Australian Government
Australian Transport Safety Bureau

Safety study into Australian balloon transport operation occurrences from 2014 to 2022

ATSB Transport Safety Report
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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

Why the ATSB conducted this safety study

The ATSB occurrence data reported by industry identified a trend towards a heightened exposure to risk in the commercial ballooning sector, compared with other forms of non-scheduled passenger carrying commercial aviation. This study incorporates a detailed analysis of the data and aims to identify key areas of focus for safety improvements, with an intent to reduce passenger injuries.

What the ATSB found

The ATSB found that over the period 2014–2022, commercial ballooning carried a higher risk to fare paying passengers compared with similar operations in small aeroplanes and helicopters. Specifically, a commercial ballooning flight was more likely to have a:

- reported occurrence – especially a serious incident or accident
- passenger sustain an injury.

The ATSB also found that minor injuries, serious injuries, serious incidents and accidents were all more likely to occur during landing than any other phase of flight, and wind was the most common factor reported to have contributed to these occurrences.

Also identified, was that between 2014 and 2022 there was a significant increase in balloons with an envelope size above 400,000 cubic ft on the Civil Aviation Safety Authority's aircraft register. This reflected an increase in the number of balloons capable of carrying the maximum passenger limit of 24 per flight, thereby increasing overall exposure to risk.

Safety message

Balloons are distinct from other aircraft, in that they travel by moving with the wind. Directional control is achieved using differing wind directions at different altitudes. As such, balloon pilots should use all available information sources, including approved Bureau of Meteorology products, to ensure they understand the weather, particularly the wind, and its influence on flight safety. Accurate weather assessment is critical for safe go/no-go decisions. Pilots should also apply threat and error management by anticipating risks such as powerlines and poor visibility, and prioritising safety over logistical pressures in adverse conditions.

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is reducing passenger injuries in commercial ballooning operations.

Reducing accident rates and passenger injuries in balloon operations requires effective safety practices. Although not required by legislation for balloon operators, implementing a Safety Management System (SMS) provides a structured approach to identifying and managing risks.

Recommended risk controls to reduce passenger injury risks include:

- thorough passenger safety briefings and visual safety cards
- ensuring correct brace/landing positions
- clear emergency instructions
- seating or positioning to minimise passenger contact injuries.

Contents

Introduction

Background

The ATSB occurrence statistics report for the 10-year period 2010–2019 (AR-2020-047) identified 19 accidents involving commercial balloon operations. These accidents resulted in 1 fatality and 19 serious injuries. Over the same period there were 70 minor injuries involving commercial balloon operations reported to the ATSB.

The report also found the following rates of accidents per million hours flown for the 5-year period 2014–2019:[1]

- 291.2 for commercial ballooning operations
- 26.3 for non-scheduled commercial aeroplane operations
- 20.9 for non-scheduled commercial helicopter operations.

In addition to attempting to reduce the accident rate, one of the ATSB's SafetyWatch priorities is to reduce passenger injuries in commercial ballooning operations.

This study benchmarks ballooning operations against other similar operations in Australia, to identify any systemic areas of concern. The results of this work will form the basis of the ballooning safety watch initiative, and identify what further investigation, research and education work may be required for this sector of aviation operations.

Any systemic safety concerns identified will be shared with industry to promote a generative safety culture, encourage further reporting of occurrences, and drive future safety action.

Safety study goals

This safety study expands the understanding of the risks of Australian commercial ballooning, namely balloon transport operations, to the fare paying passenger compared with other similar operations in an aeroplane or helicopter.

The goals of this study were to:

- define what a similar operation for a fare paying passenger was in an aeroplane or helicopter to provide a valid basis for comparison
- provide a rate analysis of balloon occurrences against similar operations in an aeroplane or helicopter
- provide a statistical description of balloon occurrences, including the severity of injuries and safety factors involved
- identify commonalities between all balloon occurrences
- compare balloon occurrences by location and envelope size
- identify and analyse the risks for a fare paying passenger for a flight in a commercially-operated balloon.

[1] The reduced period was due to data availability limitations at the time the report was published.

Balloon transport operations

Part 131 of the Civil Aviation Safety Regulations (CASR) sets out specific requirements for operating balloons and hot air airships, known in industry as ‘Part 131 aircraft’.

The CASR dictionary defines a balloon as an unpowered, lighter-than-air aircraft. A free balloon is defined as a balloon that is intended for flight without being permanently tethered.

A manned free balloon is defined as one equipped:

- to carry one or more people
- with controls that enable the altitude of the balloon to be controlled.

For the purposes of the safety study, the term balloon will refer to a ‘manned free balloon’.

The focus of this study was balloon transport operations, defined in CASR 131.010 as:

- a passenger transport operation conducted using a Part 131 aircraft that is a registered aircraft or a foreign registered aircraft; and
- conducted for hire or reward; and
- undertaken wholly within Australia; and
- not undertaken as part of a flight into or out of Australian territory.

This does not include training, specialised or recreational operations as defined by the CASR.

Commercial ballooning is a flying operation that takes part in a manned free balloon carrying fare paying passengers for the purpose of a joy flight or sightseeing. As such, valid comparable operations were passenger transport operations classified as a joyflights/sightseeing flight in a Part 135 small aeroplane or a Part 133 rotorcraft subset (helicopter).

Methods and sources

Overview

To allow comparison between the different aircraft types and operations, this study used reported occurrence records of aviation incidents, serious incidents, and accidents from the ATSB national aviation occurrence database. Aircraft activity data was collected from the Bureau of Infrastructure, Transport and Research Economics (BITRE) Australian aircraft activity survey, which is conducted annually and made publicly available online.

Data analysis

The collected data sets for balloons, aeroplanes and helicopters were used to conduct:

- a rate analysis of reported occurrences of commercial ballooning against aeroplane and helicopter operations
- an injury rate comparison.

The following analysis of balloon data from the ATSB national occurrence database was conducted:

- occurrences by phase of flight
- serious incidents and accidents by phase of flight
- serious injuries by phase of flight
- safety factors identified for serious incidents and accidents
- occurrences by location.

A comparison was also conducted of the Bureau of Meteorology weather package services by location to occurrence locations, together with analysis of balloon envelope size changes over the years 2014–2022 inclusive.

ATSB national aviation occurrence database

Occurrence data is reported to the ATSB from industry through the mandatory occurrence reporting requirements of the *Transport Safety Investigation Act 2003* and stored in the national aviation occurrence database. This stored data contains information including:

- aircraft type
- registration
- location
- time of occurrence
- number of injuries
- injury level
- occurrence class (incident, serious incident, accident)
- occurrence summary.

A publicly-available search engine allows users to search the database using multiple parameters including: time period, location, type of occurrence and type of aircraft.

In classifying occurrences, the ATSB used the following definitions:

Accident: an occurrence involving an aircraft where:

- a person dies or suffers serious injury
- the aircraft is destroyed, or is seriously damaged
- any property is destroyed or seriously damaged.

Serious incident: an incident involving circumstances indicating that an accident nearly occurred (ICAO Annex 13).

Incident: an occurrence, other than an accident, associated with the operation of an aircraft which affects or could affect the safety of operation (ICAO Annex 13).

BITRE Australian aircraft activity survey

Survey data

The annual BITRE Australian aircraft activity survey and associated statistical report covers all Australian (VH-) registered aircraft used in the commercial air transport and general aviation sectors of the Australian aviation industry.

The survey is completed annually by operators, and the following data is collected:

- aircraft registration
- postcode of aircraft base (balloon operators indicate the postcode of the general area from which most flying was conducted)
- type of activity by hours flown
- type of activity by landings conducted.

The data collection allows aircraft operators to nominate the type of activity that a particular aircraft conducted over that calendar year. The survey results are merged with details from the civil aircraft register. The register gives access to additional relevant information including aircraft type, engine and fuel type, country, and year of manufacture.

Activity classification

In 2013, recommendations from the Tenth Session of the Statistics Division of the International Civil Aviation Organization (ICAO) were adopted by the ICAO Council and a new edition of the Reference Manual on the ICAO Statistics Program was published. Included within the manual was a new ICAO Classification of Civil Aviation Activities.

In 2014, BITRE adopted ICAO's new classification and began collecting statistics in their survey to reflect this change.

In 2019, the ATSB adopted the new activity classification to align with BITRE and ICAO. The ATSB conducted a multi-year project to reclassify over 320,000 occurrences and events within the ATSB occurrence database to include the new activity classification. This reduced most of the uncertainty associated with combining/comparing the databases. These changes meant the ATSB could present more accurate, higher resolution rate data (the best measure for comparison between activities) for more activities.

In response to this change, and to enable an accurate classification comparison between balloon, aeroplane and helicopter operations, this safety study used rate and occurrence data for the years 2014–2022 inclusive.

Landings versus flight hours

BITRE provided rate data in 2 forms: flight hours per operational category and number of landings per operational category. The ATSB elected to use the number of landings (as a proxy for number of flights) rather than flight hours when comparing aircraft types.

Unlike aeroplanes and helicopters, which can record several take-offs and landings within a single hour of flight, balloon flights almost always involve only one take-off and one landing. Therefore, using flight hours would not give an accurate comparison across aircraft types. The number of landings offered a more valid and consistent measure of risk exposure between them.

BITRE flying activities

BITRE defined commercial air transport as an ‘aircraft operation involving the transport of passengers, cargo or mail for remuneration or hire’; and general aviation as an ‘aircraft operation other than a commercial air transport operation’.

The Australian aircraft activity survey had the following relevant flying activities:

- general aviation
  - sport and pleasure flying
    - joyflights/sightseeing charters. Flying involving the carriage of passengers for joyflight or sightseeing purposes that take off and land at the same location
- commercial aviation
  - non-scheduled
    - passenger transport charters. Flying involving the carriage of passengers by the aircraft operator or his/her employees for hire or reward (but excluding scheduled airline operations).

A review of initial data collected from BITRE identified that commercial balloon flights had been recorded as either a joyflights/sightseeing charters activity or a passenger transport charters activity. Therefore, for the purpose of this analysis, data from both aircraft activity types was used to capture all commercial balloon transport operations (‘commercial ballooning’).

Similarly, it was possible that aeroplanes and helicopter operators also recorded joyflights/sightseeing charters as passenger transport charters and not joyflights/sightseeing charters.

As such, this study analysed the data with the passenger transport charters aircraft activity type included and then excluded for aeroplanes and helicopters for the comparison with commercial ballooning.

Collected data

Australian aircraft activity survey data 2014–2022

The following data was collected from BITRE Australian aviation activity surveys for the years 2014–2022 inclusive:

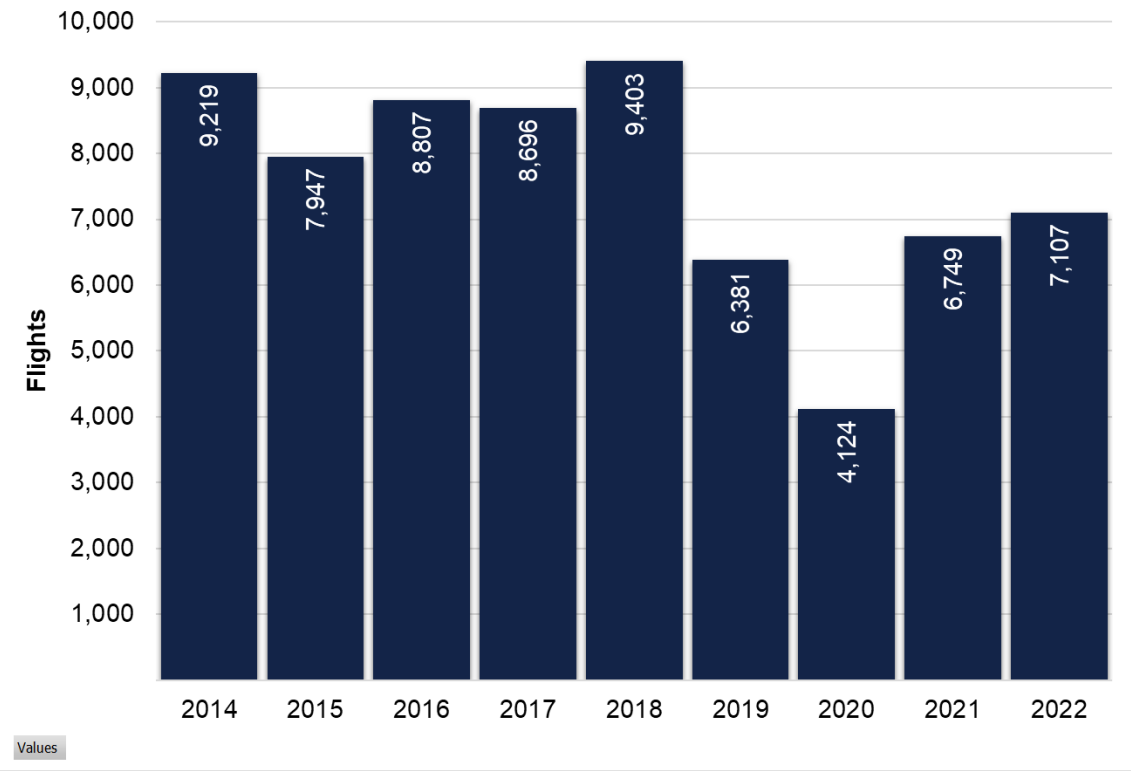
- balloon landings logged as joyflights/sightseeing and passenger transport charters
- aeroplane and helicopter landings logged as joyflights/sightseeing and passenger transport charters
- aeroplane and helicopter landings logged as joyflights/sightseeing charters only.

Results of the aircraft activity surveys conducted between 2014 and 2022 showed that there were:

- 68,433 commercial ballooning landings (Figure 1)
- 2,190,607 aeroplane joyflights/sightseeing and passenger transport landings (Figure 2)
- 1,795,332 helicopter joyflights/sightseeing and passenger transport landings combined (Figure 2)
- 260,506 aeroplane joyflights/sightseeing landings (Figure 3).
- 496,867 helicopter joyflights/sightseeing landings (Figure 3).

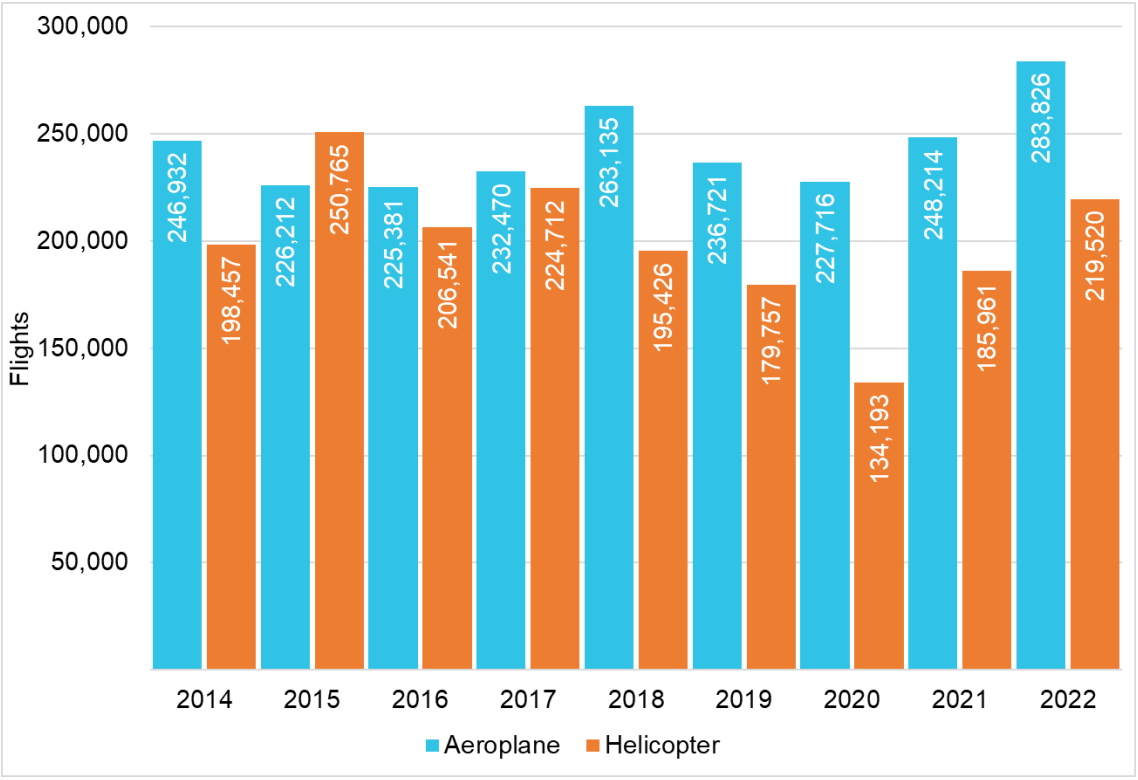
The reduction in total landings between 2019–2021 across the 3 groupings was likely due to effects of the COVID-19 pandemic.

Figure 1: Commercial ballooning flights per year (2014–2022)



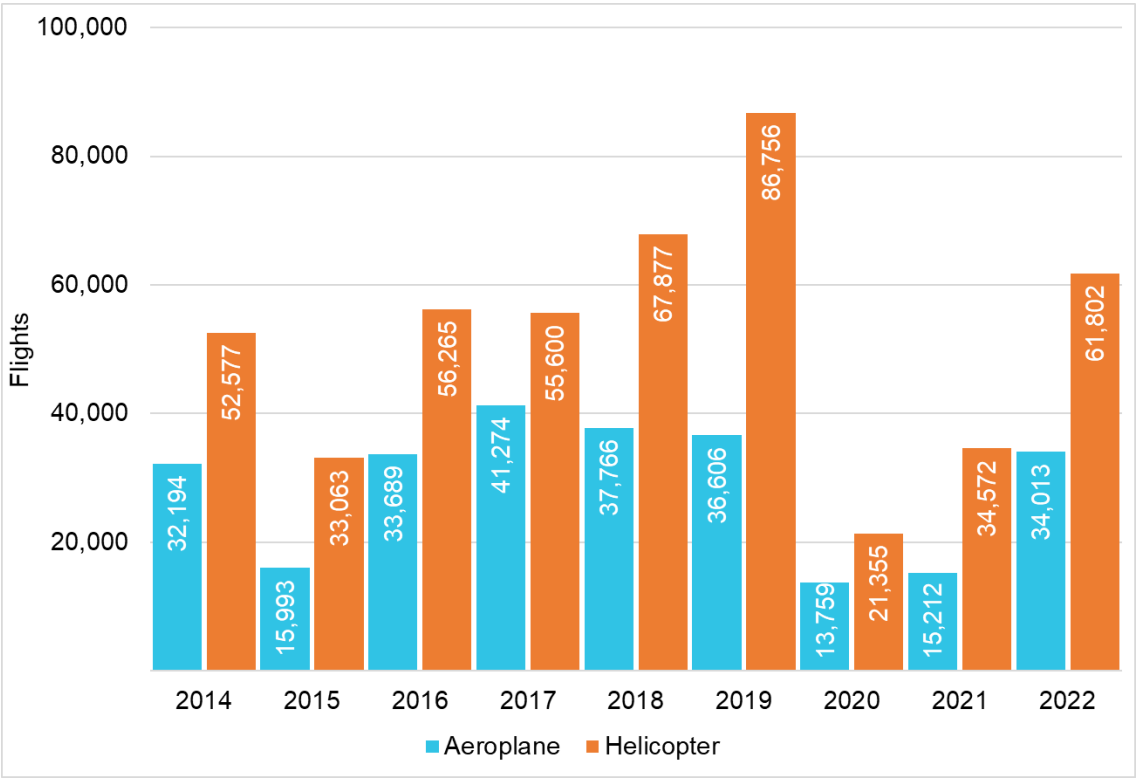
Source: BITRE, annotated by the ATSB

Figure 2: Aeroplane and helicopter joyflights/sightseeing and passenger transport flights per year (2014–2022)



Source: BITRE, annotated by the ATSB

Figure 3: Aeroplane and helicopter joyflights/sightseeing flights per year (2014–2022)



Source: BITRE, annotated by the ATSB

ATSB occurrence data 2014–2022

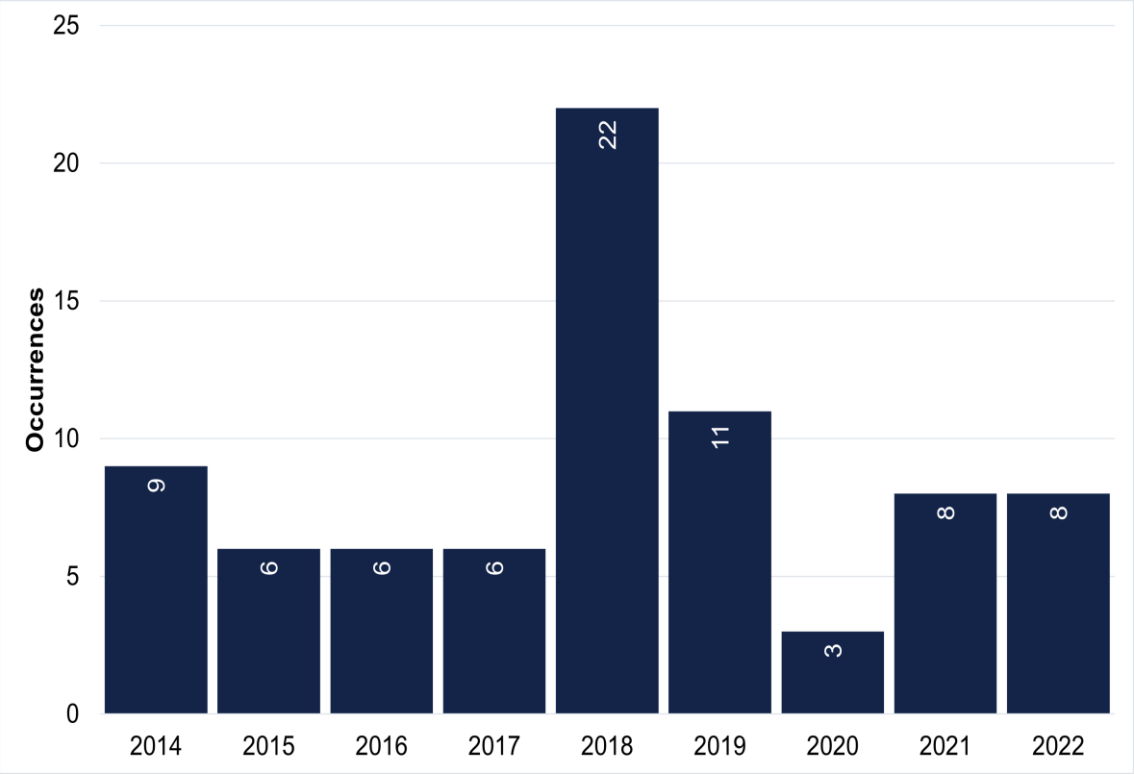
Occurrence data was extracted from the ATSB national aviation occurrence database for the years 2014–2022 inclusive of the following categories:

- manned free balloons
  - commercial ballooning operations
- aeroplanes and helicopters
  - joyflights/sightseeing operations and non-scheduled commercial passenger transport operations combined
  - joyflights/sightseeing operations.

