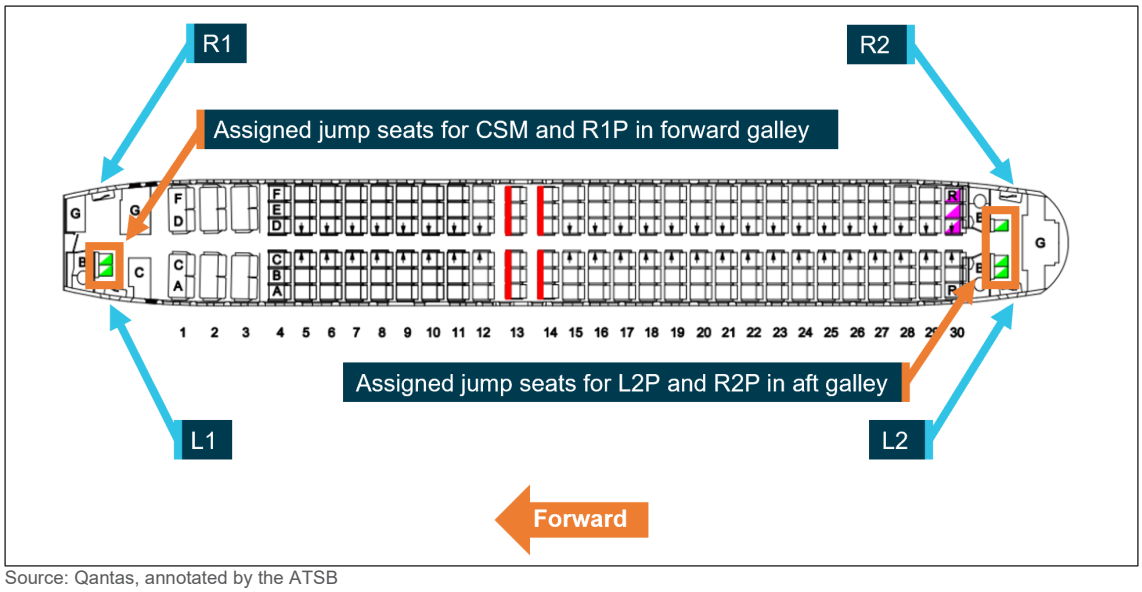
Cabin crew

The cabin crew on board was comprised of a complement of 4 members, with their assigned jump seats located in the forward and aft galleys. Each cabin crew member was responsible for one of the 4 main cabin doors (Table 1) during critical phases of flight, with their assigned jump seat (Figure 1) located immediately next to their assigned door. The cabin crew were under the supervision of the customer service manager (CSM) who was responsible to the captain for administration of in-cabin service and liaison with the crew for all service and safety related matters.

Table 1: Cabin crew door assignment

Cabin Door	Cabin crew assignment
Left one (L1)	Customer service manager (CSM)
Right one (R1)	Right one primary (R1P)
Left two (L2)	Left two primary (L2P)
Right two (R2)	Right two primary (R2P)

Figure 1: 737 Cabin layout, doors and assigned jump seats for cabin crew



Source: Qantas, annotated by the ATSB

Cabin crew injuries

R2P

The R2P had been in the process of taking their seat when the turbulence occurred. They rose into the air during the turbulence, struck their head on the ceiling, and landed heavily on their feet. R2P immediately fell to the galley floor and told L2P that they were injured, possibly with a broken bone. They were later diagnosed in the hospital with a fracture involving 2 breaks in the ankle and another break in the leg, which required surgery.

CSM

The CSM sustained minor injuries due to striking aircraft fixtures while standing unsecured during the turbulence. The CSM self-assessed their injuries and applied first aid the following day after noticing minor pain, including discomfort in their lower back and right shoulder blade. They also became aware of facial pain 2 days after the event.

L2P

The L2P sustained a head injury, due to striking the ceiling or other aircraft fixtures during the event but did not initially believe they were injured. They had several rostered days off after the event. They returned to work on 11 and 12 May and were made aware by co-workers that they were displaying symptoms of possible injury. On 16 May, 12 days after the turbulence event, they were diagnosed with concussion after a consultation with their general practitioner.