Between 2014 and 2022, the following numbers of occurrences were reported to the ATSB:

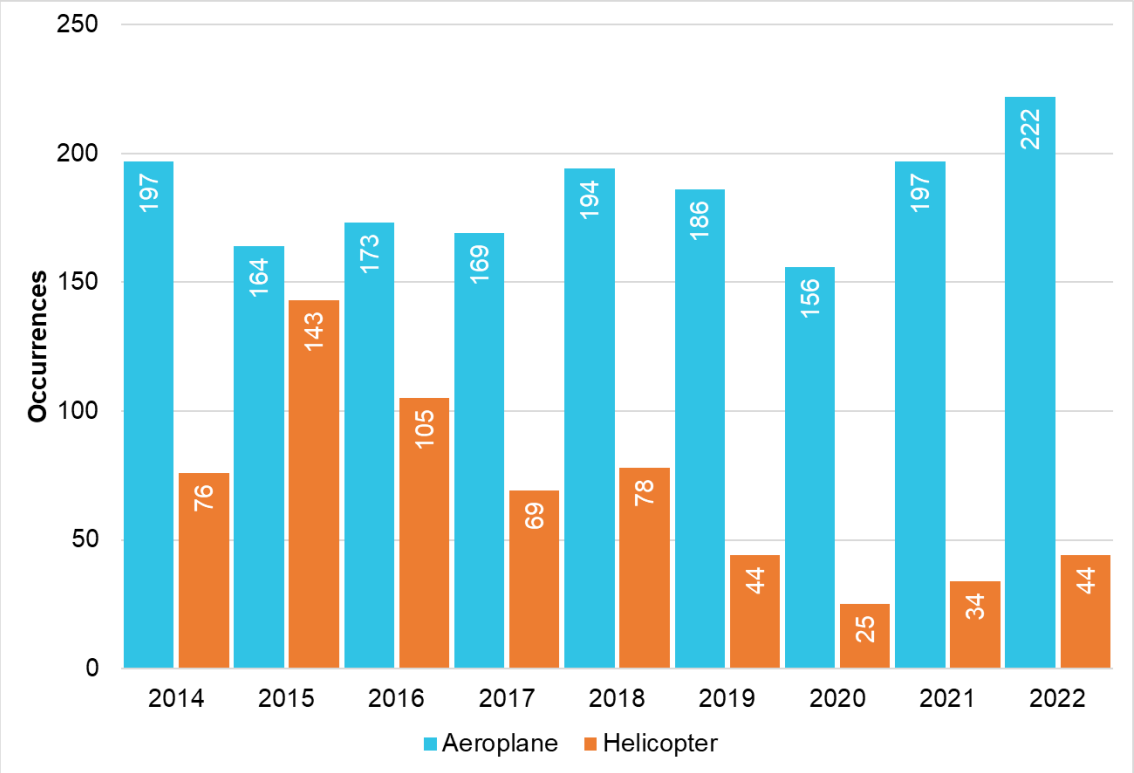
- 79 commercial ballooning occurrences (Figure 4)
- 1,658 aeroplane joyflights/sightseeing and passenger transport occurrences (Figure 5)
- 618 helicopter joyflights/sightseeing and passenger transport occurrences (Figure 5)
- 71 aeroplane joyflights/sightseeing occurrences (Figure 6)
- 62 helicopter joyflights/sightseeing occurrences (Figure 6).

Figure 4: Commercial ballooning reported occurrences per year (2014–2022)



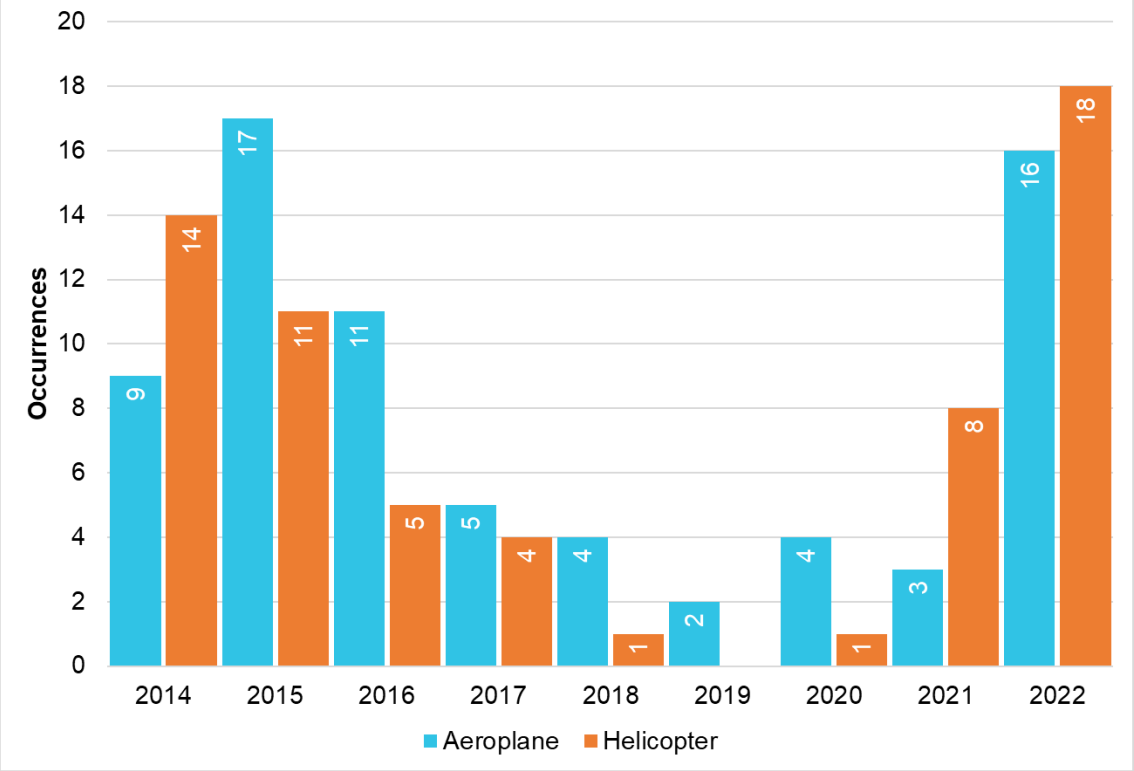
Source: ATSB

Figure 5: Aeroplane and helicopter joyflights/sightseeing and passenger transport reported occurrences per year (2014–2022)



Source: ATSB

Figure 6: Aeroplane and helicopter joyflights/sightseeing reported occurrences by year (2014–2022)



Source: ATSB

Reported occurrence rate comparison

The ATSB used reported occurrence data and activity survey data (2014–2022) to obtain an occurrence rate comparison between commercial ballooning and combined aeroplane and helicopter operations.

The 4 rate analyses were:

- occurrence rate (comparison 1)
- serious incident and accident rates (comparison 2)
- injury rate (comparison 3)
- serious injury rate (comparison 4)

Two comparisons were conducted for each rate analysis:

- commercial ballooning versus aeroplane and helicopter joyflights/sightseeing and passenger transport activities (comparison X.1)
- commercial ballooning versus aeroplane and helicopter joyflights/sightseeing (only) (comparison X.2).

Occurrence rate comparison

Comparison 1.1 – reported occurrence rate comparison between commercial ballooning and joyflights/sightseeing and passenger transport in an aeroplane and helicopter

Commercial ballooning reported occurrence rate

- 68,433 landings
- 79 reported occurrences
- 115.4 reported occurrences per 100,000 landings.

For the period 2014–2022, the commercial ballooning reported occurrence rate was 115.4 occurrences per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport reported occurrence rate

- 2,190,607 landings
- 1,658 occurrences
- 75.7 per 100,000 landings.

For the period 2014–2022, the aeroplane joyflights/sightseeing and passenger transport reported occurrence rate was 75.7 occurrences per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport reported occurrence rate

- 1,795,332 landings
- 618 occurrences
- 34.4 per 100,000 landings.

For the period 2014–2022, the helicopter joyflights/sightseeing and passenger transport reported occurrence rate was 34.4 occurrences per 100,000 landings.

ATSB finding

A commercial balloon flight was 1.5 times more likely to have a reported occurrence than a comparable joyflights/sightseeing and passenger transport activity in an aeroplane and 3.4 times more likely than a helicopter.

Comparison 1.2 – reported occurrence rate comparison between commercial ballooning and a joyflights/sightseeing activity in an aeroplane and helicopter aircraft

Commercial ballooning reported occurrence rate

For the period 2014–2022, the commercial ballooning reported occurrence rate was 115.4 occurrences per 100,000 landings.

Aeroplane joyflights/sightseeing reported occurrence rate

- 260,506 landings
- 71 occurrences
- 27.3 per 100,000 landings.

For the period 2014–2022, the aeroplane joyflights/sightseeing reported occurrence rate was 27.3 occurrences per 100,000 landings.

Helicopter joyflights/sightseeing reported occurrence rate

- 496,867 landings
- 62 occurrences
- 12.5 per 100,000 landings.

For the period 2014–2022, the helicopter joyflights/sightseeing reported occurrence rate was 12.5 occurrences per 100,000 landings.

ATSB finding

A commercial balloon flight was 4.2 times more likely to have a reported occurrence than a comparable joyflights/sightseeing activity in an aeroplane and 9.2 times more likely than a helicopter.

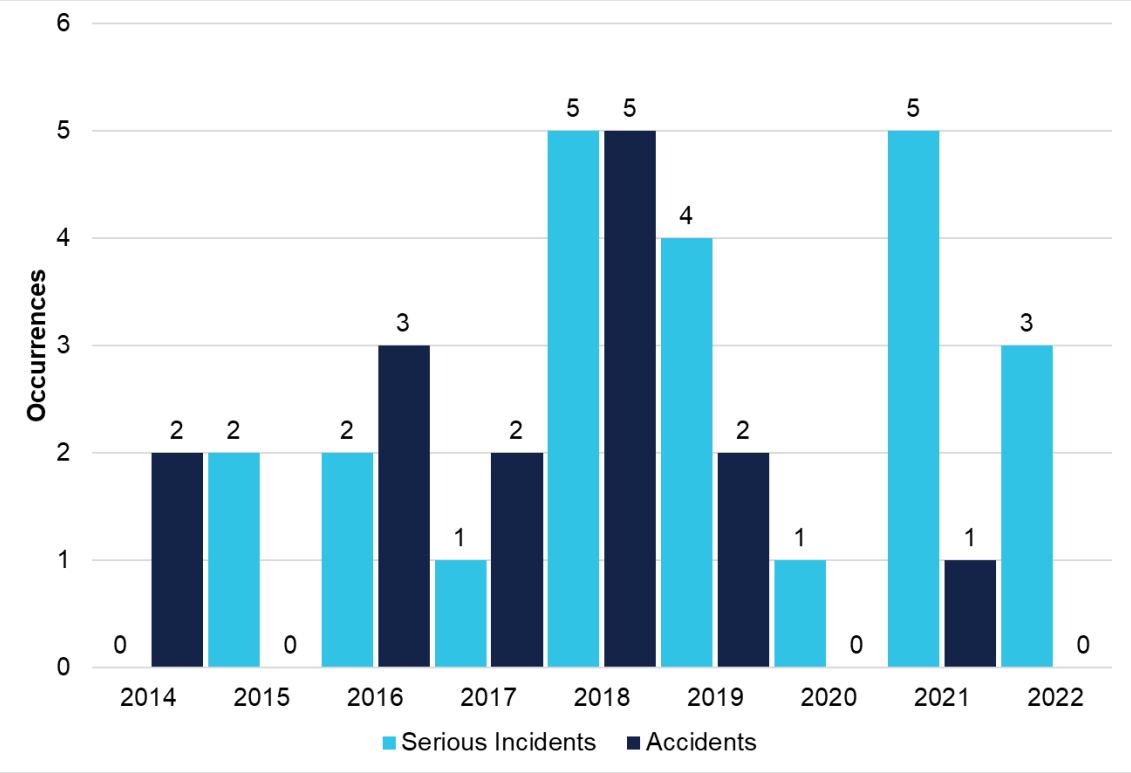
Serious incident and accident rates

Analysis of serious incident and accident data 2014–2022, found:

- 23 serious incidents and 15 accidents involving commercial balloons (Figure 7)
- 86 serious incidents and 50 accidents involving aeroplanes engaged in joyflights/sightseeing and passenger transport activities (Figure 8)

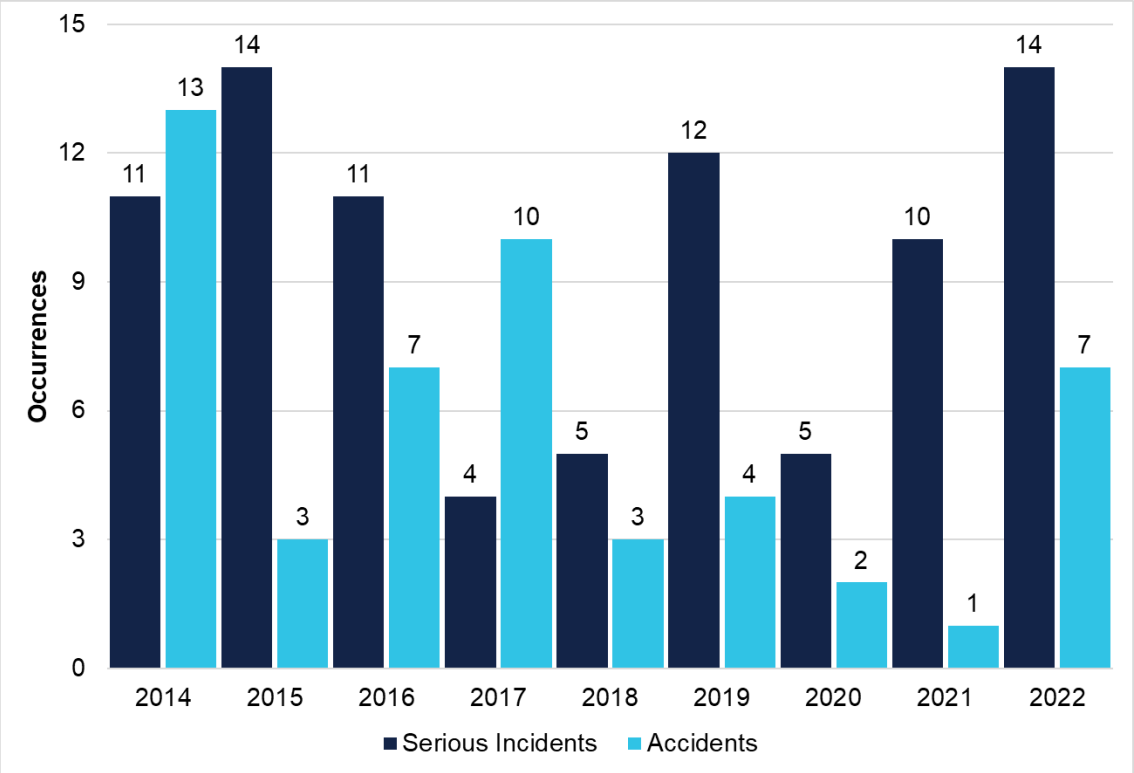
- 23 serious incidents and 16 accidents involving helicopters engaged in joyflights/sightseeing and passenger transport activities (Figure 9)
- 15 serious incidents and 12 accidents involving aeroplanes conducting joyflights/sightseeing activities (Figure 10)
- 9 serious incidents and 4 accidents involving helicopters conducting joyflights/sightseeing activities (Figure 11).

Figure 7: Commercial ballooning serious incident and accidents per year (2014–2022)



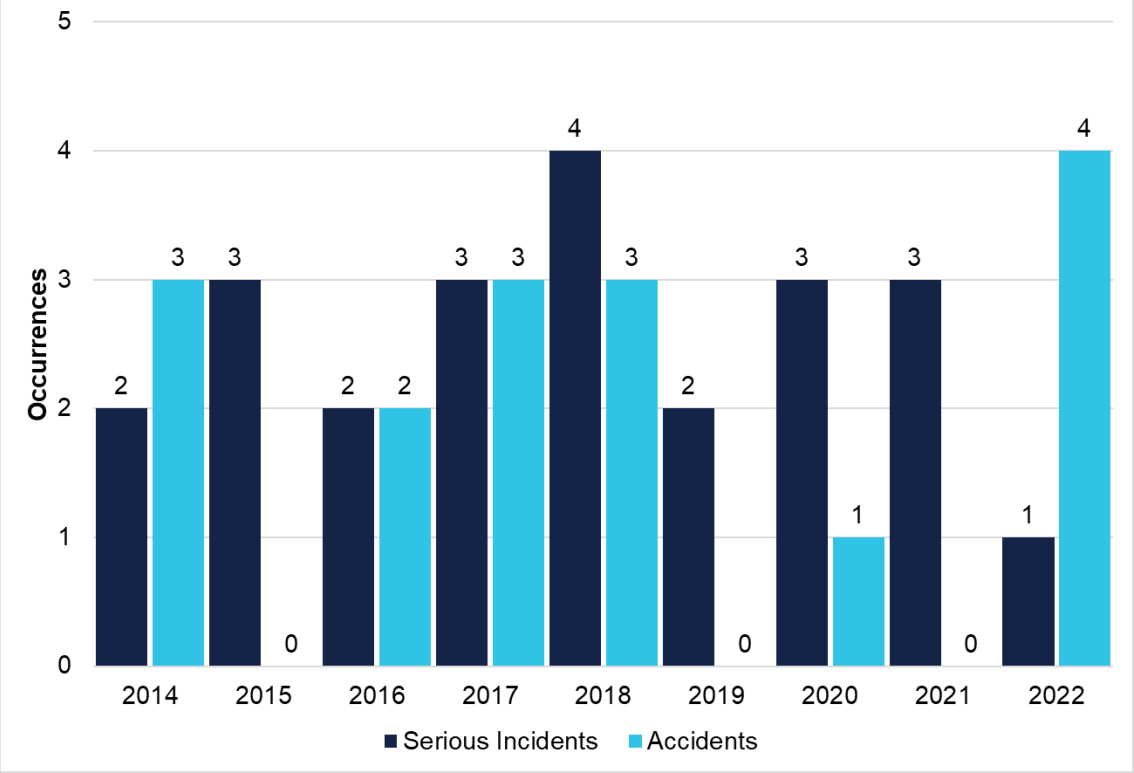
Source: ATSB

Figure 8: Aeroplane joyflights/sightseeing and passenger transport serious incidents and accidents per year (2014–2022)