Aircraft

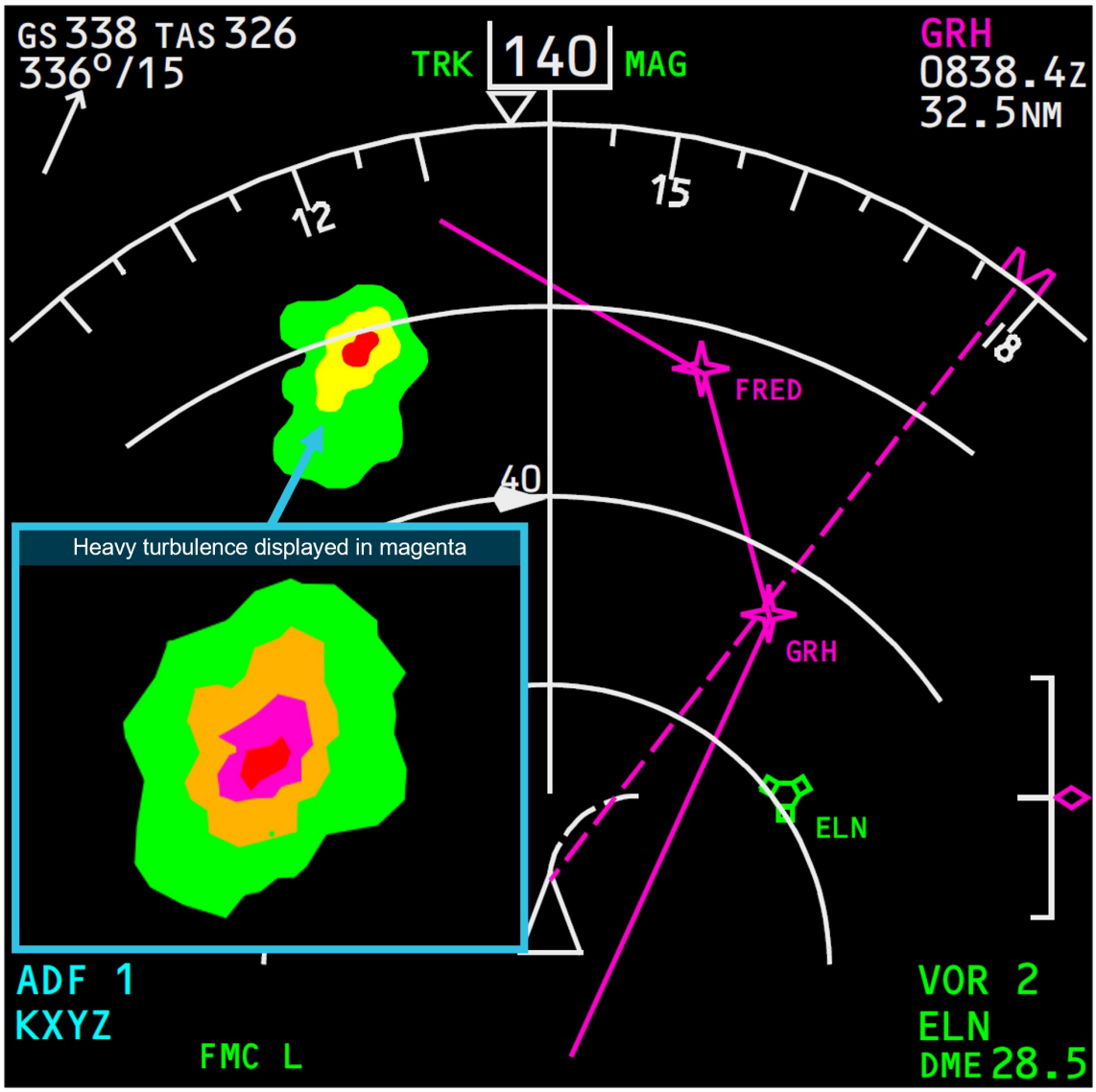
The aircraft was registered as VH-VYK in Australia on 11 January 2006, serial number 34183. The Boeing 737-800 is a twin-engine, narrow-body commercial aircraft in the 737 Next Generation series, used for short to medium-haul routes. It had a seating capacity of 174 passengers, with Qantas configuring its aircraft with 12 business class seats in a 2-2 layout and 162 economy class seats. It is powered by two CFM56-7B turbofan engines.

The passenger address system broadcasts announcements throughout the cabin, and the interphone facilitates communication between the flight and cabin crew.

Weather radar

The weather radar system fitted to the Boeing 737 detects and locates various types of precipitation bearing clouds along the flight path of the aircraft and gives the pilot a visual indication in colour of the cloud's intensity. The radar antenna sweeps a forward arc of 180°. The radar indicates a cloud's rainfall intensity by displaying colours contrasted against a black background. Areas of heaviest rainfall appear in red, the next level of rainfall in amber, and the least rainfall in green (Figure 2).

Figure 2: Example depiction of 737 weather radar returns on pilot's navigational display



Source: Qantas, annotated by the ATSB

The turbulence mode displays normal precipitation and precipitation associated with turbulence. When the radar detects a horizontal flow of precipitation with velocities of 5 or more metres per second toward or away from the radar antenna, that target display becomes magenta. These magenta areas are likely associated with heavy turbulence.

The captain did not recall identifying areas of turbulence on the weather radar on descent or report that they were experiencing any difficulties operating the weather radar. Neither the captain nor the operator reported that the weather radar fitted to the aircraft was unserviceable during this occurrence.

Post-event maintenance

Aircraft data was collected for use by the operator's maintenance operations control, and engineering. The aircraft health monitoring (AHM) section collected and analysed data from aircraft components and systems post-event to assess their condition and identify any potential overstressing of components. The operator's AHM and flight data analysis showed that the event did not exceed tolerances, and no additional inspections were required.

Meteorological information

Brisbane Airport weather

The TAF for Brisbane Airport predicated winds from 100° at 10 kt with visibility more than 10 km in light rain showers and scattered cloud at 3,500 ft from 1200–2000 local time. Table 2 shows the automatic terminal information service (ATIS)[3] report at the time of departure.

Table 2: Brisbane Airport automatic terminal information service (abridged)

Condition/requirement	ATIS and time issued
	'Foxtrot' 1159 local time
Approach type	Expect instrument approach
Visibility	Greater than 10 km
Weather	Showers in the area
Cloud	Few[4] at 1,500 ft and scattered at 3,500 ft
Temperature	22°

Gold Coast Airport weather

The TAF for Gold Coast Airport predicted winds from 100° at 10 kt with visibility more than 10 km in light rain showers and scattered cloud at 2,000 ft. There was a significant intermittent variation from the prevailing conditions from 1300–2200 local time. For up to 30 minutes at a time during this period, the visibility was forecast to reduce to 4 km in rain showers with broken[5] cloud at 1,500 ft.

Graphical area forecast

The flight transited through a region contained in the graphical area forecast for Queensland south, covering subdivisions A and A2 (Figure 3). Table 3 shows the

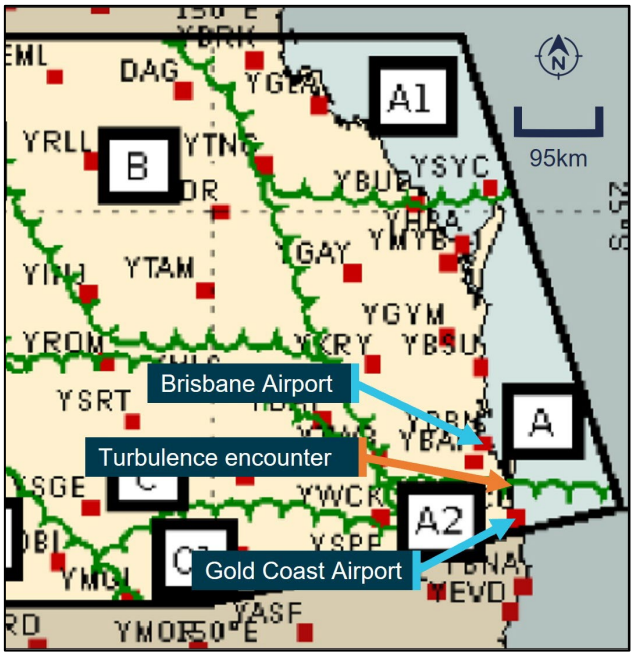
[3] Automatic terminal information service (ATIS): the provision of current, routine information to arriving and departing aircraft by means of continuous and repetitive broadcasts.