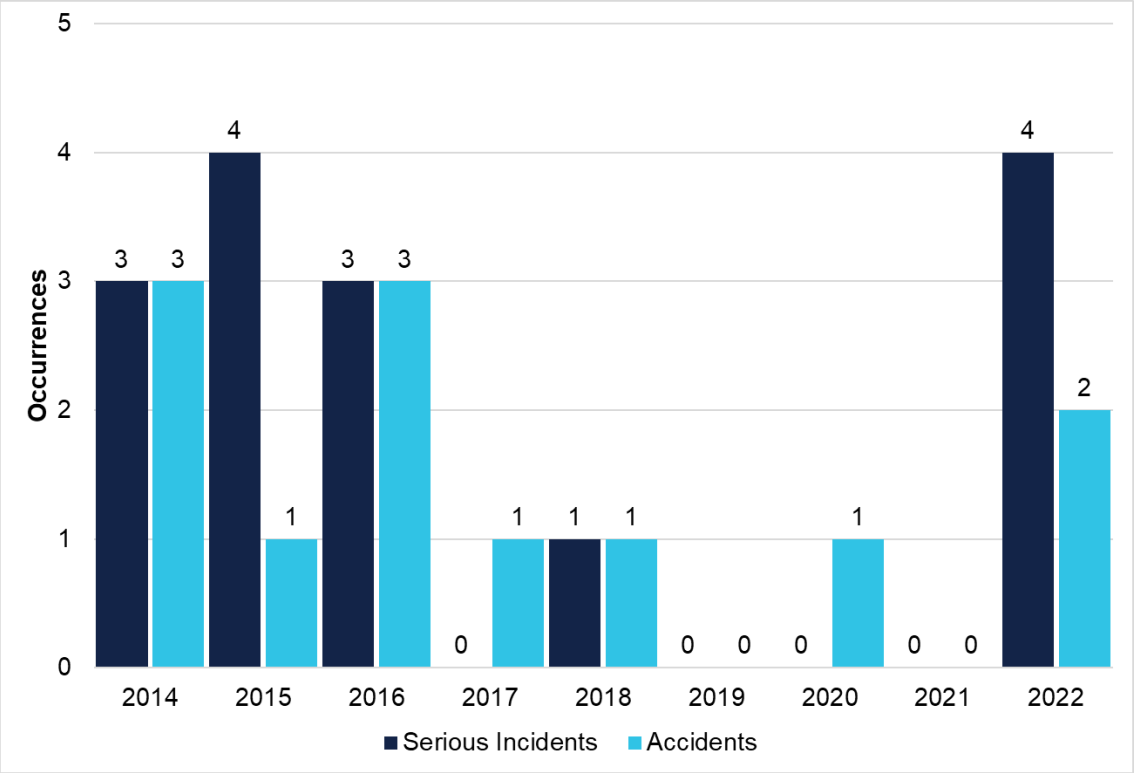
Source: ATSB

Figure 9: Helicopter joyflights/sightseeing and passenger transport serious incidents and accidents per year (2014–2022)



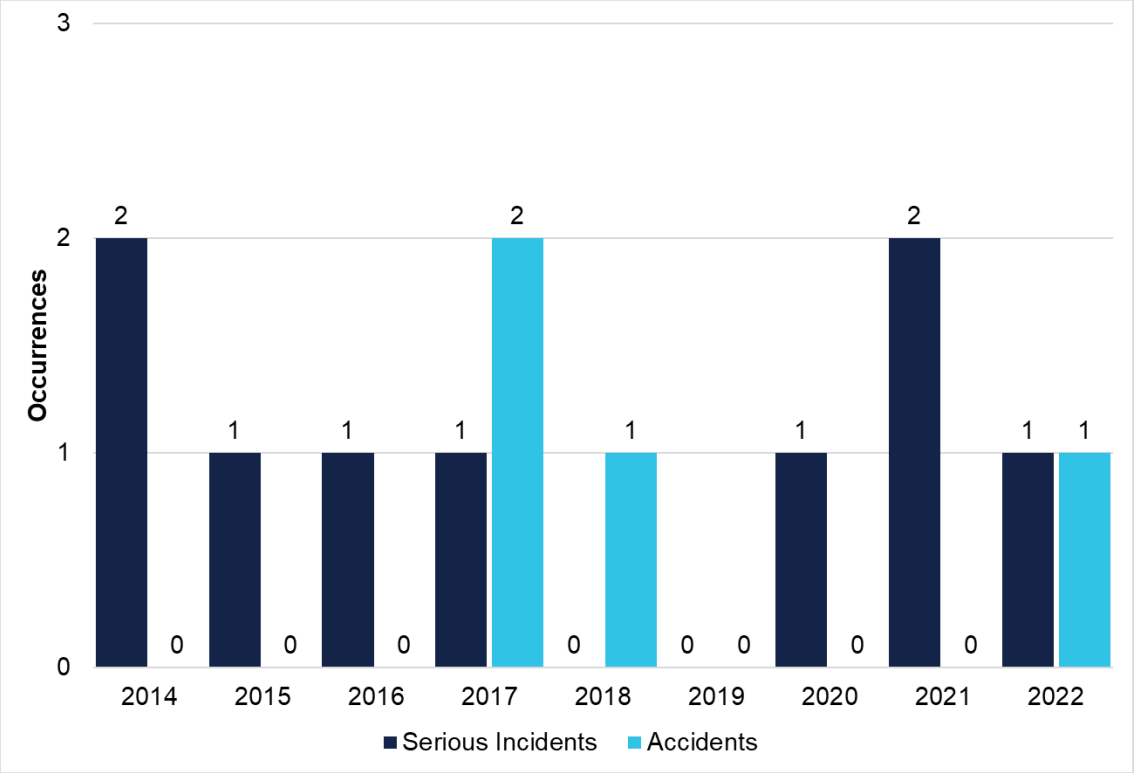
Source: ATSB

Figure 10: Aeroplane joyflights/sightseeing serious incidents and accidents per year (2014–2022)



Source: ATSB

Figure 11: Helicopter joyflights/sightseeing serious incidents and accidents per year (2014–2022)



Source: ATSB

Serious incident and accident rate comparison

Comparison 2.1 – comparison between commercial ballooning and a joyflights/sightseeing and passenger transport activity in an aeroplane and helicopter

Commercial ballooning serious incident and accident rate

- 68,433 commercial balloon landings
- 23 serious incidents + 15 accidents = 38 total
- 55.5 serious incidents and accidents per 100,000 landings.

Commercial ballooning had 55.5 serious incidents or accidents per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport serious incident or accident rate

- 2,190,607 landings
- 86 serious incidents and 50 accidents = 136 total
- 6.2 serious incidents and accidents per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport had a serious incident or accident rate of 6.2 per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport serious incident or accident rate

- 1,795,332 landings
- 23 serious incidents and 16 accidents = 39 total
- 2.2 serious incidents and accidents per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport had a serious incident or accident rate of 2.2 per 100,000 landings.

ATSB finding

A serious incident or accident was 8.9 times more likely to occur on a commercial balloon flight than a joyflights/sightseeing or passenger transport activity in an aeroplane and 25.6 times more likely than in a helicopter.

Comparison 2.2 – comparison between commercial ballooning and a joyflights/sightseeing activity in an aeroplane and helicopter

Commercial ballooning serious incident or accident rate

Commercial ballooning had 55.5 serious incidents or accidents per 100,000 landings.

Aeroplane joyflights/sightseeing serious incident or accident rate

- 260,506 landings
- 15 serious incidents and 12 accidents = 27 total
- 10.4 serious incidents and accidents per 100,000 landings.

Aeroplane joyflights/sightseeing had a serious incident or accident rate of 10.4 per 100,000 landings.

Helicopter joyflights/sightseeing serious incident or accident rate

- 496,867 landings
- 9 serious incidents and 4 accidents = 13 total
- 2.6 serious incidents and accidents per 100,000 landings.

Helicopter joyflights/sightseeing had a serious incident or accident rate of 2.6 per 100,000 landings.

ATSB finding

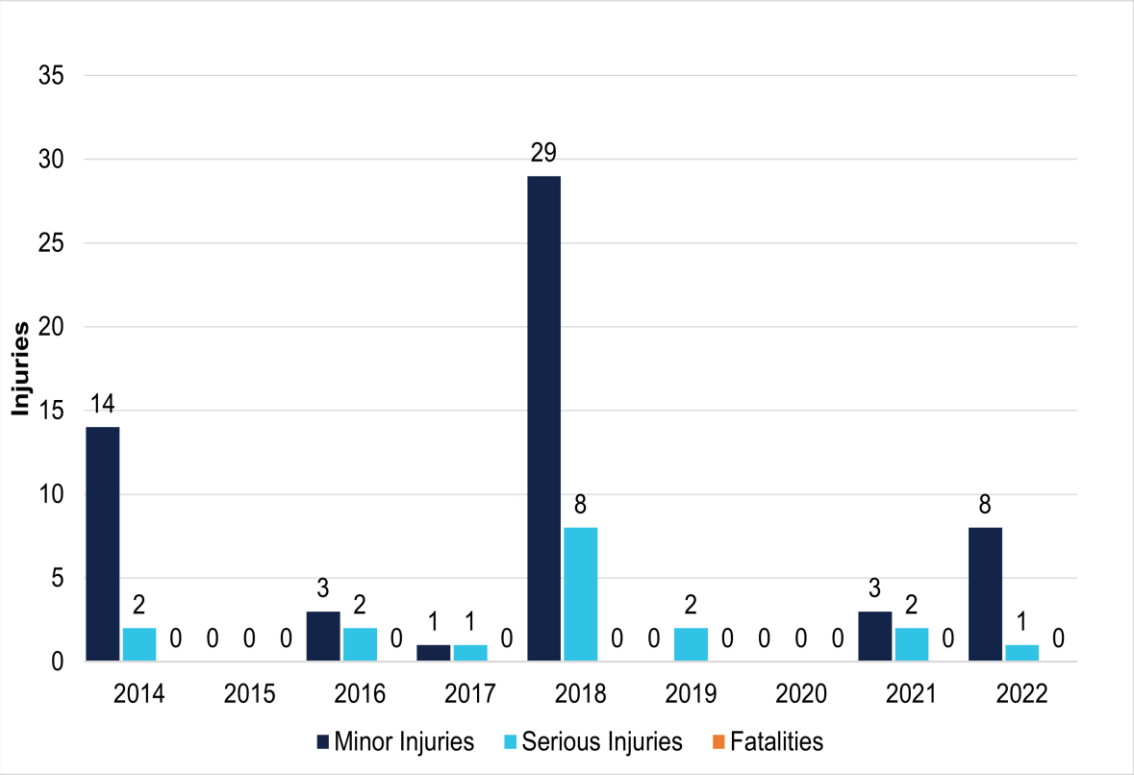
A serious incident or accident was 5.4 times more likely to occur on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 21.2 times more likely than a helicopter.

Reported injuries

Analysis of injury data in the reported occurrences 2014–2022, found:

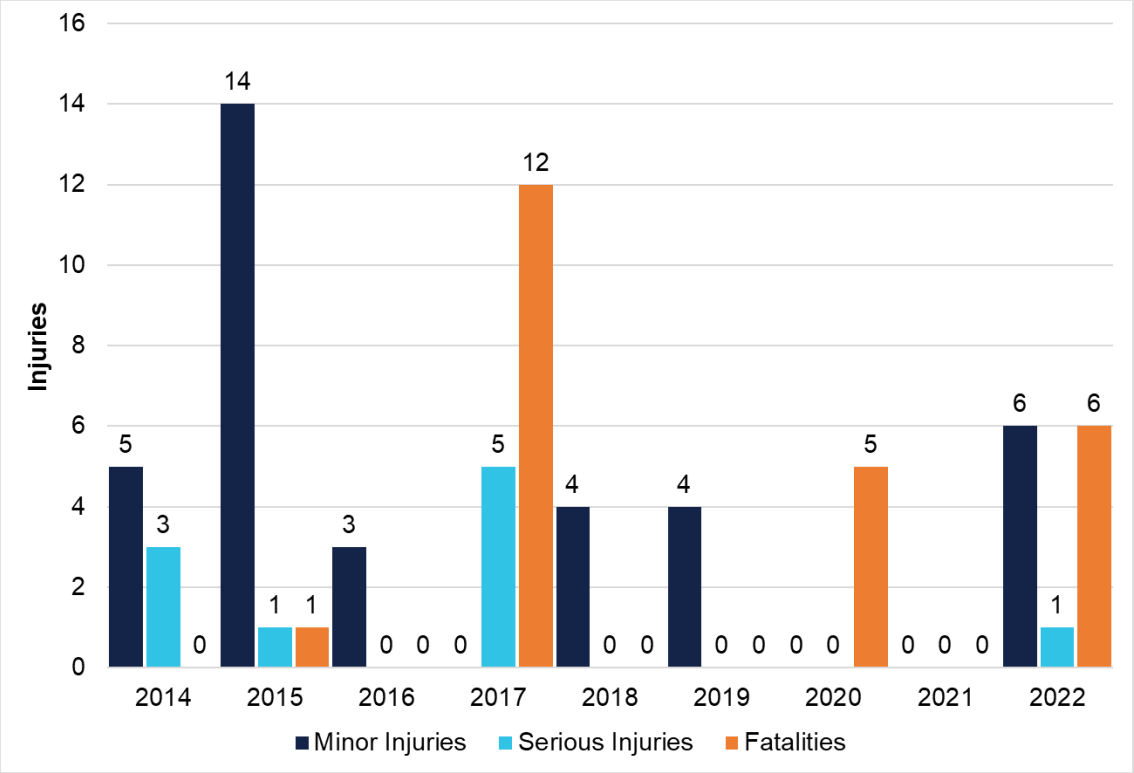
- no fatalities involving commercial balloon flights
- 24 fatalities involving aeroplane joyflights/sightseeing and passenger transport activities
- 8 fatalities involving helicopter joyflights/sightseeing and passenger transport activities
- 7 (of the 32) fatalities occurred in aeroplane and helicopter joyflights/sightseeing activities.
- 76 injuries (58 minor, 18 serious) involving commercial ballooning (Figure 12)
- 36 minor injuries and 10 serious injuries involving aeroplanes conducting joyflights/sightseeing and passenger transport activities combined (Figure 13)
- 17 minor injuries and 9 serious injuries involving helicopters conducting joyflights/sightseeing and passenger transport activities (Figure 14)
- 12 minor injuries and 2 serious injuries involving aeroplanes conducting joyflights/sightseeing activities (Figure 15)
- 3 minor injuries and 5 serious injuries involving helicopters conducting joyflights/sightseeing activities (Figure 16).

Figure 12: Reported commercial ballooning injuries per year (2014–2022)



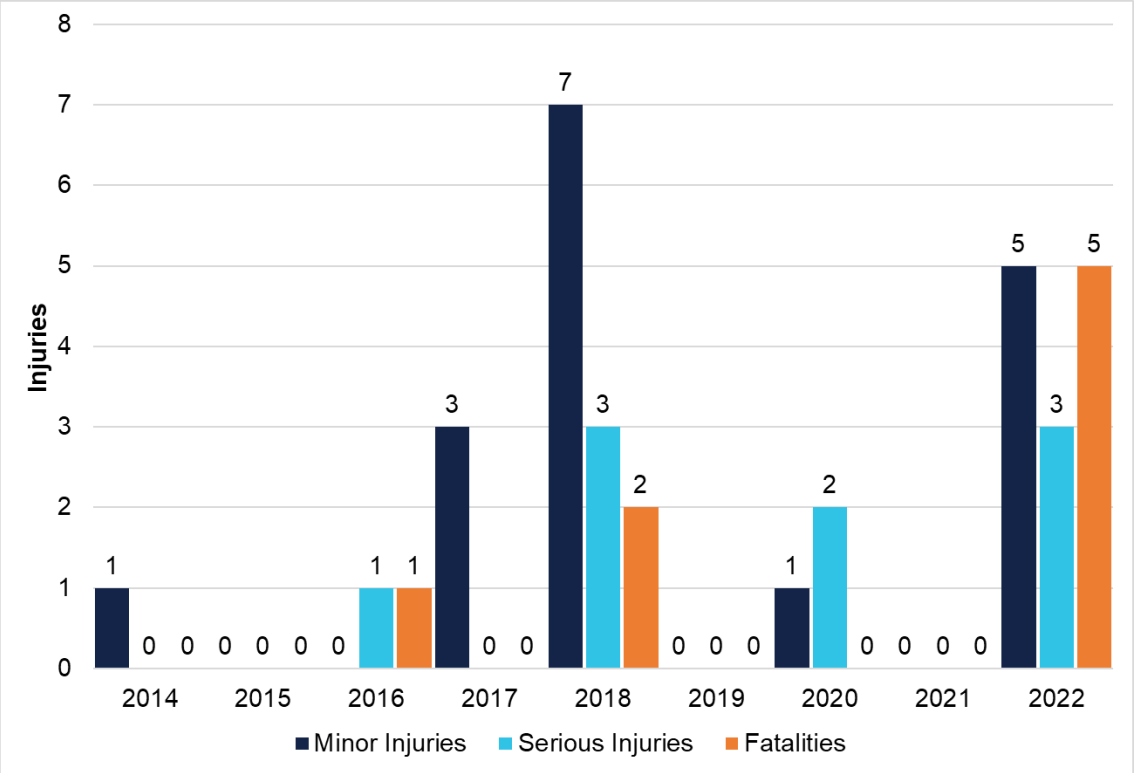
Source: ATSB

Figure 13: Reported aeroplane joyflights/sightseeing and passenger transport injuries per year (2014–2022)



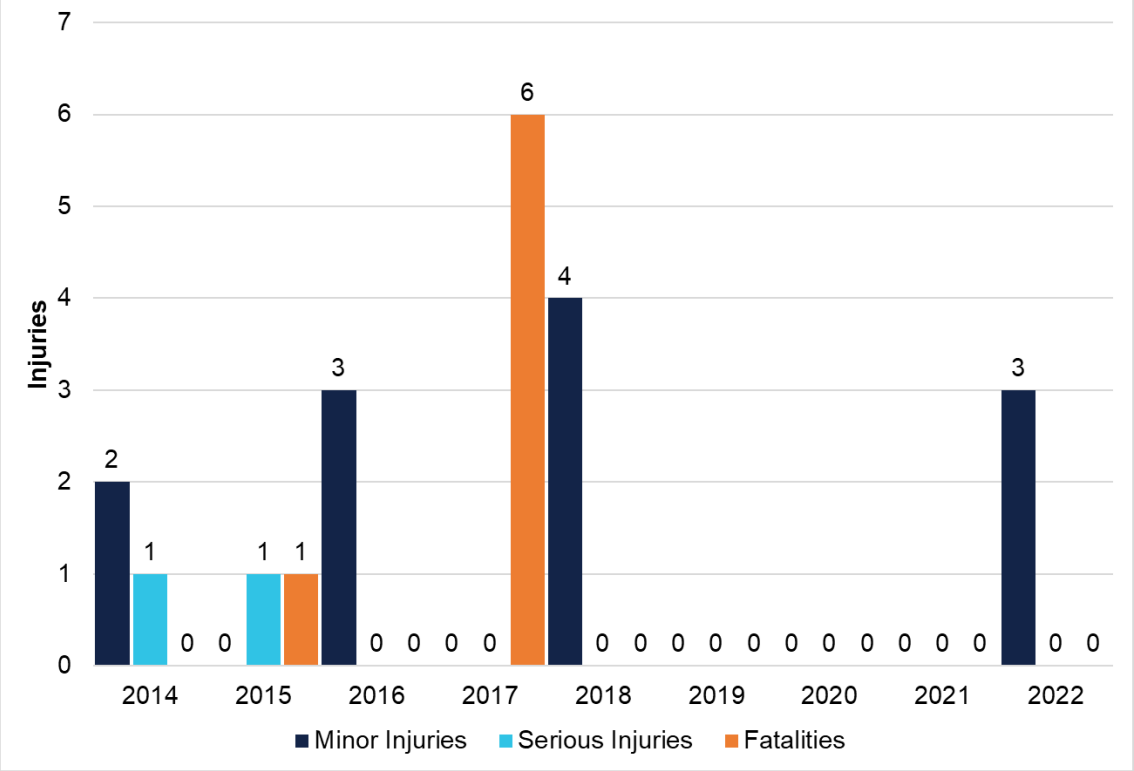
Source: ATSB

Figure 14: Reported helicopter joyflights/sightseeing and passenger transport injuries per year (2014–2022)



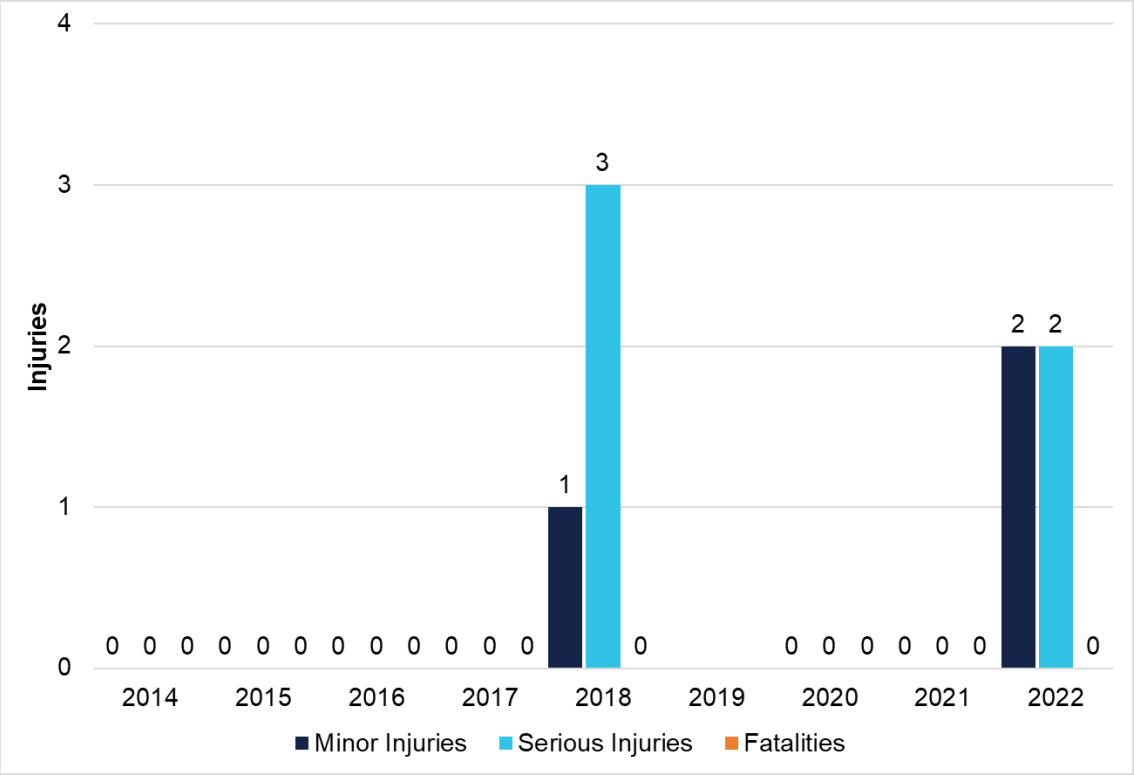
Source: ATSB

Figure 15: Reported aeroplane joyflights/sightseeing injuries per year (2014–2022)



Source: ATSB

Figure 16: Reported helicopter joyflights/sightseeing injuries per year (2014–2022)



Source: ATSB

Injury rate comparison

Comparison 3.1 – comparison between commercial ballooning and joyflights/sightseeing and passenger transport activity in an aeroplane and helicopter

Commercial ballooning total injury rate

- 68,433 landings
- 76 total injuries (no fatalities)
- 111.1 injuries per 100,000 landings.