[4] Few is a meteorological term used in aviation to describe cloud coverage that occupies 1 to 2 oktas (eighths) of the sky.

[5] Broken cloud is a meteorological term used in aviation to describe cloud coverage that occupies 5 to 7 oktas (eighths) of the sky.

forecast conditions for the duration of the descent into Brisbane Airport which was issued at 0815 local time.

Figure 3: Graphical area forecast Queensland south



Source: Australian Bureau of Meteorology, annotated by the ATSB

Table 3: Graphical area forecast Queensland south

Area	Surface visibility and weather	Cloud	Turbulence
A	• Visibility greater than 10 km	• Scattered[6] cumulus/stratocumulus clouds between 2,500–8,000 ft AMSL • Scattered altocumulus/altostratus clouds from 8,000 ft to above 10,000 ft • Broken cumulus cloud between 2,000–9,000 ft	• Moderate turbulence associated with stratocumulus and altocumulus clouds
A2	• Visibility 3 km in scattered showers of rain • Visibility 1 km in isolated thunderstorms with rain showers	• Isolated towering cumulus cloud from 2,000 ft to above 10,000 ft • Broken stratus cloud between 800–2,000 ft • Broken cumulus cloud from 2,000 ft to above 10,000 ft	• Moderate turbulence associated with cumulus cloud • Severe turbulence associated with thunderstorms, cumulonimbus and towering cumulus clouds

[6] Scattered cloud is a meteorological term used in aviation to describe cloud coverage that occupies 3 to 4 oktas (eighths) of the sky.

Turbulence reporting

In accordance with the requirements of regulation 91.675 of CASR (Civil Aviation Safety Regulations 1988) and instructions contained in the *Aeronautical Information Publication Australia*, a special air report must be provided to air traffic control whenever turbulence meeting the following specifications is encountered:

- Moderate: Changes to accelerometer readings of between 0.5 g and 1.0 g at the aircraft's centre of gravity. Moderate changes to aircraft attitude and/or altitude may occur but aircraft remains under positive control. Usually small changes in airspeed. Difficulty in walking. Loose objects moved about.
- Severe: Changes to accelerometer readings greater than 1.0 g at the aircraft's centre of gravity. Abrupt changes to aircraft attitude and/or altitude may occur; aircraft may be out of control for short periods. Usually large changes of airspeed. Loose objects tossed about.

The flight crew could not recall whether a special air report was provided to air traffic control and the turbulence event was classified as moderate in a post-flight conference call between the captain and Qantas personnel. The operator defined moderate turbulence as 'causing rapid bumps or jolts without appreciable changes in aircraft altitude or attitude.' The description elaborated that unsecured objects are dislodged, and walking is difficult.

Recorded data

The operator's internal investigation report detailed flight data and showed that over a 4-second period, at an altitude of approximately 11,100 ft, the aircraft recorded:

- vertical G went from +1.2G to -0.06G (negative) to +1.35G to +0.61G to +1.59G.
- pitch attitude changed from -2.4deg to -0.7deg over 1 sec.

Operator procedures

Dispatch weather briefing

For the operator's domestic sectors, a flight plan, textual weather, and notice to airmen (NOTAM)[7] were provided in a briefing package to flight crew via an electronic application installed on their iPads. The briefing information included graphical area forecasts, additional weather, turbulence information and weather radar overlay imagery. Figure 4 shows a weather radar overlay issued at the time of departure. For operator domestic flights under 90 minutes, the crew did not receive a flight watch service[8] from the operator's flight dispatch during the flight and consequently, any hazard alerts or amended terminal forecasts (TAF)[9] were only provided by air traffic control.

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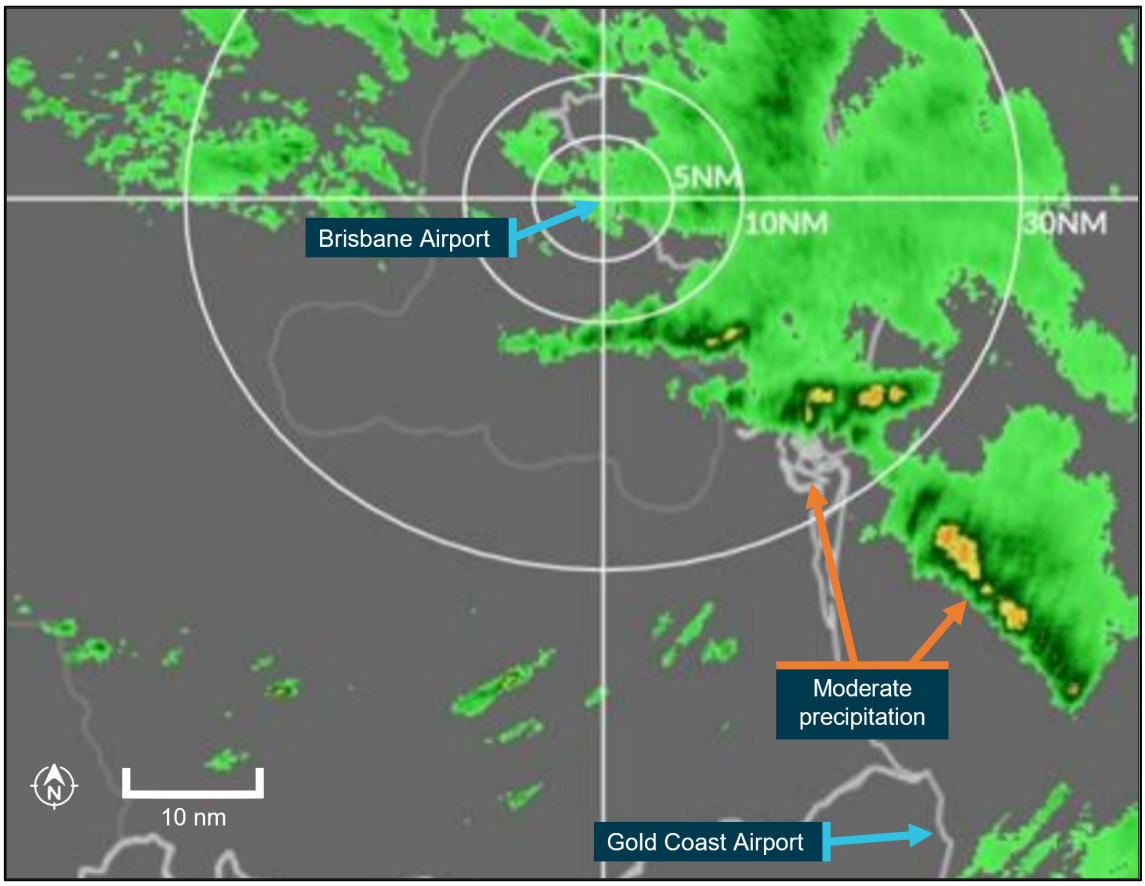
7 NOTAM: Notice to Airmen (NOTAM) is a notice containing information or instructions concerning the establishment, condition or change in any aeronautical facility, service, procedure or hazard, the timely knowledge of which is essential to persons concerned with flight operations.