Commercial ballooning had an injury rate of 111.1 injuries per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport total injury rate

- 2,190,607 landings
- 70 total injuries including fatalities
- 3.2 injuries per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport had an injury rate of 3.2 injuries per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport total injury rate

- 1,795,332 landings
- 34 total injuries including fatalities
- 1.9 per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport had an injury rate of 1.9 injuries per 100,000 landings.

ATSB finding

A person was 34.7 times more likely to sustain an injury on a commercial balloon flight than in an aeroplane on a joyflights/sightseeing and passenger transport charter activity and 58.5 times more likely than in a helicopter.

Comparison 3.2 – comparison between commercial ballooning and a joyflights/sightseeing activity in an aeroplane and helicopter

Commercial ballooning total injury rate

For the period 2014–2022, the commercial ballooning injury rate was 111.1 injuries per 100,000 landings.

Aeroplane joyflights/sightseeing total injury rate

- 260,506 landings
- 21 total injuries including fatalities
- 8.1 per 100,000 landings.

Aeroplane joyflights/sightseeing had an injury rate of 8.1 injuries per 100,000 landings.

Helicopter joyflights/sightseeing total injury rate

- 496,867 landings
- 8 total injuries (no fatalities recorded)
- 1.6 per 100,000 landings.

Helicopter joyflights/sightseeing had an injury rate of 1.6 injuries per 100,000 landings.

ATSB finding

A person was 13.7 times more likely to sustain an injury on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 69.4 times more likely than in a helicopter.

Serious injury rate comparison

Comparison 4.1 – comparison between commercial ballooning and a joyflights/sightseeing and passenger transport activity in an aeroplane and helicopter

Commercial ballooning serious injury rate

- 68,433 balloon landings
- 18 serious injuries
- 26.3 serious injuries per 100,000 landings.

Commercial ballooning had a serious injury rate of 26.3 injuries per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport serious injury rate

- 2,190,607 landings
- 10 serious injuries
- 0.5 serious injuries per 100,000 landings.

Aeroplane joyflights/sightseeing and passenger transport had a serious injury rate of 0.5 injuries per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport serious injury rate

- 1,795,332 landings
- 9 serious injuries
- 0.5 serious injuries per 100,000 landings.

Helicopter joyflights/sightseeing and passenger transport had a serious injury rate of 0.5 injuries per 100,000 landings.

ATSB finding

A person was 57.2 times more likely to sustain a serious injury on a commercial balloon flight than a joyflights/sightseeing and passenger transport charter activity in an aeroplane and 52.6 times more likely than in a helicopter.

Comparison 4.2 – comparison between commercial ballooning and a joyflights/sightseeing activity in aeroplane and helicopter

Commercial ballooning serious injury rate

For the period 2014–2022, the commercial ballooning serious injury rate was 26.3 serious injuries per 100,000 landings.

Aeroplane joyflights/sightseeing serious injury rate

- 260,506 landings
- 2 serious injuries
- 0.8 serious injuries per 100,000 landings.

Aeroplane joyflights/sightseeing had a serious injury rate of 0.8 injuries per 100,000 landings.

Helicopter joyflights/sightseeing serious injury rate

- 496,867 landings
- 5 serious injuries
- 1.0 per 100,000 landings.

Helicopter joyflights/sightseeing had a serious injury rate of 1.0 injuries per 100,000 landings.

ATSB finding

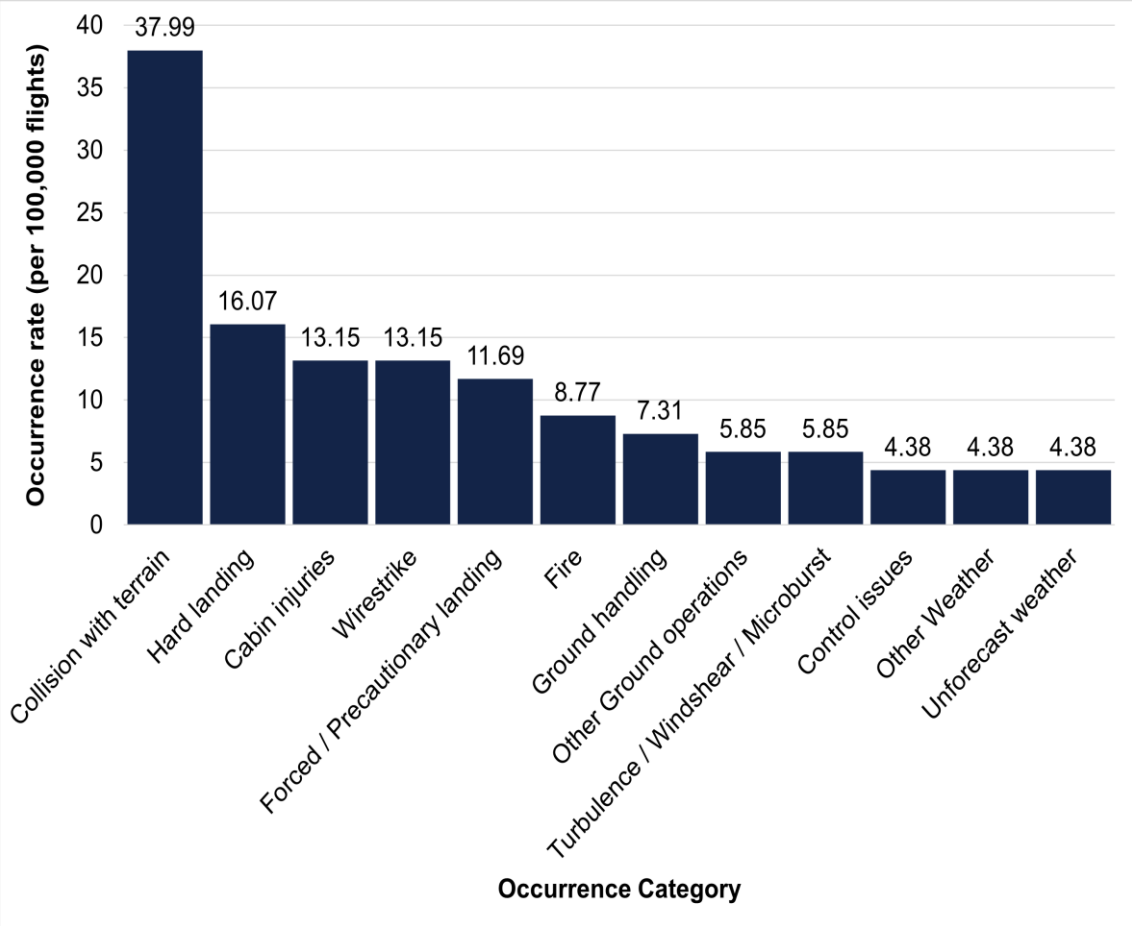
A person was 34.2 times more likely to sustain a serious injury on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 26.0 times more likely than in a helicopter.

Occurrence categories

Commercial ballooning occurrence categories

Figure 17 shows the occurrence rate per most common commercial ballooning occurrence categories for the period 2014–2022.[2] Collision with terrain was the most common with 38.0 occurrences per 100,000 flights, followed by hard landings (16.1), cabin injuries (13.2) and wirestrikes (13.2).

Figure 17: Commercial ballooning occurrence rate per most common occurrence categories (2014–2022)



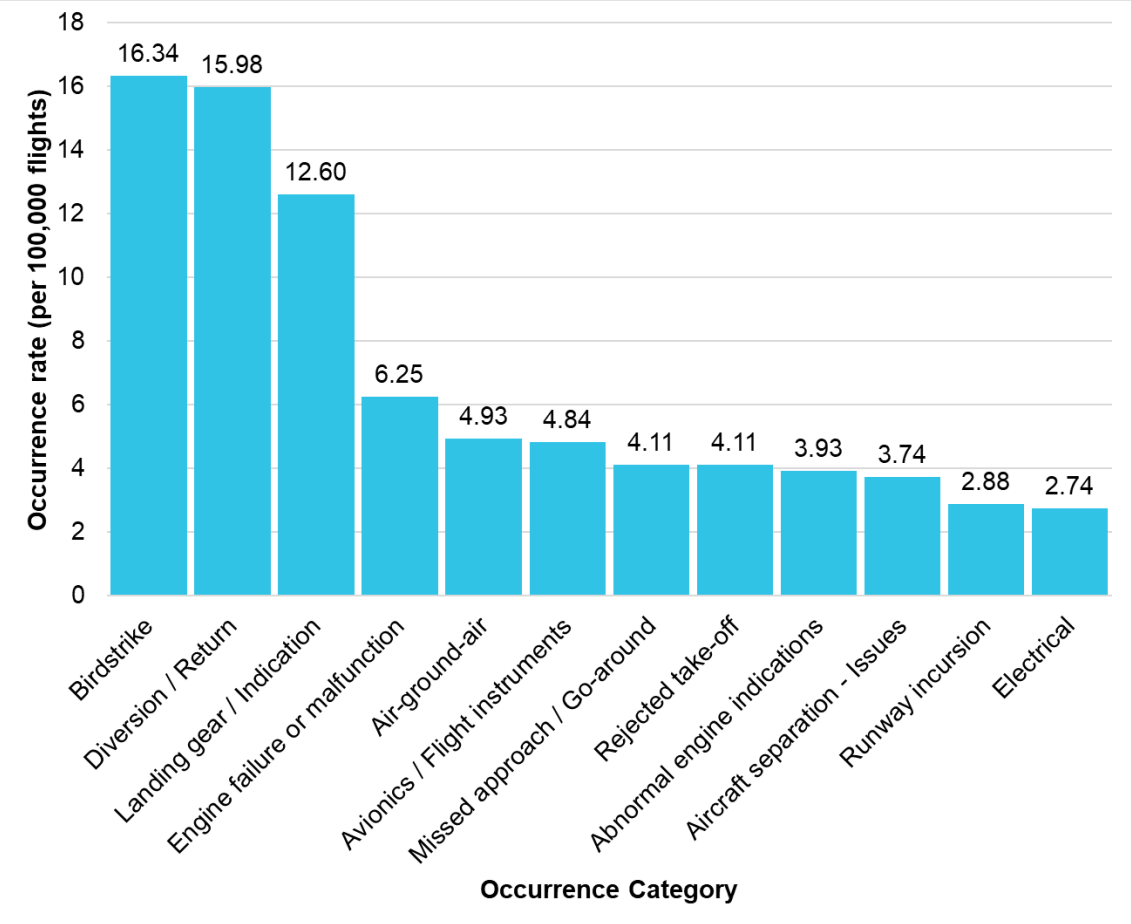
Source: BITRE and ATSB

Aeroplane and helicopter occurrence categories

The most common aeroplane and helicopter occurrence categories for joyflights/sightseeing and passenger transport combined are displayed in Figure 18 and Figure 19 respectively. Aeroplane occurrences involving a birdstrike had a rate of 16.3 occurrences per 100,000 flights, this was followed by diversion/returns (16.0), and a landing gear/indication (12.6). An engine failure or malfunction had an occurrence rate of 6.3 per 100,000 flights. Helicopters' most common occurrence category was diversion/returns at 9.0 per 100,000 flights, followed by warning devices (5.8) and birdstrikes (5.2).

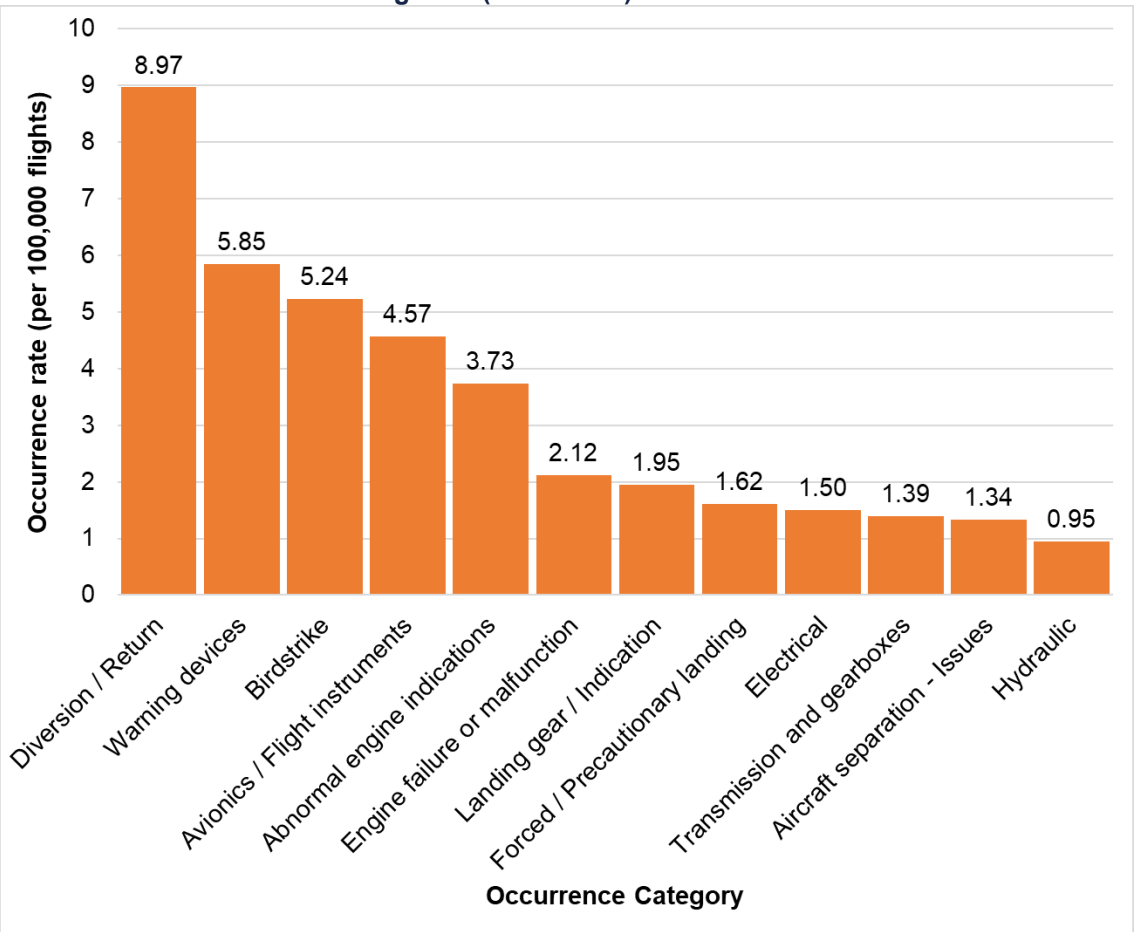
[2] Multiple categories can be assigned to a single occurrence.

Figure 18: Aeroplane joyflights/sightseeing and passenger transport occurrence rate per most common occurrence categories (2014–2022)



Source: BITRE and ATSB

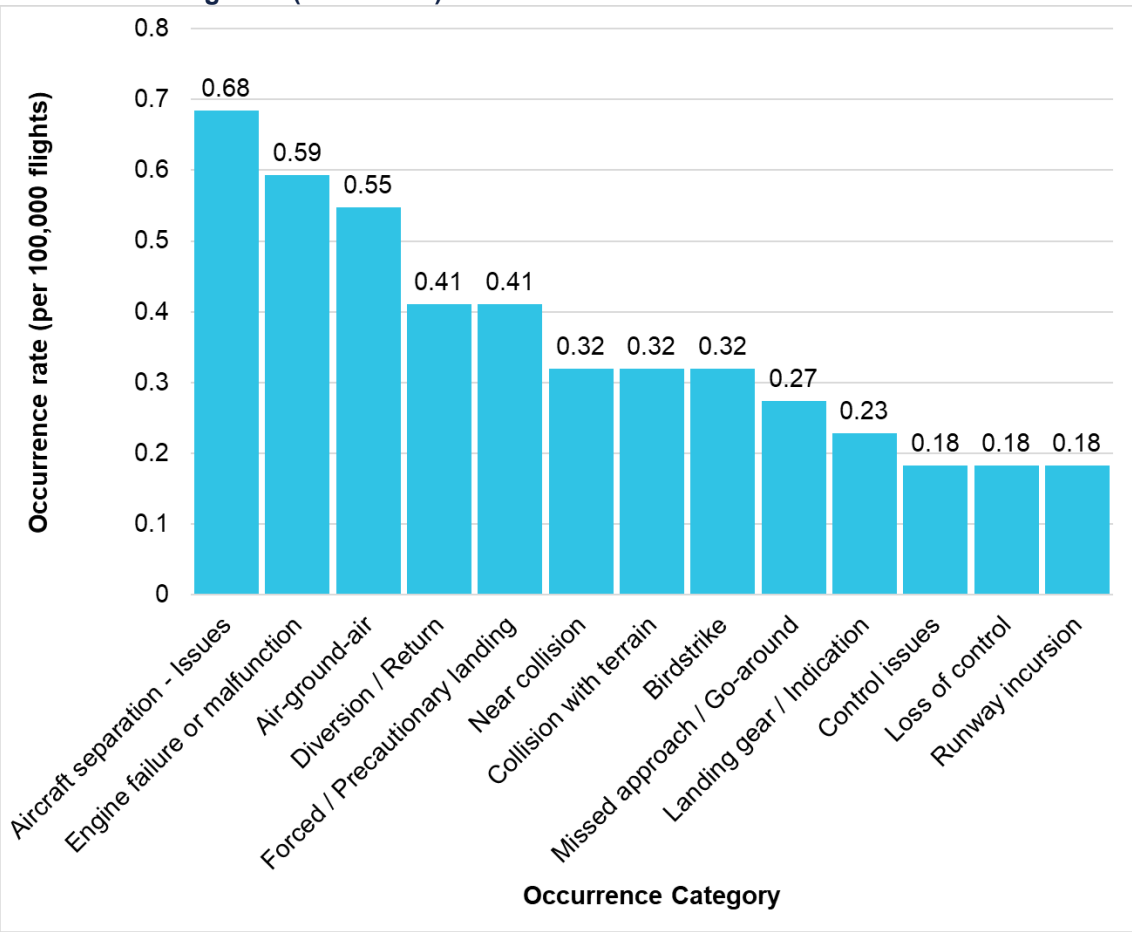
Figure 19: Helicopter joyflights/sightseeing and passenger transport occurrence rate per most common occurrence categories (2014–2022)