8 Flight watch service: a flight watch service provides updated weather information to pilots en route.

9 Terminal forecast (TAF): a TAF is a coded statement of meteorological conditions expected at an aerodrome and within a radius of 8 kilometres of the aerodrome reference point.

Prior to departure from Sydney, the flight crew conducted their pre-flight planning and reviewed the weather briefing package. The crew recalled that the weather briefing package contained forecast light showers and some cloud in the vicinity of Brisbane and that the forecast weather for departure at Sydney was worse.

Figure 4: Brisbane Airport weather radar overlay on 4 May at 1200 local time (time of departure)



Source: Qantas, annotated by the ATSB

Cabin preparation for landing

The Qantas *Flight administration manual* (FAM) specifies that the flight crew make the 'prepare cabin' public announcement (PA) for cabin crew to commence cabin preparations at 20,000 ft or no lower than 10,000 ft above the destination airport. This PA can be performed at a higher altitude when considering descent profile, arrival procedures, weather and workload management. The customer service manager will then confirm receipt of the PA by directly contacting the flight crew.

The Qantas *Cabin crew operation manual* (CCOM) states the timing of this announcement should provide the cabin crew at least 10 minutes to secure the cabin and occupants for landing prior to the illumination of the seatbelt sign. After receipt of the 'prepare cabin' PA, all activity by the cabin crew shall be safety-related only and no new service duties may be initiated.

Additionally, the FAM stated, 'should contingencies occur that impact on the planned preparation time, every effort should be made to advise the cabin crew of these changes.'

In the case of the occurrence, the CSM recalled that the captain advised them that they would prepare the cabin earlier for a 'bit of weather'. The prepare cabin PA was performed after passing 30,000 ft and the seatbelt sign was illuminated less than 10 minutes later following a further discussion with the CSM relating to the progress of the cabin preparations.

Anticipated turbulence on descent

In the event that turbulence is anticipated on descent, the Qantas FAM stated that:

> Where turbulence is anticipated during descent, the flight crew should consider the 10 minutes requirement to prepare the cabin for landing. Cabin crew are to be alerted to anticipated turbulence as early as possible to enable them to complete their duties.

Any time the seatbelt signs are illuminated for turbulence, a PA must be made by the crew.

Securing cabin for landing

Cabin secured for landing

The CCOM specified that when the seatbelt sign is illuminated at the conclusion of the 10 minutes, the CSM will make the following PA:

> All customers and crew must now be seated for landing with their seatbelt fastened

The cabin crew will subsequently perform the following procedures:

- ensure passengers are seated
- verify lavatories are vacant
- conduct a simultaneous galley secure check
- return to jump seats and secure within one minute
- after one minute, the CSM initiates a callback from their jump seat to the other cabin crew, to advise that the cabin was secure
- perform silent [safety] review.

Cabin unsecured for landing

Approximately one minute after the seatbelt sign is illuminated, the CSM will initiate a callback from their designated jump seat. Each cabin crew member will respond with 'door number, name, cabin secured for landing'. If the cabin is not secured for landing, the CSM will inform the flight crew. In this case, the CCOM stated the 'the CSM will assess the situation and inform the flight crew regarding the status of the cabin.' This allows alternative actions before the no contact period, which commences when the landing gear is extended for landing. The cabin crew are not to contact the flight deck under any circumstances during this period.

In this case, the captain stated they would have ensured that passengers and cabin crew assisting the injured member were seated before landing had they been informed the cabin was not secure.

Use of cabin secure notifications in Australian airlines

The ATSB also reviewed the cabin secure procedures of 7 similar Part 121 passenger air transport operators in Australia. Of those, 4 operators employed a positive signal to confirm cabin security during normal operations, while 3 did not.

In the past 20 years, the ATSB identified 26 occurrences involving unrestrained occupants on landing, based on historical occurrence data. None of these resulted in fatalities, serious injuries, or minor injuries. Of these 26 occurrences, only 4 could potentially be linked to the absence of a positive cabin secure signal.

Anticipated turbulence procedure

If the flight crew anticipates turbulence, the following procedure from the CCOM will apply:

> When the flight crew become aware of anticipated turbulence, they will liaise with the CSM advising the time and likely duration of the anticipated turbulence.
>
> The CSM will relay this information to the members of the cabin crew to enable them to prioritise their duties by securing carts, galleys, items of service equipment, cabin and galley curtains, and the passenger cabin, based on time available.
>
> A PA may be made by the flight crew to the passengers and cabin crew advising that cabin service is to cease as there is a likelihood of turbulence and the following actions will be initiated (Table 4):

Table 4: Crew actions during anticipated turbulence

Action	Description
Seatbelt sign illumination	Must be illuminated by the flight crew no later than one minute prior to anticipated turbulence.
Cabin crew seated	Cabin crew to be seated in their jump seat within one minute of seatbelt signs illumination
Seatbelt announcement	Flight crew announces, 'all passengers and crew to be seated and fasten seatbelts.'
Call back procedure	CSM initiates call back to ensure all cabin crew are seated and have assessed the cabin condition.
Cabin crew call back response	Cabin crew respond to CSM with, 'door number, name, seated and secured,' or if cabin or crew are not secure, cabin crew report this to CSM during the call back.
Confirming security	If secure, CSM calls flight crew via interphone to confirm, 'passengers and crew are secure', as well as any other relevant information

Unanticipated turbulence

Unanticipated light turbulence

If it is deemed necessary to illuminate the seatbelt signs for unanticipated light turbulence, the flight crew will perform the 'seatbelts' PA announcing, 'all passengers and crew must be seated and fasten seatbelts.'

The CCOM states the following will then apply:

> Cabin crew are to prioritise their duties by securing carts, galleys, items of service equipment and the passenger cabin and initiate crew actions for anticipated turbulence…..

When the captain illuminated the seatbelt sign prior to the turbulence encounter, they performed the 'seatbelts' PA. They stated they did this as a precautionary measure as this was their normal practice if there is the possibility of some turbulence.

Unanticipated turbulence posing an immediate hazard

In the event of unanticipated turbulence that poses an immediate safety hazard, the flight crew must select the seatbelt signs on and announce the 'turbulence' PA:

> All passengers and crew be seated and fasten seatbelts immediately.

Following this announcement, the CCOM issues the following instructions:

> Cabin crew will lock carts in position and secure themselves in the nearest seat or wedge themselves in the aisle.
>
> If circumstances permit, the CSM will initiate the call back procedure, ascertain the condition of the cabin and relay this information to the flight crew.

Cabin crew incapacitation

In the event of a cabin crew member's incapacitation, the CCOM calls for first aid to be administered, and the CSM and captain to be notified as soon as practicable. The CSM would then reassign the duties of the incapacitated crew member to an assist crew member, if available. If the incapacitation results in a crew complement less than the minimum required, the CSM, in consultation with the captain, will determine whether any additional off-duty crew members are available to assume the role of the incapacitated cabin crew for landing.

The timing of the incapacitation placed concurrent procedural demands on the CSM and disrupted the cabin secure procedures. The CCOM procedures were sequential instructions designed to achieve consistent performance and reduce the potential for miscommunication and non-conformances.

Injury response tool

The Qantas *Group injury response tool* specified the actions the crew must follow if an injury has occurred inflight. In this case, the injury response tool directed crew to seek immediate doctor advice via telephone for a turbulence event and for a head blow or head strike which fell under the classification as a 'specific circumstance'. Consequently, the crew would be required to cease work immediately.

However, as neither co-workers nor the injured crew recognised the symptoms of a concussion in the L2P or a facial injury in the CSM, they were not triaged according to the *Group injury response tool*. The operator stated that this likely occurred due to the injury response tool process relying on the self-assessment of injuries which may not be immediately apparent.

Integrated operations controls procedures

The integrated operations control (IOC) was the central point of contact during any kind of disruption or incident on a Qantas aircraft. At the time of this occurrence, the IOC incident notification communications protocol contained in the operations control procedure (Figure 5) included contact with the on-call doctor in cases of severe turbulence regardless of whether there were reported injuries. The IOC notification process for a 'significant passenger/crew injury or illness' event did not include contact with the Qantas on-call doctor.

As the turbulence in this event was deemed post-event by flight crew as moderate, contact with the on-call doctor was not required under the process.

Figure 5: Qantas incident notification communications protocol version 11, March 2024

Incident Notification	Crisis Chair	Head of IOC	Duty Captain	Duty Safety	Corporate Comms	MOC	Duty Security Controller	Load Control	Diversion Port	Destination Port	Airports Duty Contact	Cabin Crew Manager	Qantas On-Call Doctor	Industrial Relations	SMS Exec List	SMS EFA Freighters List
Aircraft MAYDAY call (Potential GCAT)	√															
Aircraft PAN call			√	√	√	√	√		√	√		√			√	
Flight delays > 3 hours															√	
Aborted Take-off			√	√	√							√			√	
Air Turn Back			√	√	√					√		√			√	
Dom Diversions (*safety incident)			√	√*	√	√	√	√	√			√			√	
Int Diversions (*safety incident)		√	√	√*	√	√	√	√	√			√			√	
Fumes/Smoke Events (pg. 6)			√	√	√	√						√	√			
Turbulence, Stick shaker events (pg.7)			√	√	√	√						√	√		√	
Death on-board			√		√		√					√	√		√	
Safety • Safety incident		√	√	√	√						√	√				
• Any aircraft damage		√	√	√	√	√					√	√				
• Fuel/hydraulic spill				√							√					
• Injury to ground staff		√	√	√	√	√					√					
• Significant passenger/crew injury or illness			√	√	√							√				

Source: Qantas

Research into turbulence detection

There are occasions where it can be challenging to identify turbulence. The US National Transportation Safety Board conducted 10 case studies (National Transportation Safety Board, 2021) of accidents between 2019–2020 that involved turbulence and embedded convection and determined that:

> Embedded convection may not be easily detected by onboard or ground-based weather radar, and when not visible outside the aircraft windows, this class of convective activity can act as a hidden source of severe turbulence encounters within an otherwise benign-looking cloud mass.

Research into turbulence related injuries

From 2009 through 2018, the US National Transportation Safety Board (NTSB)[10] found that turbulence-related accidents accounted for more than a third of all Part 121 accidents. The accident data revealed that the most common phase of flight associated with turbulence-related accidents in Part 121 operations was during the en route descent, which accounted for 36.0% of accidents.

Further analysis indicated that cabin crew accounted for 78.9% of serious injuries, with the majority occurring in the aft section of the aircraft cabin. Passengers accounted for 21.1% of serious injuries, while no flight crew members were seriously injured (National Transportation Safety Board, 2021).