Source: BITRE and ATSB

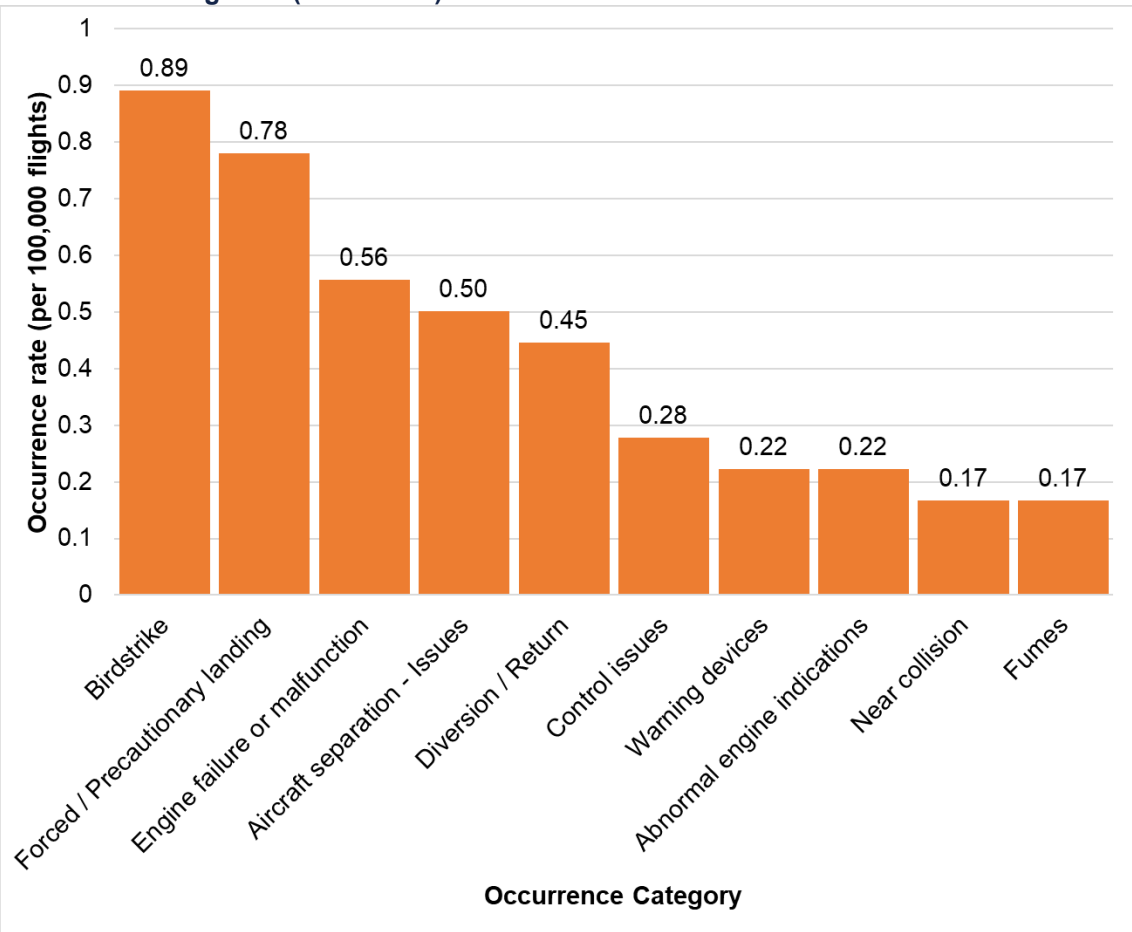
Figure 20 and Figure 21 display the most common aeroplane and helicopter occurrence categorisations for joyflights/sightseeing only. Aircraft separation was the most common category with 0.7 per 100,000 flights, followed by engine failure or malfunction (0.6) and air-ground-air (communications) at 0.6. Helicopters' most common occurrence category was a birdstrike at 0.9 per 100,000 flights, followed by forced/precautionary landing (0.8) and engine failure or malfunction (0.6).

Figure 20: Aeroplane joyflights/sightseeing occurrence rate per most common occurrence categories (2014–2022)



Source: BITRE and ATSB

Figure 21: Helicopter joyflights/sightseeing occurrence rate per most common occurrence categories (2014–2022)



Source: BITRE and ATSB

Commercial ballooning occurrences

Flight phase analysis

The following analysis of the 79 balloon occurrences identified the phases of flight in which:

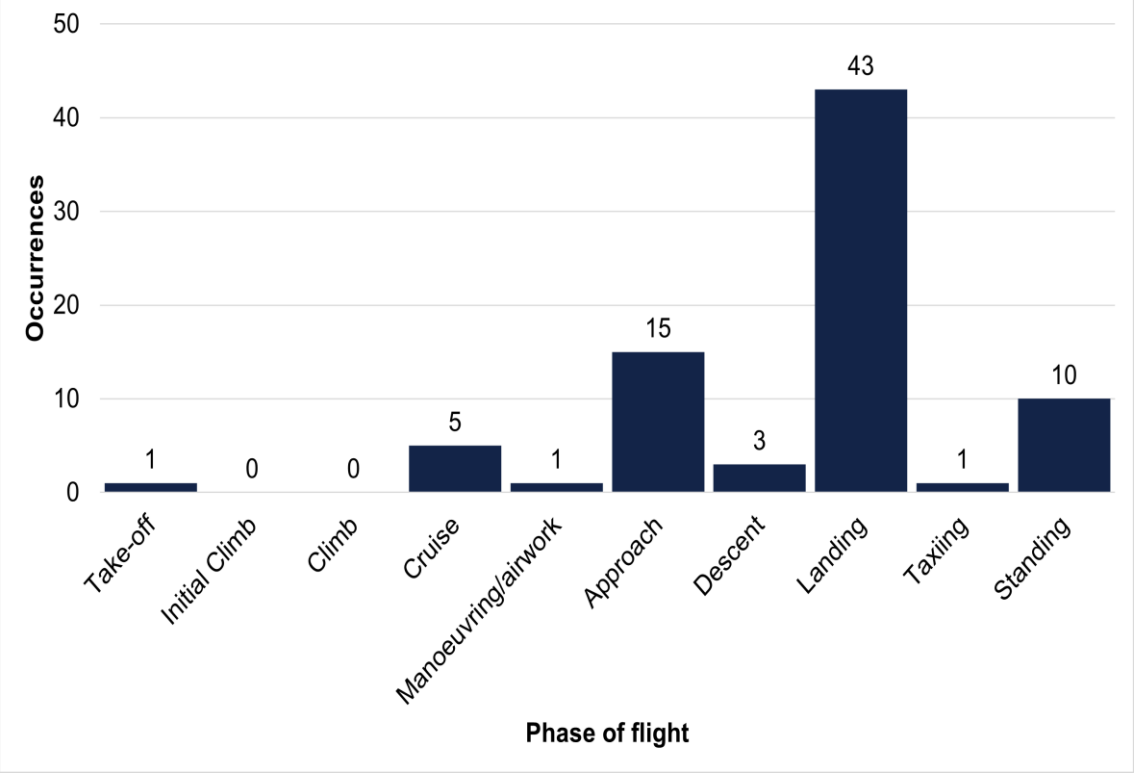
- the occurrences happened
- the serious incidents and accidents occurred
- people sustained injuries.

Additionally, the occurrence categories and the key safety factors that contributed to, or increased the risk of, an occurrence were extracted from the ATSB occurrence database and analysed.

Occurrence phases of flight

For the period 2014–2022, Figure 22 shows the number of occurrences per phase of flight for the 79 commercial ballooning occurrences reported to the ATSB. The majority (43 of 79, or 54%) occurred in the landing phase and a further 19% occurred during the approach phase, equalling a combined 73%.

Figure 22: Commercial ballooning occurrences per phase of flight (2014–2022)



Source: ATSB

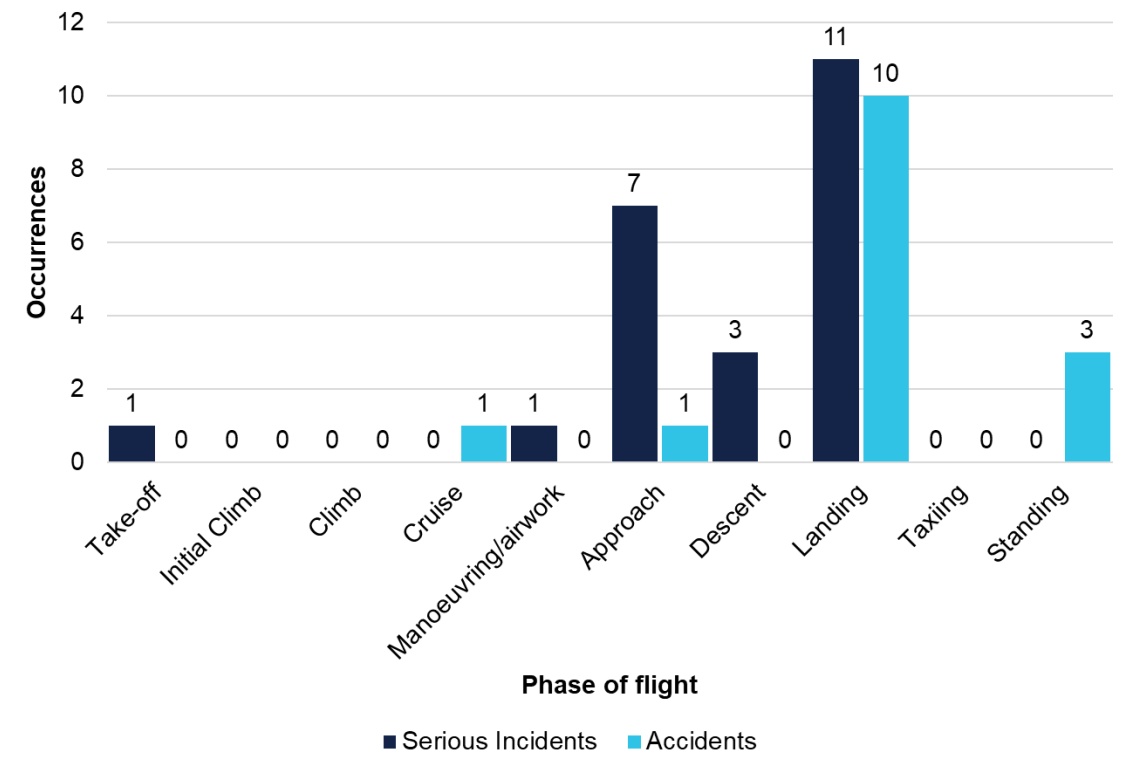
ATSB finding

A commercial ballooning reported occurrence was more likely to occur during landing than any other flight phase.

Phases of flight of serious incidents and accidents

The reported occurrence data 2014–2022 inclusive identified 23 serious incidents and 15 accidents involving commercial ballooning. Figure 23 shows a breakdown of these serious incidents and accidents with respect to phase of flight.

Figure 23: Commercial ballooning serious incidents and accidents per phase of flight (2014–2022)



Source: ATSB

Proportionally:

- 11 out of 23 (48%) serious incidents occurred during the landing phase
- 7 out of 23 (30%) serious incidents occurred during the approach phase
- 10 out of 15 (67%) accidents occurred during the landing phase
- 1 out of 15 (7%) accidents occurred during the approach phase.

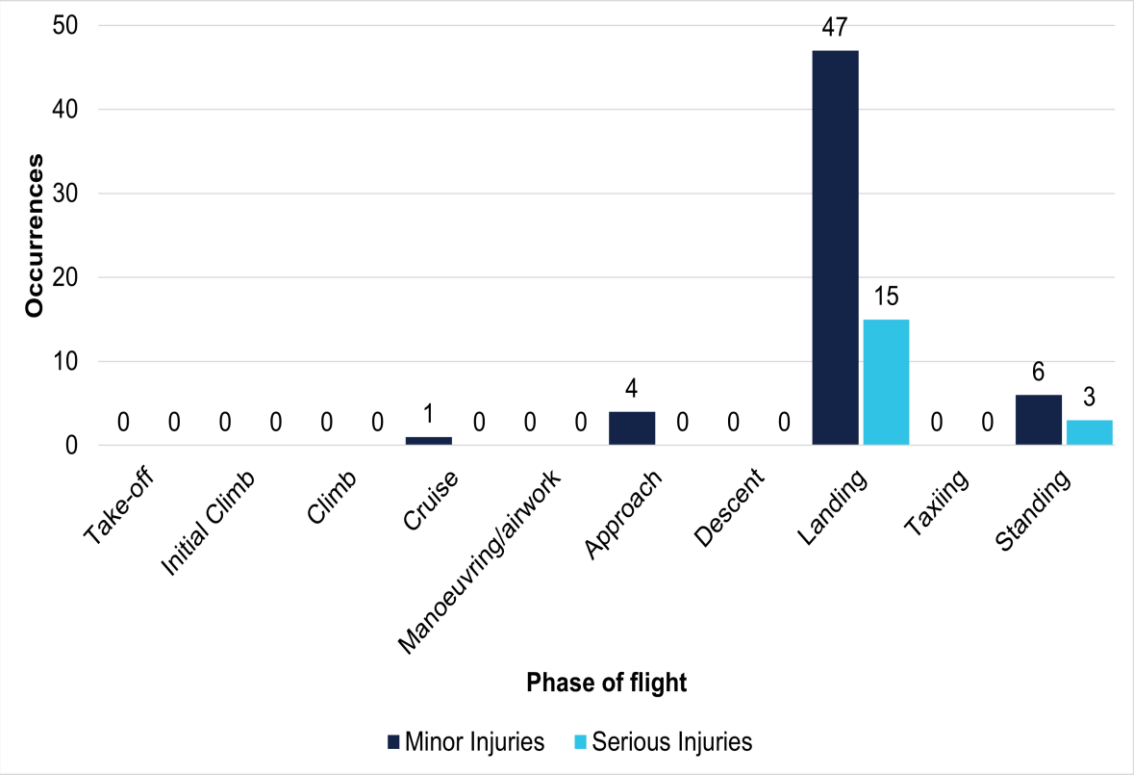
ATSB finding

A commercial ballooning serious incident or accident was more likely to occur during landing than any other flight phase.

Injuries sustained in each phase of flight

For the period 2014–2022, the ATSB occurrence database recorded 58 minor injuries, and 18 serious injuries sustained in commercial ballooning. Figure 24 shows the number of minor and serious injuries sustained in each phase of flight with phases that recorded no injuries omitted.

Figure 24: Commercial ballooning injuries by phase of flight (2014–2022)



Source: ATSB

The data identified that 47 (81%) of the minor injuries and 15 (83%) of the serious injuries occurred during landing, significantly higher than all other phases of flight.

The percentage of injuries that occurred during landing was higher than the percentages of balloon occurrences (55%), serious incidents (48%) and accidents (67%) that occurred during the landing phase of flight.

This is likely due to the nature of a balloon occurrence where an injury has occurred. For an injury to occur, a collision with an object, such as a tree or powerline, or the ground itself is usually required. This is also reflected with 7% of minor injuries occurring during the approach phase, and 10% of minor injuries and 17% of serious injuries occurring when the balloon is inflated and stationary on the ground (standing phase).

ATSB finding

A minor or serious injury on a commercial ballooning flight was most likely to occur during the landing phase of flight.

Types of injuries in commercial ballooning

Severity of injuries was recorded in the ATSB occurrence database, but details of the injuries sustained were limited, especially if the related occurrence was not investigated by the ATSB. Additionally, details of the type of basket fitted to the balloons was not captured in the occurrence database. As a result, no correlation could be made between injuries and basket type. From the available information, there were some minor injuries due to collisions with trees. Layover and hard landings contributed to the largest number

of serious injuries. These resulted from balloon passengers being unrestrained within the basket and, in some occurrences, adopting an incorrect landing position. These injuries were mainly flail-type, due to collisions with other passengers, and lower limb and spinal injuries from deceleration. No fatalities occurred during ballooning operations conducted between 2014–2022.

Common reported occurrence safety factors

The safety factors recorded for the 79 commercial balloon occurrences reported to the ATSB in the period 2014–2022, were extracted from the database. The 4 leading safety factors are listed in Table 1, along with the associated injury count. 75 of the 79 occurrences identified at least 1 of these 4 leading safety factors. The most common safety factor was ‘wind’, a safety factor in 44.3% of all occurrences. Injuries were also most prevalent when wind was identified as a safety factor. The second most common was ‘assessing and planning’, which was a safety factor in 19% of occurrences, and aircraft handling also at 19% and monitoring and checking in 12.7% of all occurrences. Most occurrences had multiple safety factors. For example, wind and planning coexisted where pilots had not obtained accurate wind information during pre-flight preparation.

Aviation safety factor types that were identified were:

- Wind: Situations where the direction or magnitude of wind had influenced aircraft performance, or the ability of the pilot to control the aircraft. May have also included situations where wind influenced performance of ground personnel.
- Assessing and planning: Problems associated with assessment and planning activities, including briefings conducted as part of planning for a particular task. For example, pre-take-off briefings, landing position briefings.
- Aircraft handling: Direct manipulation of aircraft flight path and configuration. Direct manipulation referred to actions having a relatively immediate change of flight parameters or configuration.
- Monitoring and checking: Flight crew actions associated with maintaining awareness of system states (e.g. fuel, engine temperature), environmental states (e.g. weather), traffic disposition and other relevant variables.

Table 1: Commercial ballooning occurrence safety factors

Safety Factors	Occurrences	Serious Incidents	Accidents	Minor Injuries	Serious Injuries	Proportion of occurrences
Wind	35	8	5	22	5	44.3%
Assessing and planning (Aircraft operation action)	15	7	3	6	0	19.0%
Aircraft handling	15	6	1	7	0	19.0%
Monitoring and checking (Aircraft operation action)	10	7	0	0	0	12.7%
Communicating and coordinating - External	5	2	0	1	0	6.3%
Procedures	4	3	0	3	0	5.1%
Other physical environment factors	4	2	0	0	0	5.1%
Passenger action	2	0	1	8	2	2.5%
Other weather conditions	2	0	0	0	0	2.5%
Ground handling action	2	0	1	1	1	2.5%
Distractions	2	0	0	0	0	2.5%
Task knowledge / skills	2	1	0	1	0	2.5%
Using equipment (Aircraft operation action)	2	1	1	0	0	2.5%
Communicating and coordinating - Internal	2	0	0	2	0	2.5%
Pre-flight inspecting	1	0	0	0	0	1.3%
Runway / movement area surface	1	1	0	0	0	1.3%
Electrical discontinuity	1	0	1	7	2	1.3%
Task experience / recency	1	0	0	0	0	1.3%
Other	1	1	0	3	0	1.3%
Wear	1	1	0	0	0	1.3%
Turbulence	1	1	0	0	0	1.3%
Other task demand factors	1	1	0	0	0	1.3%
Design	1	1	0	6	0	1.3%
Light conditions	1	0	1	7	2	1.3%
Other equipment factors	1	1	0	3	0	1.3%
Regulatory influences	1	0	1	1	1	1.3%

Source: ATSB

ATSB finding

Of the 79 balloon occurrences reported to the ATSB between 2014 and 2022, 35 (44%) attributed wind as a safety factor, and 15 (19%) attributed assessing and planning as a safety factor resulting in 8 serious incidents and 5 accidents associated with wind, and 7 serious incidents and 3 accidents associated with assessing and planning.

Occurrence review

A review of the occurrences (Appendix B – Balloon occurrences 2014–2022) identified that 44% had a wind contribution and 33% were categorised as a collision with terrain with 14% categorised as a hard landing. It was found that wind contributed in different ways. Strong winds on the ground necessitate a ‘layover’ landing, in which the basket is dragged on its side until the balloon deflates, with little directional control. These resulted in collisions with trees or other obstacles within the landing area.

In addition to impact with obstacles, occupants sustained injuries in layover landings when they did not adopt the required brace position, were unable to hold on/brace effectively and were ejected from the basket or were injured by impact with other occupants. In one occurrence, AO-2018-016, the pre-flight safety briefing was ineffective in ensuring that all passengers understood the briefing and as a result the passengers

did not adopt the required landing position during a hard landing, resulting in 4 serious injuries and 7 minor injuries.

Strong winds also increased the approach distance and resulted in collisions with powerlines or trees when the pilot did not allow sufficient distance in which to manoeuvre the balloon. This was also influenced by balloon size, as larger balloons were less manoeuvrable and therefore required more obstacle clearance margin.

Pre-flight planning includes a review of the winds at different altitudes to determine approach launch and expected landing sites. When this was not done adequately, or the wind differed from expected or changed during the flight, this resulted in occurrences due to landing in unplanned locations, where the pilot did not have adequate information about the hazards.

Managing vertical descent rate relies on pilots using winds and temperatures at different heights. In one occurrence, climbing into a temperature inversion resulted in unexpected sink. In others, hard landings resulted from mismanagement of the balloon vents, delayed application of heat, or attempting to land in a confined area. Gusty conditions also resulted in hard impacts and associated injuries due to the limited cushioning of the basket.

In one occurrence, the wind was stronger than expected and the balloon overflew all suitable landing sites. This resulted in the balloon drifting over water, where the pilot elected to offload the passengers onto a boat while there was sufficient gas remaining to control the descent and passenger transfer.

In several occurrences, launching in the early morning resulted in the rising sun affecting the pilot's visibility and subsequent impact with obstacles. Fog was another factor that reduced a pilot's visibility and resulted in impact with obstacles during approach.