The distribution of cabin crew injuries found most occurring in or near an aft galley (Figure 6), which likely reflects that the service-related duties of cabin crew often require

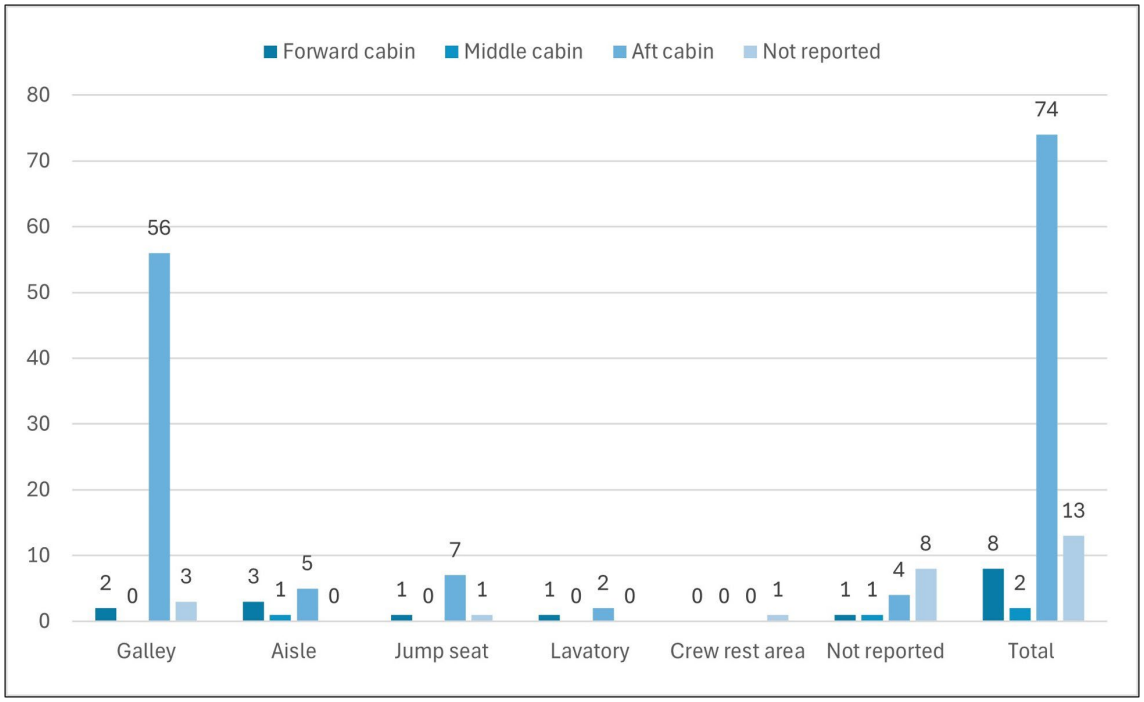
[10] National Transportation Safety Board. (2021). Preventing Turbulence-Related Injuries in Air Carrier Operations Conducted Under Title 14 Code of Federal Regulations Part 121.

them to spend more time working unrestrained in the galley area. The most commonly reported cabin crew activities at the time of serious injury were:

- preparing the cabin for landing (39.2%)
- conducting cabin service (13.4%)
- preparing for cabin service (9.3%).

During this occurrence, the R2P and L2P sustained the most severe injuries while unrestrained in the aft galley as they prepared the cabin for landing, which is consistent with research on turbulence-related injuries.

Figure 6: Location of cabin crew at time of turbulence-related serious injury, 2009–2018



Source: National Transportation Safety Board

Safety analysis

Crew communication

During the descent into Brisbane, the captain commenced cabin preparations earlier than usual, using standard protocols to account for known weather conditions en route. Although the graphical area forecast indicated the possibility of moderate to severe turbulence, the captain did not observe weather radar returns or receive any other pilot reports indicating the presence of moderate to severe turbulence during the descent.

Approximately 5–6 minutes after initiating cabin preparations, the aircraft entered stratiform cloud and the captain contacted the customer service manager (CSM) to check on the cabin crew's progress. The purpose of this communication was to provide the captain with information to guide the timing of the seatbelt sign illumination. However, the captain did not provide any weather-related information to the CSM during this interaction, leaving the cabin crew unaware of any increased likelihood of turbulence.

Two minutes later, the seatbelt sign was illuminated, accompanied by the 'seatbelt' public announcement (PA). The captain then observed an approaching cumulus cloud along the flight path but determined it did not pose an immediate hazard based on a visual assessment and the lack of radar indications. As a result, the captain did not perform the 'turbulence' PA, which would have prompted the cabin crew to immediately secure themselves in the nearest seat or wedge themselves in the aisle to prepare for the turbulence encounter.

Although the captain contacted the CSM to confirm the time remaining to prepare the cabin, the absence of indications to the subsequent severity of the turbulence limited the captain's perception of the possible threat. Therefore, additional precautions were not considered. The captain followed normal descent procedures, however, did not discuss any additional weather-related information in communications with the CSM.

As a result, the cabin crew, who relied on information from the flight crew, were unprepared for the turbulence encounter. This situation underscores the difficulties posed by unexpected turbulence, as the procedures for managing in-flight turbulence rely on the flight crew's ability to predict or avoid these situations.

Contributing factor

The captain did not communicate to the cabin crew about the expected turbulence, likely as a result of the captain not knowing the severity of the turbulence.

Crew unrestrained during severe turbulence

When the seatbelt sign was illuminated during the descent, cabin crew members were required to perform several duties whilst being unrestrained. In the moments immediately preceding the turbulence encounter, the CSM and R2P recalled checking their assigned lavatories as part of securing the cabin for landing.

Cabin crew were required to complete their assigned duties within one minute of the seatbelt sign being illuminated, which was also the case for unanticipated light turbulence. The captain performed the ‘seatbelts’ PA when the seatbelt sign was illuminated, which indicated unanticipated light turbulence to the cabin crew members. However, the cabin crew did not recall hearing this PA and remained unaware of the increased risk of turbulence as the aircraft approached a cumulus cloud.

Because the turbulence event occurred less than one minute after the illumination of the seatbelt sign, which was accompanied by the ‘seatbelt’ PA, the cabin crew did not have sufficient time to ensure they were seated and restrained prior to the aircraft being affected by turbulence. The injuries sustained during the encounter reflect research showing that cabin crew members face a higher risk of turbulence-related injuries, especially during the descent phase of a flight when they are preparing for landing (National Transportation Safety Board, 2021).

Contributing factor

Three cabin crew were unrestrained while performing duties during unanticipated severe turbulence resulting in all 3 receiving injuries.

Cabin management

After the turbulence event, the CSM and left 2 primary (L2P) turned their attention to the right 2 primary (R2P) who was laying on the floor of the aft galley and was unable to move due to their injury. The turbulence event occurred in the latter stages of the descent, which meant there was little time to provide first aid to the R2P and complete the required preparations for landing. The CSM, L2P and the passengers assisting the R2P were reluctant to return to their assigned seats despite the clear instructions from the captain to do so.

The situation in the aft galley disrupted the procedural flow and meant that the CSM and L2P became focused on providing first aid rather than returning to their seats to complete the callback and silent review prior to landing. Interruptions often lead people to forget to resume their tasks, while multitasking can further complicate the situation by increasing the overall workload within a limited timeframe (Loukopoulos & Barshi, 2009). In this case, the CSM and L2P had to balance providing first aid and securing the cabin. High stress levels are also known to cause errors (Kim & Hyun, 2022), which likely contributed to the CSM prioritising providing first aid over securing themselves and the cabin for landing.

The CSM subsequently lost situational awareness with respect to the phase of flight and the sequence of the standard operating procedures. As a result of being situated in the aft galley, the CSM likely missed audible cues, such as the extension of the landing gear.

The captain did not recall receiving any requests for more time to prepare the cabin for landing. Additionally, the single aisle cabin configuration of the Boeing 737 offered limited options for accommodating the R2P anywhere other than the aft galley. After repeated instructions for everyone to be seated for landing, the captain was confident that all uninjured occupants had complied.

The decision of the CSM and L2P to remain unrestrained in the aft galley during a critical phase of flight increased the risk of incapacitation to additional cabin crew, which could have further compromised their ability to manage a landing-based emergency effectively if one was to happen. Additionally, the 5 occupants in the aft galley created a potential obstruction to emergency exits, increasing the likelihood of delays or complications if they needed to enact an emergency evacuation.

Other factor that increased risk

Although the captain had instructed that the uninjured passengers and crew needed to be seated, 3 cabin crew and one passenger were unrestrained for landing due to being preoccupied with administering first aid to the injured cabin crew member. This increased the risk of injury to the unrestrained occupants and had the potential to compromise a safe emergency evacuation if required.

The aircraft landed with the CSM, L2P, R2P and 2 passengers unrestrained in the aft galley. The flight crew was made aware by the CSM that the injured cabin crew member was unsecured and unable to be made secured for landing and instructed the CSM to ensure everyone else was secure for landing. While this instruction was communicated to those people unsecure in the cabin, the instruction was not followed as described above. The CSM attempted to inform the flight crew by instructing the L2P to communicate with them. However, the captain again instructed that everyone who could be secured needed to be, as they were landing. As such, the flight crew assumed all cabin occupants would be secure apart from the injured R2P crew. At this stage, the cabin crew operating procedures requiring the CSM to inform the flight crew if the cabin was not secure broke down as there was no further communication that the cabin was not secure.

The captain stated that if they had known that 4 uninjured occupants were still unrestrained in the aft galley, they would have taken appropriate action to ensure they had returned to their seats prior to the final approach to land. The lack of a positive signal increased the likelihood that flight crew would be unaware of unrestrained occupants during the approach and landing phases of flight.

While the lack of a positive cabin secure signal played a role in this occurrence, the available data does not indicate it as a significant ongoing risk.

Other factor that increased risk

The Qantas 737 procedures did not require flight crew to receive positive confirmation that the cabin was secure for landing. This increased the risk that occupants and objects were not secure for landing.

Post-flight medical assessment

Shortly after arrival at the gate at Brisbane airport, the R2P was attended to by ambulance personnel. However, the CSM and L2P, who were also injured during the

event, did not receive any follow-up medical assessments or treatment. This situation arose due to procedural gaps, which relied on crew members to self-assess and report a significant injury to receive a medical assessment.

While the CSM self-diagnosed a minor injury and reported it the following day, the L2P was unaware of their injury. As a result, the L2P operated on multiple flights while experiencing symptoms of an undiagnosed concussion, until some days later when co-workers noticed signs of a possible injury.

Other factor that increased risk

A crew member with undiagnosed concussion from the accident flight operated on subsequent flights without receiving appropriate medical attention.

The Qantas integrated operations control protocols did not mandate contacting the on-call doctor in cases where a passenger or crew member was significantly injured. Although the protocol required consultation with the on-call doctor in cases of severe turbulence, this turbulence event was classified as moderate, and no medical consultation was either required or requested. Additionally, the Qantas group injury response tool also relied on crew members self-assessing their injuries to determine if medical treatment would be required, but an injured crew member may not realise the extent of their injury at the time.

In the cases of a concussion, symptoms may include impairments in neurocognitive functioning, primarily affecting attention, concentration, memory, and judgment or problem-solving (Ryan & Warden, 2003). Returning to work with an undiagnosed concussion likely compromised the L2P's ability to perform safety-critical tasks. A subtle incapacity due to an undiagnosed injury could negatively impact operational safety, particularly during emergencies.

Other factor that increased risk

Qantas lacked a procedure to ensure cabin crew fitness was assessed after a significant injury. This increased the risk that a crew member could continue to operate while being unfit for duty. (Safety issue)

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.

Safety issues are highlighted in bold to emphasise their importance. A safety issue is a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operating environment at a specific point in time.

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 turbulence event and cabin crew injury involving Boeing 737, VH-VYK, 36 km south-east of Brisbane Airport, Queensland, on 4 May 2024.

Contributing factors

- The captain did not communicate to the cabin crew about the expected turbulence, likely as a result of the captain not knowing the severity of the turbulence.
- Three cabin crew were unrestrained while performing duties during unanticipated severe turbulence resulting in all 3 receiving injuries.