Occurrence locations

As the ATSB occurrence data included location, geographical data for Australian balloon occurrences between 2014–2022 was extracted from the database and plotted using Google Earth (Figure 25).

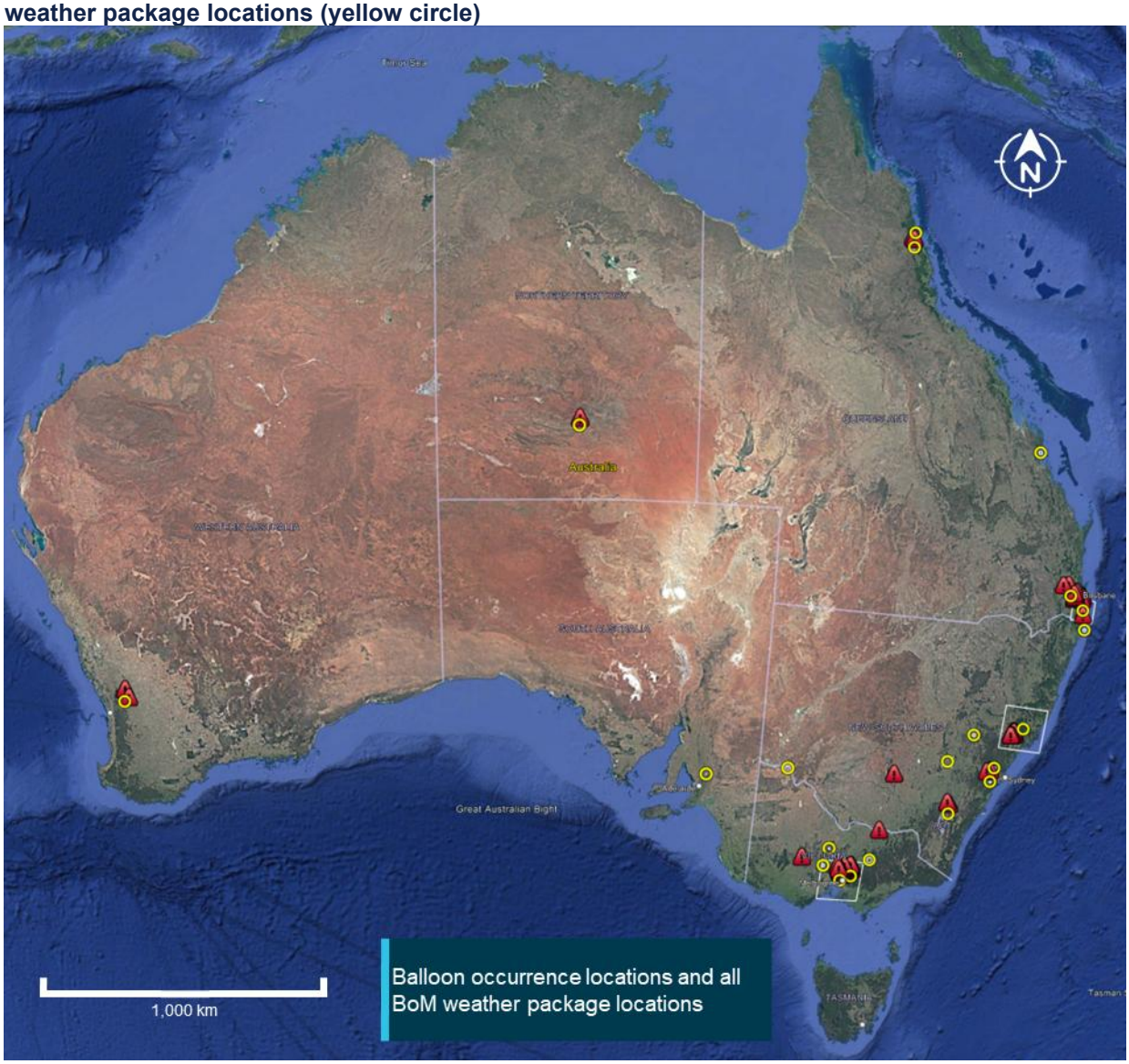
Balloon weather packages

CASR Part 131 requires balloon operators to obtain a weather forecast from an authorised source, such as the Bureau of Meteorology, valid for a period extending 2 hours beyond their landing time. Since October 2020, the Bureau of Meteorology provided balloon weather packages, available through the Bureau of Meteorology website, containing a compilation of relevant information for balloon flight planning. The weather packages replaced a previous recorded phone service for balloon pilots and a text-based product for Alice Springs. The packages have standardised and automated weather information for 21 locations around Australia that are frequently used by balloonists (Figure 25).

Most of the information provided in the product can be found in other aviation weather products, including area and aerodrome forecasts and observations. The unique components of the package are model meteograms (which give time series of wind and humidity at different levels in the atmosphere), 'F160 forecasts' (which show the vertical distribution of wind and temperature) and a wind profiler time series. These products

assist the pilot in determining cloud and wind at different heights throughout the period of the forecast.

Figure 25: Reported commercial ballooning occurrences 2014–2022 (red triangle) and weather package locations (yellow circle)



Source: Google Earth and Bureau of Meteorology, annotated by the ATSB

Occurrences by weather package location

Comparison of the occurrence and weather package locations identified that 77 of the 79 occurrences were geographically located within a 40 km radius of the nearest central point of a balloon weather package location. The remaining 2 occurrences were located about 75 km and 200 km from the nearest respective weather package areas.

The availability of a weather package did not relate to the number of occurrences or their contributing factors.

Injuries by factor and by weather package location

Table 2 shows the number of occurrences by weather package location where wind was identified as a safety factor and the number of those that resulted in serious and/or minor injuries (regardless of how many people were injured). Canberra, Sydney, and Alice Springs had zero injuries in all occurrences. The locations with the highest percentage of injuries per occurrence with wind as a safety factor, were Avon Valley (67%) and the Hunter Valley (50%).

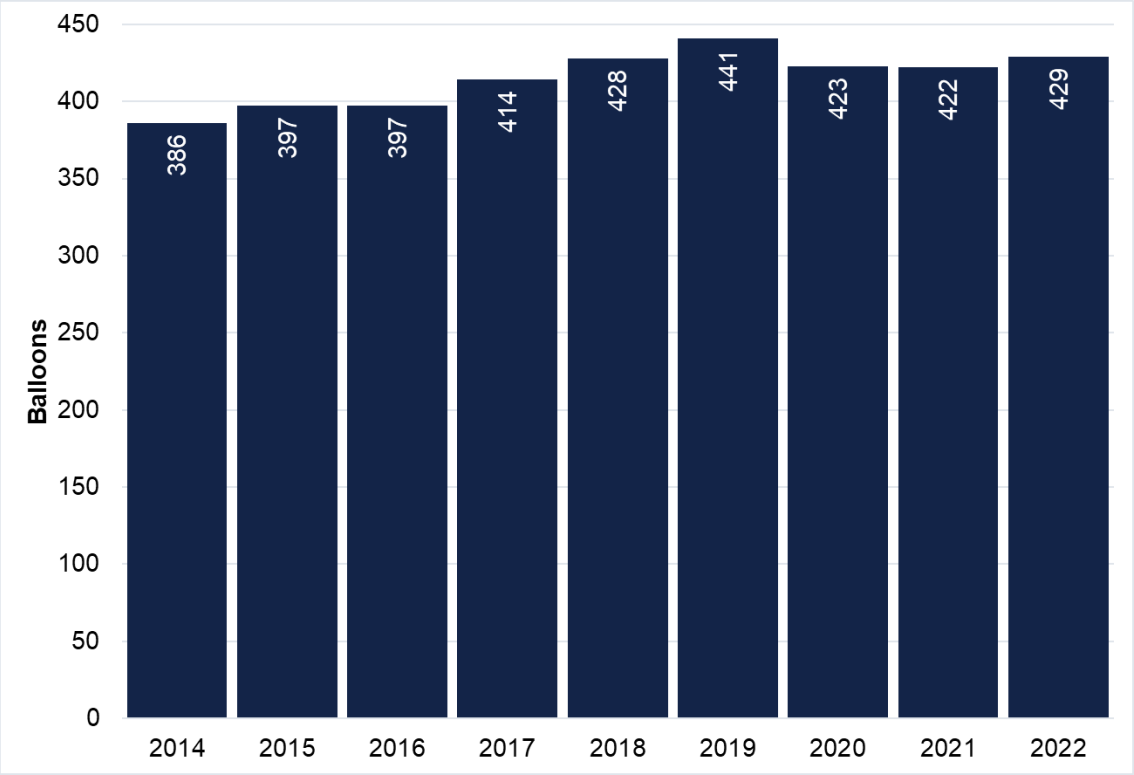
Table 2: Wind occurrences with an injury by location

Nearest weather package location	Wind occurrence	Wind occurrence with injury	Serious injury occurrence	Minor injury occurrence	Occurrences with injuries
Melbourne (Vic)	13	3	2	2	23%
Yarra Valley (Vic)	5	2	0	2	40%
Hunter Valley (NSW)	2	1	0	1	50%
Gold Coast/Ipswich (Qld)	6	2	1	2	33%
Avon Valley (WA)	3	2	1	2	67%

Balloon envelope size

The Civil Aviation Safety Authority (CASA) maintains a register of all VH-registered aircraft. This register includes the type of aircraft, manufacturer, model, and the registration holder of all VH-registered aircraft. However, the database does not include the type of basket that is used nor the number of passengers that the balloon can carry. The ATSB collected end of calendar year registers from 2014 to 2022 and extracted VH-registered balloon data. The total number of VH-registered balloons by year is shown in Figure 26. This data includes private balloons.

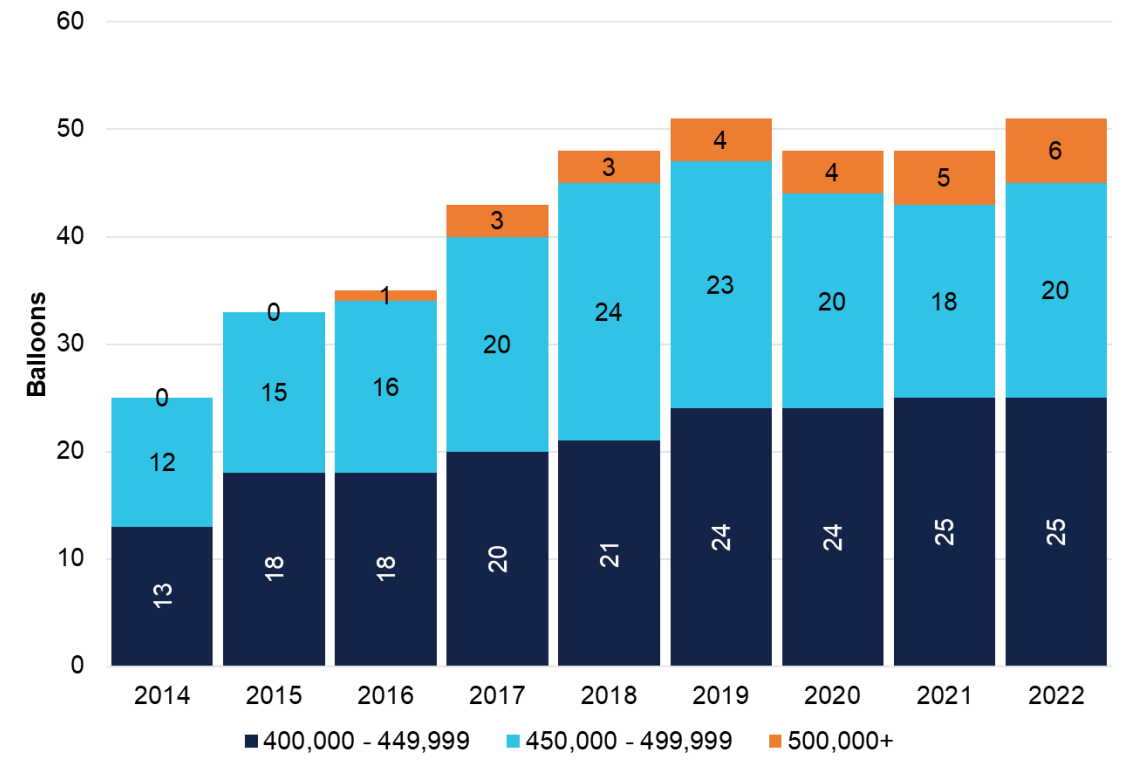
Figure 26: Total number of VH-registered balloons per year (2014–2022)



Source: CASA, annotated by the ATSB

Due to the aircraft register not recording envelope size, the designated model of each balloon was extracted from the database and cross-referenced with manufacturer data to determine the envelope size. Between 2014 and 2022, the total number of VH-registered balloons on the Australian civil aircraft register increased from 386 to 429, an 11% increase. The increase in the number of VH-registered balloons over 400,000 cubic ft is shown in Figure 27.

Figure 27: Number of VH-registered balloons over 400,000 cubic ft per year (2014–2022)



Source: CASA, annotated by the ATSB

At the end of calendar year 2014 there were 25 balloons over 400,000 cubic ft. By the end of 2022 this number had increased to 51, an increase of 104%, with a breakdown as shown in Table 3:

Table 3: VH-registered balloons over 400,000 cubic ft

Envelope size (cubic ft)	2014	2022	Increase
400,000 to 449,999	13	25	92%
450,000 to 499,999	12	20	67%
>= 500,000 (2016 onwards)	0	6	500% from 2016

Over the safety study period, there was an 11% increase in total VH-registered balloons. This increase included a 92% increase in balloons between 400,000 and 449,000 cubic ft, and a 67% increase in balloons between 450,000 and 499,000 cubic ft. One balloon above 500,000 cubic ft was first registered in 2016, increasing to a total of 6 by the end of 2022.

CASR Part 131 Manual of Standards, Chapter 25.03, specified that the maximum number of passengers permitted per flight was 24. To carry this number, a balloon must have a minimum volume of 450,000 cubic feet (Cameron Balloons Ltd, 2025). During the safety study period, there was a 116% increase in balloon envelopes exceeding 450,000 cubic feet. This growth indicates a rise in the number of balloons capable of carrying the maximum passenger load on a single flight.

ATSB finding

Over the safety study period, from 2014–2022, there was a significant increase in balloons with an envelope size above 400,000 cubic ft on the CASA aircraft register, and as a result, an increase in the number of balloons capable of carrying the maximum number of passengers per flight.

Occurrences by balloon envelope size

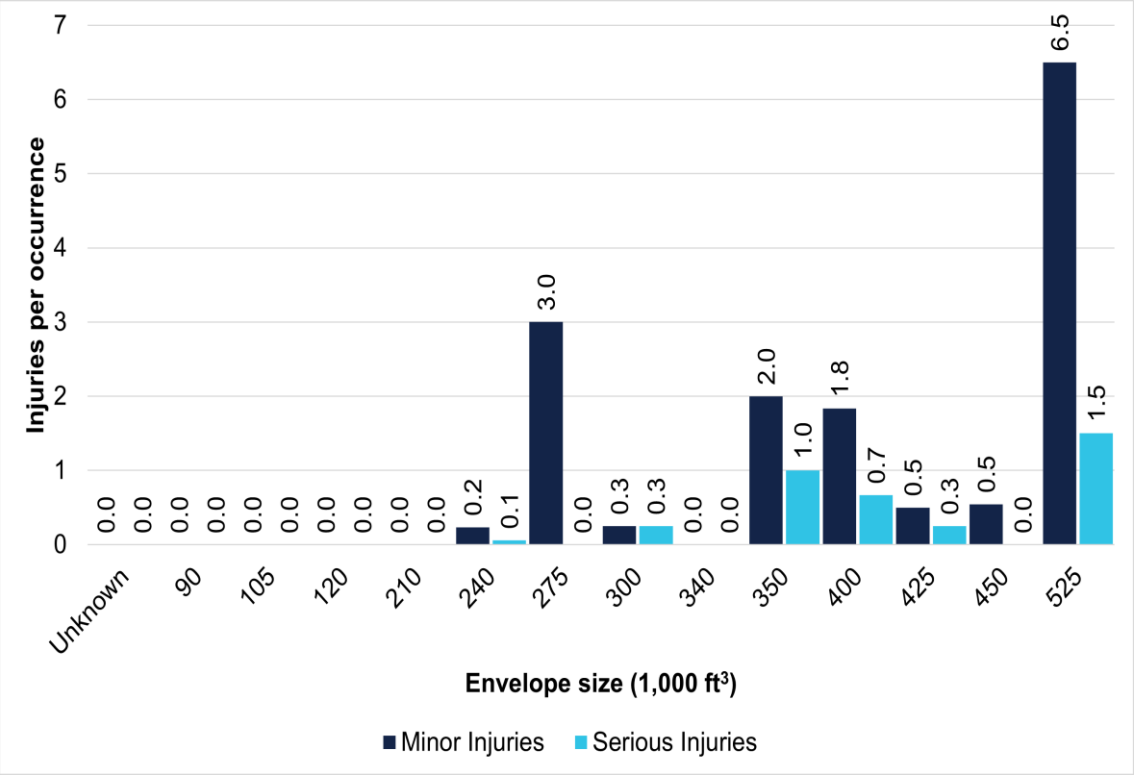
Using the same methodology to determine envelope size as above, the balloon sizes of all occurrences was extracted from the occurrence data. This data was then compared against occurrences and injuries and displayed in Table 4, identifying that:

- balloons with an envelope size of 240,000 cubic ft had the highest number of occurrences with a total of 34, these occurrences resulted in 8 minor injuries and 2 serious injuries
- balloons with an envelope size of 350,000 cubic ft had the highest number of serious injuries, with a total of 6 with an associated 12 minor injuries over 6 occurrences
- there were 2 occurrences involving balloons with an envelope size of 525,000 cubic ft, with 2 serious injuries and 13 minor injuries
- balloons above 400,000 cubic ft had a combined total of 23 occurrences out of 79 (29%), 34 out of 58 minor injuries (59%), and 9 out of 18 serious injuries (50%).

Table 4: Occurrences and injuries by balloon size 2014–2022

Envelope size (1,000 ft^3)	Occurrences	Minor injuries	Serious injuries
unknown	1	0	0
90	1	0	0
105	1	0	0
120	2	0	0
210	1	0	0
240	34	8	2
275	1	3	0
300	4	1	1
340	1	0	0
350	6	12	6
400	6	11	4
425	8	4	2
450	11	6	0
525	2	13	3
Total	**79**	**58**	**18**

Figure 28: Average injuries per occurrence by balloon envelope size (2014–2022)

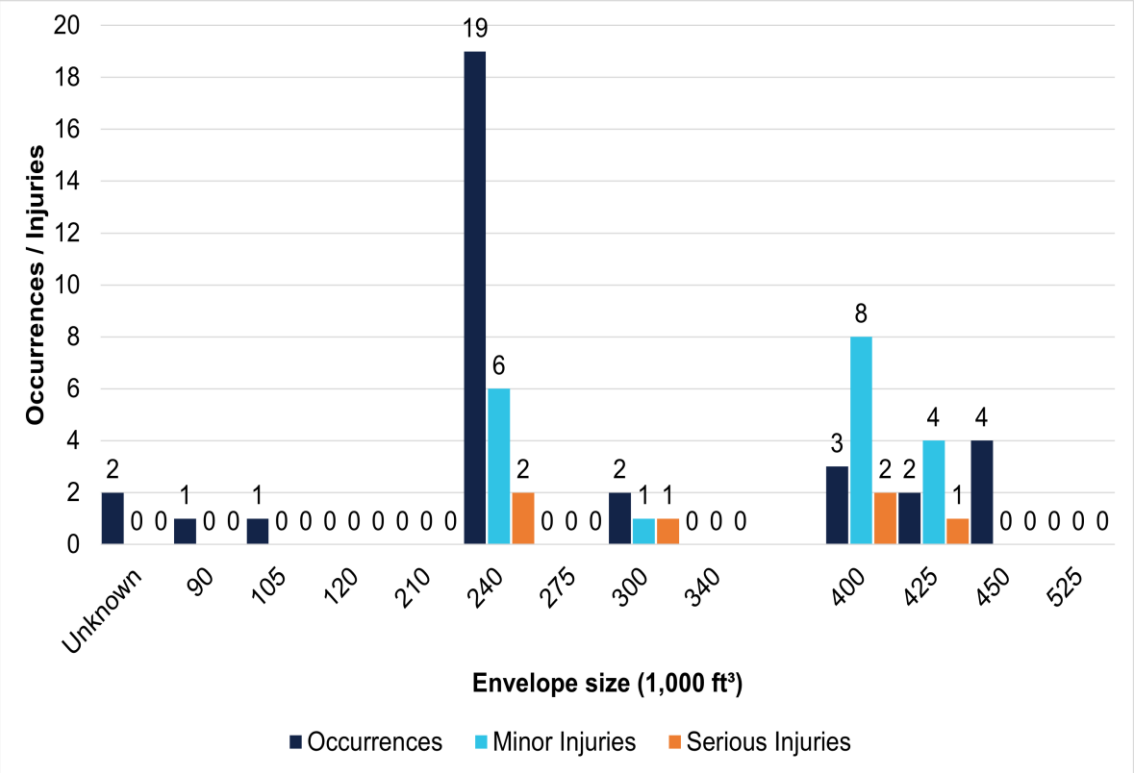


Source: ATSB

The following was identified with wind as a safety factor (Figure 29):

- the 240,000 cubic ft balloons had the highest number of occurrences with 6 minor injuries and 2 serious injuries from 19 wind-related occurrences
- the 350,000 cubic ft balloons had the highest number of serious injuries with 4 serious injuries from 4 wind-related occurrences
- the 350,000, 400,000 and 425,000 cubic ft balloons had 7 serious injuries, 23 minor injuries out of 9 occurrences combined.