Other factors that increased risk

- Although the captain had instructed that the uninjured passengers and crew needed to be seated, 3 cabin crew and one passenger were unrestrained for landing due to being preoccupied with administering first aid to the injured cabin crew member. This increased the risk of injury to the unrestrained occupants and had the potential to compromise a safe emergency evacuation if required.
- The Qantas 737 procedures did not require flight crew to receive positive confirmation that the cabin was secure for landing. This increased the risk that occupants and objects were not secure for landing.
- A crew member with undiagnosed concussion from the accident flight operated on subsequent flights without receiving appropriate medical attention.
- **Qantas lacked a procedure to ensure cabin crew fitness was assessed after a significant injury. This increased the risk that a crew member could continue to operate while being unfit for duty.** (Safety issue)

Safety issues and actions

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues. The ATSB expects relevant organisations will address all safety issues an investigation identifies.

Depending on the level of risk of a safety issue, the extent of corrective action taken by the relevant organisation(s), or the desirability of directing a broad safety message to the Aviation industry, the ATSB may issue a formal safety recommendation or safety advisory notice as part of the final report.

All of the directly involved parties are invited to provide submissions to this draft report. As part of that process, each organisation is asked to communicate what safety actions, if any, they have carried out or are planning to carry out in relation to each safety issue relevant to their organisation.

The initial public version of these safety issues and actions will be provided separately on the ATSB website on release of the final investigation report, to facilitate monitoring by interested parties. Where relevant, the safety issues and actions will be updated on the ATSB website after the release of the final report as further information about safety action comes to hand.

Undiagnosed injuries

Safety issue description

Qantas lacked a procedure to assess cabin crew fitness after a serious injury. This increased the risk that a crew member could continue to operate while being unfit for duty.

Issue number:	AO-2024-032-SI-01
Issue owner:	Qantas Airways Limited
Transport function:	Aviation: Air transport
Current issue status:	Closed-Adequately addressed
Issue status justification:	The ATSB acknowledges that the introduction of medical assessment guidelines, which includes unrestrained crew during a moderate turbulence event to be implemented by Qantas reduces the risk associated with this safety issue.

Proactive safety action taken by Qantas Airways Limited

Action number:	AO-2024-032-PSA-300
Action organisation:	Qantas Airways Limited
Action status:	Closed

Qantas integrated operations control incident notification communications protocol was updated and published on 22 July 2024 to include contact with the Qantas on-call doctor in the event of significant cabin crew injury or illness.

Additionally, the ATSB was advised on 8 April 2025, that the operator had implemented additional controls to adequately assess the fitness of crew member after a turbulence event, or other unplanned aircraft movement.

Following any turbulence or unplanned aircraft movement event that is classed as severe, or an event classed as moderate with reported injuries, the operator will arrange immediate medical consultation. Additionally, in the case of a moderate turbulence event or aircraft movement with unrestrained crew, immediate medical assessment will be conducted.

General details

Occurrence details

Date and time:	04 May 2024 1311 East Australia Standard Time	
Occurrence class:	Accident	
Occurrence categories:	Turbulence / Windshear / Microburst, Cabin injuries	
Location:	36 km 132 degrees from Brisbane Aerodrome	
	Latitude: 27.6017° S	Longitude:153.3866° E

Aircraft details

Manufacturer and model:	THE BOEING COMPANY 737-838	
Registration:	VH-VYK	
Operator:	Qantas Airways Limited	
Serial number:	34183	
Type of operation:	Part 121 Australian air transport operations - Larger aeroplanes-Standard Part 121	
Activity:	Commercial air transport-Scheduled-Domestic	
Departure:	Sydney Aerodrome, NSW	
Destination:	Brisbane Aerodrome, QLD	
Persons on board:	Crew - 6	Passengers – 143
Injuries:	Crew – 1 serious, 2 minor	Passengers – 0
Aircraft damage:	Nil	

Glossary

AHM	Aircraft health monitor
AMSL	Above mean sea level
ATIS	Automatic terminal information service
CCOM	Cabin crew operations manual
CSM	Customer service manager
FAM	Flight administration manual
IOC	Integrated operations control
L1	Left one
L2	Left two
L2P	Left two primary
NOTAM	Notice to airmen
NTSB	National Transportation Safety Board
PA	Public announcement
R1	Right one
R1P	Right one primary
R2P	Right two primary
TAF	Terminal area forecast

Sources and submissions

Sources of information

The sources of information during the investigation included:

- the captain of the accident flight
- the customer service manager on the accident flight
- the R2 primary cabin crew member on the accident flight
- Qantas Airways Limited
- the manager of Safety, Qantas Airways Limited
- Civil Aviation Safety Authority
- Bureau of Meteorology

References

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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 captain of the accident flight
- the customer service manager on the accident flight
- the L2 primary cabin crew member on the accident flight
- the R2 primary cabin crew member on the accident flight
- Qantas Airways Limited

- Civil Aviation Safety Authority
- Bureau of Meteorology.

Submissions were received from:

- the L2 primary cabin crew member on the accident flight
- the R2 primary cabin crew member on the accident flight
- Qantas Airways Limited
- Civil Aviation Safety Authority
- Bureau of Meteorology

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

About the ATSB

The **Australian Transport Safety Bureau** is the national transport safety investigator. Established by the *Transport Safety Investigation Act 2003* (TSI Act), the ATSB is an independent statutory agency of the Australian Government and is governed by a Commission. The ATSB is entirely separate from transport regulators, policy makers and service providers.

The ATSB's function is to improve transport safety in aviation, rail and shipping through:

- the independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis, and research
- influencing safety action.

The ATSB prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

Purpose of safety investigations

The objective of a safety investigation is to enhance transport safety. This is done through:

- identifying safety issues and facilitating safety action to address those issues
- providing information about occurrences and their associated safety factors to facilitate learning within the transport industry.

It is not a function of the ATSB to apportion blame or provide a means for determining 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.

The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

About ATSB reports

ATSB investigation final reports are organised with regard to international standards or instruments, as applicable, and with ATSB procedures and guidelines.

Reports 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

An explanation of ATSB terminology used in this report is available on the ATSB website.