Figure 29: Safety factor of wind by balloon size



Source: ATSB

Civil Aviation Safety Regulations Part 131 exposition requirements

In December 2021 a regulatory change came into effect for ballooning, with the introduction of CASR Part 131 Balloons and hot air airships. These changes were not fully implemented until November 2024, when the Part 131 Manual of Standards commenced.

There are 12 CASR Part 131 AOC holders in Australia. A requirement for the issue of a Part 131 Air Operator's Certificate (AOC), is for balloon transport operators to produce a CASA-approved company exposition. Included within the exposition is the following requirement as per CASR Part 131:

> 131.195 Content of exposition
>
> (h) details of each plan, process, procedure, program and system implemented by the operator to safely conduct and manage the operator's balloon transport operations in compliance with the civil aviation legislation.
>
> Note: The plans, processes, procedures, programs and systems mentioned in paragraph (h) may be set out in one or more operator manuals.

Australian air transport aeroplane and helicopter AOC holders are also required to maintain a CASA-approved exposition and require a separate safety management system as per CASR Part 119. There is no current requirement for a Part 131 AOC holder to maintain a separate safety management system.

CASA advised the ATSB that it reserved the requirement for Balloon AOC holders to have an SMS in the drafting of Part 131. CASA also assessed that the transition to CASR Parts 91 and 131 was sufficient regulatory change for operators to manage at that time. Since the commencement of Part 131, CASA reported concentrating on implementing the Part 131 MOS and giving operators time to produce a compliant exposition. CASA also advised that the next tranche of work will be the transitioning of balloon pilot licensing to CASRs, followed by the transition of continuing airworthiness and maintenance requirements into Part 131. Inclusion of an SMS for balloon transport operators has not been scheduled at this time.

Summary

The data showed that a commercial balloon flight was 1.5 to 4 times more likely to have a reported occurrence than a comparable joyflights/sightseeing and passenger transport activity in an aeroplane, and about 3 to 9 times more likely than in a helicopter. These occurrences were coded as incidents, serious incidents or accidents, depending on the severity of injuries and aircraft damage. The data showed that a serious incident or accident was about 6 to 9 times more likely to occur during a commercial balloon flight than a comparable aeroplane flight and 21 to 25 times more likely than during a helicopter flight.

The data also showed a difference between the most common occurrence categories for balloons, compared with aeroplanes and helicopters. Commercial balloons were more likely to have a collision with terrain, hard landing, cabin injury or wirestrike. Aeroplanes and helicopters were more likely to have a birdstrike, diversion, forced/precautionary landing or engine failure/malfunction.

The balloon occurrences and associated injuries usually happened during approach and landing. The effect of wind was identified as a contributing safety factor to most occurrences. However, as the number of flights per region was not collected from operators, a correlation between the availability of detailed weather information and wind-related occurrences could not be determined. Assessing and planning, aircraft handling, and monitoring and checking were also identified as common safety factors. The combination of wind-related pilot planning and decision-making, and aircraft handling in those conditions, resulted in most of the occurrences and injuries.

There were no fatalities in commercial ballooning during the 2014–2022 period, while aeroplane and helicopter joyflights/sightseeing activities resulted in 7 fatalities, and a further 24 fatalities occurred in aeroplane and helicopter passenger transport activities. However, passengers in commercial balloon flights were 14 to 35 times more likely to sustain an injury than in an aeroplane and 60 to 70 times more likely than in a helicopter.

Overall, a passenger in a commercial balloon flight was at significantly greater risk of minor or serious injury than in a similar aeroplane or helicopter flight, but unlikely to be fatally injured. Additionally, the number of passengers exposed to the risk in a single occurrence has increased with the increase in balloon size being used for commercial passenger flights. However, there was no apparent link between larger balloons and the number of ballooning-related injuries.

Injury data showed the magnitude of passenger injury risk in balloon flights compared with aeroplane and helicopter flights. While 99.7% of aeroplane and 99.8% of helicopter

joyflights/sightseeing and passenger transport incidents, and 100% of both aeroplane and helicopter incidents in joyflights/sightseeing activities resulted in no injuries, only 71% of balloon incidents were injury-free.

Similarly, 95% of aeroplane and 100% of helicopter joyflights/sightseeing and passenger transport serious incidents had no injuries, and 100% of both aeroplane and helicopter joyflights/sightseeing serious incidents reported no injuries, only 83% of balloon serious incidents were injury-free.

Furthermore, 62% of aeroplane and 38% of helicopter joyflights/sightseeing and passenger transport flight accidents had no injuries, and 25% of aeroplane and 50% of helicopter joyflights/sightseeing accidents had no injuries. 27% of balloon accidents reported no injuries. This shows that joyflights/sightseeing passengers in a balloon were slightly less likely to be injured in an accident than in an aeroplane, but more likely to be injured than in a helicopter. Furthermore, balloon passengers were more likely to be injured in an accident than aeroplane or helicopter passengers in a passenger transport accident.

The increased injury risk for balloon passengers is likely due to balloon passengers being unrestrained in an open basket. Fewer injuries per accident for aeroplanes and helicopters shows that these aircraft sustain greater damage with fewer injuries to occupants than balloons. From the available injury information, the majority of the balloon accident injuries consisted of lower limb injuries from terrain collisions, and flail type injuries from passengers colliding with each other.

A collection of more detailed injury data would allow further analysis of the mechanism of injuries, with the aim of identifying possible ways to improve passenger safety in commercial balloon flights. Passengers are therefore encouraged to provide detailed injury information in ATSB occurrence notifications. Prior to a balloon flight, passengers should be informed of the injury risks, as balloons do not have the restraint systems or impact reduction engineering afforded to passengers in aeroplanes or helicopters.

Although not a legislative requirement, an SMS can assist balloon operators to employ a structured approach to managing risk. This study identified several hazards applicable to balloon operations in Australia, such as wind, pre-flight planning, and passenger position during landings. However, there will be additional hazards applicable to specific locations or types of operation that individual operators will be aware of. Structured identification and treatment of these hazards should result in a reduction of occurrences and injuries in commercial ballooning operations.

Previously identified passenger injury risk mitigators include:

- detailed passenger safety briefings and visual cards
- ensuring passengers can adopt the appropriate brace or landing position
- clear instructions to passengers in an emergency
- positioning of passengers to reduce injuries resulting from contact between them.

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.

From the evidence available, the following findings are made with respect to the Australian balloon transport operation occurrences between 2014–2022:

ATSB findings

- A commercial balloon flight was 1.5 times more likely to have a reported occurrence than a comparable joyflights/sightseeing and passenger transport activity in an aeroplane and 3.4 times more likely than a helicopter.
- A commercial balloon flight was 4.2 times more likely to have a reported occurrence than a comparable joyflights/sightseeing activity in an aeroplane and 9.2 times more likely than a helicopter.
- A serious incident or accident was 8.9 times more likely to occur on a commercial balloon flight than a joyflights/sightseeing or passenger transport activity in an aeroplane and 25.6 times more likely than in a helicopter.
- A serious incident or accident was 5.4 times more likely to occur on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 21.2 times more likely than a helicopter.
- A person was 34.7 times more likely to sustain an injury on a commercial balloon flight than in an aeroplane on a joyflights/sightseeing and passenger transport charter activity and 58.5 times more likely than in a helicopter.
- A person was 13.7 times more likely to sustain an injury on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 69.4 times more likely than in a helicopter.
- A person was 57.2 times more likely to sustain a serious injury on a commercial balloon flight than a joyflights/sightseeing and passenger transport charter activity in an aeroplane and 52.6 times more likely than in a helicopter.
- A person was 34.2 times more likely to sustain a serious injury on a commercial balloon flight than a joyflights/sightseeing activity in an aeroplane and 26.0 times more likely than in a helicopter.
- A commercial ballooning reported occurrence was more likely to occur during landing than any other flight phase.
- A commercial ballooning serious incident or accident was more likely to occur during landing than any other flight phase.

- A minor or serious injury on a commercial ballooning flight was most likely to occur during the landing phase of flight.
- Of the 79 balloon occurrences reported to the ATSB between 2014 and 2022, 35 (44%) attributed wind as a safety factor, and 15 (19%) attributed assessing and planning as a safety factor resulting in 8 serious incidents and 5 accidents associated with wind, and 7 serious incidents and 3 accidents associated with assessing and planning.
- Over the safety study period, from 2014–2022, there was a significant increase in balloons with an envelope size above 400,000 cubic ft on the CASA aircraft register, and as a result, an increase in the number of balloons capable of carrying the maximum number of passengers per flight.

Glossary

CASA	Civil Aviation Safety Authority
CASR	Civil Aviation Safety Regulations
BITRE	Bureau of Infrastructure, Transport and Research Economics
BOM	Bureau of Meteorology
ICAO	International Civil Aviation Organization
MOS	Manual of Standards
SMS	Safety management system. A systematic approach to organisational safety encompassing safety policy and objectives, risk management, safety assurance, safety promotion, third party interfaces, internal investigation and SMS implementation.

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Civil Aviation Safety Authority
- Bureau of Infrastructure, Transport and Research Economics
- Bureau of Meteorology
- Australian Balloon Federation.

References

Cameron Balloons Ltd. (2025). *Cameron Balloons a-type.* Retrieved from Cameron Balloons: https://www.cameronballoons.co.uk/a-type

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:

- Civil Aviation Safety Authority
- Bureau of Infrastructure, Transport and Research Economics.

Submissions were received from:

- Civil Aviation Safety Authority
- Bureau of Infrastructure, Transport and Research Economics.

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

Appendices

Appendix A – Weather package location data

Safety factors and injuries by location

Table 5: Safety factors and total injuries by weather package location

Location	Wind			Planning			Other weather			Aircraft handling			Communication		
	Occu	Minor Injury	Serious Injury	Occu	Minor Injury	Serious Injury	Occu	Minor Injury	Serious Injury	Occu	Minor Injury	Serious Injury	Occu	Minor Injury	Serious Injury
Melbourne	14	4	2	7	1	0	2	0	0	4	1	0	2	1	0
Yarra Valley	5	11	4	4	4	2	3	7	4	3	1	2	2	7	6
Canberra	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sydney	1	0	0	0	0	0	0	0	0	0	0	0	1	1	0
Hunter Valley	3	3	1	3	15	3	2	16	4	1	0	0	0	0	0
Brisbane Valley	6	8	2	1	0	0	4	7	2	7	5	0	1	1	0
Cairns	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0
Alice Springs	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Avon Valley	3	2	1	1	0	0	0	0	0	0	0	0	0	0	0

Phase of flight by location

A breakdown of the occurrences by geographical location and phase of flight showed that the locations with a higher number of occurrences had similar percentages of occurrences in the approach and landing phases of flight as the overall totals (71%) (Table 6). However, this is expected as those locations contributed a large proportion of the total occurrences.

Table 6: Occurrences by location and phase of flight

Location	Take-off	Initial climb	Climb	Cruise	Manoeuvring / Airwork / Other / Taxiing	Approach	Descent	Landing	Standing	Total occurrences
Melbourne	0	0	0	2	1	5	0	19	0	27
Yarra Valley	0	0	0	1	0	1	1	7	1	11
Hunter Valley	1	0	0	0	1	0	0	4	4	10
Brisbane Valley	0	0	0	0	1	5	2	7	1	16
Canberra	0	0	0	1	0	0	0	1	0	2
Sydney	0	0	0	0	0	0	0	0	2	2
Cairns	0	0	0	0	0	1	0	3	0	4
Alice Springs	0	0	0	1	0	0	0	0	0	1
Avon Valley	0	0	0	0	0	1	0	1	1	3

Appendix B – Balloon occurrences 2014–2022

The following tables show the summaries of each of the 80 reported incidents or accidents that occurred as a commercial ballooning operation.

Table 7: Balloon occurrences 2014 to 2022

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
OA2014-01228		**31 Jan 2014**	**near Mareeba Aerodrome**	**Minor**	**Incident**	**Collision with terrain**
During the approach, the balloon basket contacted trees. On landing the basket tipped over and after dragging approximately 15 metres, came to a rest on its side. A passenger sustained a minor injury.						
OA2014-01540		**11 Feb 2014**	**Hawthorne**	**Nil**	**Incident**	**Forced / Precautionary landing | Other Miscellaneous**
During cruise, the wind decreased significantly, and the balloon was not able to reach the intended landing site. A precautionary landing was conducted in a garden resulting in minor envelope damage.						
OA2014-02168		**28 Feb 2014**	**Essendon Aerodrome, 150° M 8Km**	**Minor**	**Incident**	**Cabin injuries**
During the landing, a passenger sustained a minor ankle injury.						
OA2014-02538		**12 Mar 2014**	**Beaudesert (HLS)**	**Minor**	**Incident**	**Cabin injuries**
During landing, the balloon basket tipped onto its side and one passenger sustained a minor injury.						
OA2014-07202	**AO-2014-157**	**26 Sep 2014**	**Gold Coast Aerodrome, 300° M 60Km (near Woodhill)**	**Serious**	**Accident**	**Hard landing**
On 26 September 2014 at about 0450 Eastern Standard Time, the pilot of a Kavanagh Balloon, registered VH-CNX, conducted pre-flight preparations for a charter flight with 22 passengers. Due to the forecast winds, the pilot elected to depart from Beaudesert, with a planned landing site in Cedar Grove, Queensland. The pilot conducted a safety briefing including demonstration of the landing position. The passengers then assumed their landing positions and the pilot was satisfied they understood the correct position to adopt. After completing the pre-flight checks, the balloon lifted off at about 0550. After about a 20-minute flight, the pilot commenced the descent to the landing site. During the approach, the pilot observed a light ground fog and was heading directly into the sun, making the landing site difficult to see. The pilot attempted to obtain an accurate rate of descent from the altimeter, but it was reading erratically. The pilot instructed the passengers to adopt the landing position, but not all of them complied. He repeated his instructions to the passengers, the altimeter continued to read erratically and facing directly into the sun made visual assessment of the approach difficult. The balloon landed hard and bounced once before landing about 3 m further along the ground. Two passengers sustained serious injuries, and seven had minor injuries. The balloon was undamaged.						
OA2014-08827		**5 Oct 2014**	**Essendon Aerodrome, 078° T 20Km (Anthony Beale reserve)**	**Nil**	**Accident**	**Collision with terrain**
During landing, the balloon's envelope contacted a lighting tower resulting in substantial damage.						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
OA2014-09253		**22 Oct 2014**	**Gold Coast Aerodrome, 297° M 58Km (near Beaudesert)**	**Minor**	**Incident**	**Hard landing**
During approach, the balloon's rate of descent was higher than assessed by the pilot. The balloon landed hard and four passengers sustained minor injuries.						
OA2014-10036		**22 Nov 2014**	**Canberra Aerodrome, 300° T 12Km (Aranda Oval)**	**Nil**	**Incident**	**Other Ground operations**
After landing, the deflating balloon envelope made contact with a light pole causing minor damage.						
OA2014-10754		**28 Dec 2014**	**Essendon Aerodrome, 149° T 8Km (Royal Park)**	**Nil**	**Incident**	**Other Ground operations**
After landing, the balloon envelope made contact with a barbed-wire fence causing minor damage.						
OA2015-00109		**28 Jan 2015**	**Essendon Aerodrome, 085° M 2Km (Strathmore)**	**Nil**	**Serious incident**	**Wirestrike**
During landing, the balloon envelope contacted powerlines.						
OA2015-01205		**28 Mar 2015**	**Essendon Aerodrome, E M 15Km (Yallambie)**	**Nil**	**Incident**	**Collision with terrain**
While deflating the envelope after landing, the balloon contacted a tree resulting in minor fabric damage.						
OA2015-02055		**10 Mar 2015**	**Moorabbin Aerodrome, 337° M 20Km (Yarra Glen GC)**	**Nil**	**Incident**	**Ground strike**
After landing, the balloon envelope contacted a tree that resulted in minor fabric damage.						
OA2015-03465		**19 Apr 2015**	**Amberley Aerodrome, 306.29° M 6Km**	**Nil**	**Incident**	**Collision with terrain**
During landing, the balloon contacted a tree resulting in minor fabric damage.						
OA2015-04640		**22 Apr 2015**	**Yarra Glen (HLS), 40.64° M 3Km**	**Nil**	**Incident**	**Wirestrike**
During landing, the balloon's envelope contacted power lines resulting in minor damage.						
OA2015-05274	**AO-2015-136**	**11 Nov 2015**	**Northam (ALA), 358° M 3Km**	**Nil**	**Serious incident**	**Issues**
Early on the morning of 11 November 2015, a Watco freight train was travelling southbound on the Frenches to East Northam rail line in Western Australia. As the train rounded a left corner approximately 3 km north of Northam, the driver saw a hot air balloon. The hot air balloon was low to the ground and inside the rail corridor to the left of the rail tracks. The train driver applied the brakes in an attempt to stop						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
the train before it reached the balloon's location. However, there was insufficient distance to bring the train to a stop before it passed the balloon. The driver also sounded the horn to alert the pilot and passengers of the balloon that the train was approaching. The train passed the balloon at slow speed before continuing on its journey. The balloon had been on an early morning scenic flight in the Avon Valley. The balloon was at the end of the scenic flight and on approach to land in a paddock next to the rail corridor when the train passed. The balloon was just above fence height and moving away from the rail tracks as the train passed.						
OA2016-00167	**AO-2016-008**	**7 Feb 2016**	**near Mareeba Aerodrome (Byrnes Rd)**	**Nil**	**Serious incident**	**Wirestrike**
On 7 February 2016, the pilot of a Kavanagh G-450 balloon, registered VH-RUW, conducted a 30-minute scenic flight from Mareeba, Queensland with 18 passengers on board. Shortly before 0627 Eastern Standard Time, the balloon approached the target landing area. The pilot referred to his iPad, which showed the location of the balloon and a set of powerlines strung across the paddock. The pilot sighted two power poles either side of the landing area but was unable to see the wires. The pilot estimated where the wires would be based on the crossbars on the poles and assessed that the balloon had sufficient height to pass over the powerlines. The pilot then sighted the powerlines, about half a metre ahead of and below the basket. The pilot applied all four burners to try to climb and avoid the powerlines, but the left side of the basket contacted one wire, breaking it. Due to the amount of heat in the balloon, the balloon was climbing. The pilot then conducted a normal controlled descent and landing into a paddock about 500 m beyond the original planned landing site. The balloon landed without further incident, and no one was injured. The wicker basket sustained scorching and a stainless-steel cable fixed to the underside of the basket sustained arc damage.						
OA2016-00569	**AO-2016-039**	**24 Apr 2016**	**near Cessnock Aerodrome (Rothbury)**	**Minor**	**Accident**	**Fire**
On 24 April 2016, the pilot of Kavanagh Balloons B400, registered VH-WNV (WNV) prepared to land at Rothbury near Cessnock New South Wales. On board were the pilot and 16 passengers. After a gentle touchdown, the pilot advised the ground crew that the balloon needed to be moved back about 10 m from the tree line. The pilot checked that the neck of the balloon was not obstructed and then turned on the pilot light of one of the two burners. Moments later the pilot noted that the wind had pushed part of the neck of the balloon back on itself, and there was black smoke emanating from this area. As the balloon envelope kept sliding on itself, the fire continued and some of the melted fabric began to drip onto the occupants of the basket. The pilot quickly re-directed the ground crew from the task of pulling the top of the balloon down, to assisting the passengers to disembark and move away to a safe area. The pilot pulled the smart vent to rapidly release any air. Both the ground crew and the pilot (still in the basket) discharged fire extinguishers. Within a few minutes, the crew were able to spread the balloon envelope out and extinguish the fire. During the emergency disembarkation, two of the passengers received minor injuries. The lower section of the balloon envelope was substantially damaged.						
OA2016-00589		**22 Apr 2016**	**near Cessnock Aerodrome**	**Serious**	**Accident**	**Ground handling | Cabin injuries**
After landing, the ground crew mishandled the crown line and the balloon basket tipped over. The pilot fell from the basket and was struck by the burner resulting in serious injuries.						
OA2016-00694	**AO-2016-052**	**21 May 2016**	**near Moorabbin Aerodrome (Black Rock)**	**Nil**	**Serious incident**	**Forced / Precautionary landing | Other Flight preparation / Navigation | Other Weather**
On 21 May 2016, the pilot of a Kavanagh Balloons E-240, registered VH-VBM (VBM), planned to conduct a one-hour scenic flight from Bundoora, Victoria with nine passengers. The wind was from the north to north-west at 5 to 10 kt. The pilot therefore assessed the balloon would track in a southerly direction and nominated potential landing sites at Burnley and Dendy Park in Brighton. At about 0700 Eastern						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
Standard Time, the balloon departed Bundoora in company with five other balloons. About 35 minutes later, the balloon arrived overhead Burnley. The pilot of VBM elected to continue to Dendy Park, along with another balloon from the same operator, to extend the flight to one hour. At about 0800, the balloon in company with VBM landed safely at Dendy Park. The wind speed was about 10 kt as VBM approached Dendy Park. As the balloon descended to land, the pilot sighted a light pole directly in the balloon's path. The pilot then lit the balloon's burners to climb over the pole; however, a second light pole stood directly in the balloon's path on the far side of the available landing area. Due to the balloon's height and the wind, the pilot assessed that the balloon may collide with the second pole if the pilot attempted a landing and therefore elected not to land in the park. The pilot then attempted to land in a golf course beyond the park, but the balloon did not track towards a safe landing area. The balloon continued at low level over parkland, however, the pilot also assessed this area to be unsafe for landing. At about 0820, the balloon crossed the coast and tracked out over Port Phillip Bay. The pilot commenced a climb into a more westerly wind to track towards land. At about 0825, the pilot contacted air traffic control (ATC) and requested a clearance to climb to 5,000 ft. About 90 seconds later, the pilot advised that they were now at 4,000 ft and may require emergency assistance. At that time, the pilot stated that the balloon had an estimated 30 minutes of fuel remaining. At about 0830, the balloon tracked back over land. The pilot advised ATC that in the 5 minutes it would then take to descend and land, the balloon would track back over water. The pilot elected to descend to conserve fuel and prepared for a water landing. The pilot briefed the passengers and descended about 1 km from shore. The pilot then enacted the company emergency procedures. When asked by ATC if it was their 'intention to ditch the balloon at the moment', the pilot confirmed that it was. At about 0845, the pilot established contact with the crew of a nearby vessel. The pilot coordinated with the crew of the vessel to arrange the evacuation of passengers. The passengers evacuated one or two at a time onto the vessel over the next 30 minutes. After evacuating the passengers, the pilot conducted a climb to about 2,000 ft back into more favourable winds and subsequently landed safely at Mount Martha, Victoria. The pilot and passengers were uninjured, and the balloon was not damaged.						
OA2016-01346		**13 Apr 2016**	**Moorabbin Aerodrome, 43° M 40Km**	**Nil**	**Incident**	**Wirestrike**
During landing, the hot air balloon's envelope struck power lines resulting in minor damage to the envelope.						
OA2016-01808	**AO-2016-080**	**16 Jul 2016**	**York (ALA), 139° T 1Km (Bayly Road)**	**Serious**	**Accident**	**Cabin injuries | Hard landing**
On the morning of 16 July 2016, a Kavanagh Balloons E-300 hot-air balloon, registered VH-LPG, departed for a one-hour scenic flight from Irishtown, Western Australia. On board were the pilot and 16 passengers. The balloon tracked in a south-easterly direction and after about 52 minutes of flight covering a distance of about 33 km, the pilot made an approach to a vacant paddock near York. The balloon made an initial ground contact with about 15 kt forward speed. When the balloon struck the ground, the pilot was ejected from the balloon basket. The basket was then dragged over the top of the pilot as the balloon envelope continued to deflate. The pilot was seriously injured and air lifted to the Royal Perth Hospital. One passenger received a minor injury, and the balloon sustained minor damage.						
OA2017-02689		**8 Jun 2017**	**Southport Aerodrome, 327.42° M 5Km (Robert Dalley Park)**	**Nil**	**Incident**	**Controlled flight into terrain**
During approach, the basket contacted a goalpost, resulting in damage to the goalpost.						
OA2017-03172		**16 Jul 2017**	**near Moorabbin Aerodrome**	**Nil**	**Serious incident**	**Collision with terrain**
During landing, the balloon struck a fence resulting in minor damage.						
OA2017-04979		**3 Oct 2017**	**Boonah (ALA), 069° M 32Km (Veresdale)**	**Minor**	**Incident**	**Cabin injuries**

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
During landing, a passenger was not bracing correctly, resulting in minor injuries.						
OA2017-05386		**15 Oct 2017**	**near Cessnock Aerodrome**	**Nil**	**Incident**	**Other Crew and Cabin Safety**
During balloon inflation, a passenger got their scarf caught in the fan.						
OA2017-05614		**22 Nov 2017**	**Essendon Aerodrome, 151° T 15Km (Fawkner Park)**	**Serious**	**Accident**	**Hard landing**
During landing, the balloon basket landed hard resulting in serious injury to a passenger.						
OA2017-06145		**18 Dec 2017**	**near Lilydale (ALA)**	**Nil**	**Accident**	**Collision with terrain**
After landing, the balloon envelope drifted into a tree resulting in damage to the fabric.						
OA2018-00050	**AO-2018-004**	**13 Jan 2018**	**Maitland (NSW) Aerodrome, 288.92° T 15Km (Greta)**	**Serious**	**Accident**	**Collision with terrain | Hard landing**
The balloon was conducting a scenic charter flight in the Hunter Valley. Shortly after take-off, the balloon experienced strong winds and turbulent conditions. Consequently, the balloon deviated from its intended flight path and landing area. Due to the adverse conditions, the pilot decided to land at the first suitable site. Due to the wind conditions, the balloon landed with a significant forward velocity and was dragged for a considerable distance on its side by the balloon's partially deflated envelope. As the basket was being dragged, it struck a large bush, forcing it upwards before impacting the ground with considerable force. One passenger received severe injuries, while three others sustained minor injuries.						
OA2018-00097		**13 Jan 2018**	**Maitland (NSW) Aerodrome, 277.82° M 10Km (Greta)**	**Nil**	**Accident**	**Collision with terrain**
During landing, the balloon struck a tree resulting in substantial damage.						
OA2018-00197		**13 Jan 2018**	**Maitland (NSW) Aerodrome, 278.73° M 10Km (Greta)**	**Nil**	**Serious incident**	**Fire | Control issues | Turbulence / Windshear / Microburst**
During approach, the balloon encountered unstable wind conditions resulting in a loss of altitude. The pilot applied heat to gain height but the flame blew to the back of the opening, resulting in multiple panels being burnt.						
OA2018-00344	**AO-2018-016**	**8 Feb 2018**	**Lilydale (ALA), 36.7° T 9Km**	**Serious**	**Accident**	**Hard landing**
On 8 February 2018, a Kavanagh B-350 hot-air balloon, registration VH-EUA, departed Glenburn, Victoria for a scenic charter flight with a pilot and 15 passengers on board. About 45 minutes into the flight, over the Yarra Valley, the balloon experienced a sudden wind change with associated turbulence. The pilot decided to land immediately rather than continue over rising and heavily vegetated terrain. The resulting landing was hard and fast and 11 passengers were injured, with four of them receiving serious injuries.						
OA2018-00537		**12 Feb 2018**	**Mareeba Aerodrome**	**Nil**	**Incident**	**Low fuel**

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
After three missed approaches due to variable surface winds, the balloon landed with minimum fuel.						
OA2018-01542	**AO-2018-027**	**30 Mar 2018**	**near Cessnock Aerodrome (Pokolbin near McDonald Rd.)**	**Serious**	**Accident**	**VFR into IMC | Hard landing**
At about 0710 Eastern Daylight-saving time on 30 March 2018, a Kavanagh Balloons G-525 balloon, registered VH-HVW (HVW) and operated by The International Balloon Flight Company (Australia), launched from a site near Pokolbin, New South Wales for a planned 1-hour scenic flight. HVW was one of three balloons launched by the company from the same site. After climbing through fog to about 2,000 ft and realising how far the fog layer extended, the pilot of HVW, along with the other two pilots, decided to abort the flight and descend for a landing at the nearest suitable site. On approach to land in low-visibility conditions, HVW collided with trees, which caused the basket to rotate 180 degrees. It then landed heavily, resulting in injuries to 16 of the 24 passengers, 3 of them serious. The pilot was uninjured and 74 of the balloon's panels required patching or repair.						
OA2018-01543		**31 Mar 2018**	**Tyagarah (ALA), 338.62° T 12Km (The Pocket Road, Billinudgel)**	**Nil**	**Serious incident**	**Wirestrike**
During landing, the balloon struck a powerline.						
OA2018-01558		**2 Apr 2018**	**Narrandera Aerodrome, 0° M 25Km**	**Minor**	**Incident**	**Collision with terrain | Loss of control**
After landing while the balloon was deflating, a gust of wind caused the basket to roll over, and two passengers received minor injuries.						
OA2018-01638	**AO-2018-028**	**2 Apr 2018**	**Essendon Aerodrome, 085° M 18Km**	**Minor**	**Incident**	**Operational / Crew and Cabin Safety | Cabin Injuries**
Before flight, the pilot and ground crew conducted safety briefings for passengers on what to do and expect during take-off, flight and landing; including what positions to adopt for each stage of flight. Five minutes before landing the pilot told passengers to adopt the proper landing position. The balloon touched down and the pilot conducted a lay-over landing, where the basket tips and drags on the ground. A passenger sustained minor injuries and there was no damage to the balloon. This incident underlines the importance of following the safety procedures and ensuring that all passengers fully understand the instructions. Due to the effective communication and briefings, the passengers were able to assume the correct landing position, which resulted in only one passenger suffering minor injuries.						
OA2018-01789		**9 Apr 2018**	**near Mareeba Aerodrome**	**Nil**	**Serious incident**	**Other Ground operations**
During final approach, a ground crew member walked in front of the approaching balloon. The pilot called out to the ground crew member who took evasive action to avoid the landing basket.						
OA2018-01933		**24 Apr 2018**	**Southport Aerodrome, 280° T 40Km (near Cedar Grove Rd Beaudesert)**	**Nil**	**Serious incident**	**Wirestrike**
After landing, the crown rope broke and a gust of wind blew the balloon envelope into powerlines.						
OA2018-02105		**2 May 2018**	**Gold Coast Aerodrome, 316.82° T 22Km (Lakeside Drive, Emerald Lakes.)**	**Nil**	**Incident**	**Controlled flight into terrain**

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
During final approach over a waterway, the balloon briefly made contact with the water.						
OA2018-04934		**17 Aug 2018**	**The Oaks (ALA)**	**Nil**	**Incident**	**Rejected take-off | Ground handling | Other Airframe**
Prior to take-off, the tie-off rope between the balloon basket and the vehicle snapped resulting in the basket dragging for 20 m. The crew subsequently rejected the take-off.						
OA2018-05220		**22 Aug 2018**	**Kooralbyn (ALA), 56° M 17Km**	**Nil**	**Incident**	**Fire | Control issues | Turbulence / Windshear / Microburst**
Passing 500 ft on approach, the balloon encountered windshear and descended. The turning vent lines of the balloon were subsequently singed by the burner flame resulting in minor damage.						
OA2018-06829		**23 Sep 2018**	**near Essendon Aerodrome**	**Nil**	**Incident**	**Other Flight preparation / Navigation | Avionics / Flight instruments**
During approach, the hot air balloon lost communication with ATC and landed approximately 4.5 nautical miles from the intended landing site.						
OA2018-06913		**5 Oct 2018**	**Gold Coast Aerodrome, 307° M 61Km**	**Nil**	**Incident**	**Collision with terrain**
During landing, the balloon scoop bounced and hit a tree resulting in minor damage.						
OA2018-07160		**9 Oct 2018**	**abeam Southport Aerodrome (Maudsland)**	**Nil**	**Incident**	**Ground handling**
Due to another balloon obstructing the take-off path, while the pilot was moving the balloon to a more suitable spot the balloon struck a nearby tree resulting in minor damage to the envelope.						
OA2018-08008		**8 Nov 2018**	**Essendon Aerodrome**	**Nil**	**Incident**	**Airspace infringement | Aircraft preparation**
During cruise, the hot air balloon climbed above the assigned level of 2,000 ft. The crew were not aware of the updated controlled airspace steps.						
OA2018-08298		**18 Nov 2018**	**Moorabbin Aerodrome, 321° T 11Km (Princes Park in Caulfield South)**	**Nil**	**Incident**	**Collision with terrain | Unforecast weather**
During landing, the balloon collided with a tree and sustained minor damage.						
OA2018-09104		**21 Dec 2018**	**Lilydale (ALA), 265.70° M 21Km (Ramptons Road Reserve, Eltham)**	**Nil**	**Serious incident**	**Forced / Precautionary landing | Collision with terrain | Unforecast weather**
During approach, the balloon encountered unforecast weather and the crew conducted a precautionary landing. The balloon envelope subsequently struck trees resulting in minor damage.						
OA2018-09128	**AO-2019-001**	**26 Dec 2018**	**near Coldstream (ALA)**	**Minor**	**Accident**	**Forced / Precautionary landing | Collision with terrain | Fire**

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
On 26 December 2018, a Kavanagh B-350 hot air balloon, registration VH-ZYO, operated as a scenic charter flight by Go Wild Ballooning, departed from Wandin, Victoria with the pilot and 15 passengers on board. After 20 minutes in flight, and while operating at an altitude of about 800 ft, the pilot recalled hearing a small explosion from the front left burner and observed that a small fire had started on the outside of the burner. The pilot switched off the vapour valve at the fuel tanks to the front two burners and disconnected the hoses. About a minute later, the pilot attempted to put out the fire using one of two on-board extinguishers, but the fire re-ignited almost immediately. After a further minute, the pilot discharged the second fire extinguisher, but again the fire re-ignited. Moments later, the pilot's compartment caught fire. The pilot was wearing a cotton shirt, synthetic vest, rolled-up pants, and rubber slip-on shoes and began to feel uncomfortable with his proximity to the fire. He then moved from the pilot's compartment to the back left compartment of the basket. About 8 minutes after the fire started, the pilot identified a suitable landing position and began the approach. During the descent, the basket struck some treetops, and the ropes became tangled in the branches. Passengers reported that the branches whipped around and into the basket, with one passenger sustaining cuts to his hand. The pilot freed the ropes from the tree and brought the balloon to rest in the paddock below. As the basket touched the ground, the passengers jumped out and ran to safety. The fire continued to burn as the pilot secured the balloon. When emergency services arrived on site, flames had engulfed the balloon. By the time firefighters extinguished the flames, the fire had destroyed the balloon.						
OA2018-09492		**31 Dec 2018**	**Camden Aerodrome**	**Minor**	**Incident**	**Cabin injuries**
During balloon deflation, the basket rolled over, and a passenger sustained a minor injury.						
OA2019-00907		**18 Feb 2019**	**Moorabbin Aerodrome, 41° T 15Km (High St and George St Wantirna South)**	**Nil**	**Incident**	**Collision with terrain**
The balloon encountered a sudden wind change resulting in a longer landing run. The balloon subsequently contacted trees and the envelope sustained minor damage.						
OA2019-00909		**18 Feb 2019**	**near Melbourne Aerodrome**	**Nil**	**Incident**	**Collision with terrain | Control issues**
During landing in windy conditions, the balloon's basket skidded along the ground and the envelope was deflated over trees. The envelope sustained minor damage.						
OA2019-01685	**AO-2019-014**	**16 Mar 2019**	**Coldstream (ALA), 6° T 5Km**	**Serious**	**Accident**	**Ground handling | Cabin injuries**
On 16 March 2019, two passengers were seriously injured when the basket of a Kavanagh B 400 hot air balloon tipped over during vehicle-assisted deflation. Prior to the accident, the balloon, operated as a scenic charter flight, landed without incident at a private property near Coldstream, Victoria. Due to a lack of wind and the large size of the envelope, the crew elected to use the retrieval vehicle to assist by pulling the envelope over (by the crown line) during the deflation. During this process, with 16 passengers and the pilot on board, the vehicle assisting inadvertently pulled the basket over, seriously injuring two passengers.						
OA2019-02491		**8 Apr 2019**	**Melbourne Aerodrome, 090° M 46Km**	**Nil**	**Accident**	**Fire**
During descent, as the pilot began to arrest the rate of descent by applying heat the burner flame contacted the balloon fabric resulting in substantial burn damage.						
OA2019-02917		**30 Apr 2019**	**Kooralbyn (ALA), 49° T 22Km (Gould Hill Road, Beaudesert)**	**Nil**	**Serious incident**	**Fire**
During descent, the burners were pointed backwards resulting in fire damage to the balloon fabric and the turning vent line.						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
OA2019-04093		**7 Jun 2019**	**Moorabbin Aerodrome, 345° M 15Km**	**Nil**	**Incident**	**Forced / Precautionary landing | Other Weather**
During approach, the wind became unpredictable, and the pilot conducted a precautionary landing on a private property.						
OA2019-05253		**23 Jul 2019**	**Kooralbyn (ALA), 55.50° M 17Km (Beaudesert)**	**Nil**	**Incident**	**Forced / Precautionary landing | Collision with terrain | Unforecast weather**
During the flight, the balloon encountered unforecast weather and conducted a precautionary landing. The balloon envelope subsequently made contact with a tree resulting in minor damage.						
OA2019-07006		**22 Sep 2019**	**Moorabbin Aerodrome, 360° M 11Km**	**Nil**	**Serious incident**	**Collision with terrain**
During landing, the pilot deployed the handling line to ground crew. The pilot determined that the balloon was unable to land and instructed ground crew to let go of the handling line in order to manoeuvre to a different landing site. During the subsequent climb, the basket of the balloon contacted the roof of a house.						
OA2019-07324		**7 Oct 2019**	**Maitland (NSW) Aerodrome, 300° M 9Km**	**Minor**	**Serious incident**	**Collision**
During landing, the balloon collided with another balloon's basket on the ground.						
OA2019-07651		**21 Oct 2019**	**near Southport Aerodrome (Boyland/Biddadaba)**	**Nil**	**Serious incident**	**Collision with terrain**
During descent, the balloon struck treetops resulting in minor damage.						
OA2019-09230		**30 Nov 2019**	**Wirraway Station (ALA), 13.86° T 3Km (Private Property 3459 Beaudesert)**	**Nil**	**Incident**	**Ground handling**
During post-flight balloon deflation, the crown line rope gave way and the envelope rolled onto a fence resulting in minor damage.						
OA2020-03379		**4 Jul 2020**	**Alice Springs Aerodrome**	**Nil**	**Incident**	**Air-ground-air**
While overflying the aerodrome, the balloon pilot did not make the necessary radio calls on the CTAF.						
OA2020-05252		**27 Oct 2020**	**Cessnock Aerodrome, 256° T 6Km (De Beyers Road)**	**Nil**	**Incident**	**Taxiing collision / Near collision**
During preparation for departure, a gust of wind caused the balloon basket to come into contact with the tie-off vehicle.						
OA2020-05343		**31 Oct 2020**	**Maitland (NSW) Aerodrome, 200.08° T 6Km (Bishops Bridge)**	**Nil**	**Serious incident**	**Collision with terrain**

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
During launch, the pilot released the launch restraint early resulting in the balloon colliding with trees and sustaining minor damage.						
OA2021-00592		**31 Jan 2021**	**Melbourne Aerodrome, 085° T 48Km (Yarra Glen)**	**Minor**	**Incident**	**Other Aircraft control | Hard landing**
The balloon landed hard and the basket bounced and was dragged by the envelope resulting in minor injuries to 3 passengers.						
OA2021-01304	**AB-2021-008**	**14 Mar 2021**	**Essendon Aerodrome, 108° T 16Km (Bulleen Park)**	**Nil**	**Serious incident**	**Wirestrike**
During approach, the balloon struck a wire resulting in minor damage.						
OA2021-02927		**29 Apr 2021**	**Essendon Aerodrome, 152° T 15Km**	**Nil**	**Incident**	**Collision with terrain | Turbulence / Windshear / Microburst**
During landing, the balloon encountered an unexpected wind change and made contact with a light pole resulting in minor damage.						
OA2021-03261		**23 May 2021**	**Wangaratta Aerodrome, 044° T 6Km**	**Nil**	**Serious incident**	**Wirestrike**
During approach, the balloon basket struck powerlines.						
OA2021-04964	**AO-2021-042**	**8 Oct 2021**	**14.6 NM 268 degrees from Amberley Aerodrome**	**Nil**	**Serious incident**	**Collision with terrain**
On 8 October 2021, a Kavanagh Balloons E-240 balloon, registered VH-LUD and operated by Floating Images Aust. Pty Ltd was conducting a morning scenic flight about 45 km south-west of Brisbane, Queensland. On board was a pilot and 9 passengers. About 55 minutes into the flight, the pilot commenced a descent to locate a suitable landing area. During the descent, the balloon entered an area of localised fog where visibility reduced to 10 m. The pilot continued the descent into the fog until a tree was observed in the path of the balloon. The pilot attempted to avoid the tree by initiating a climb, but the balloon collided with, and came to rest on the side of the tree, damaging the lower part of the balloon envelope. The pilot subsequently climbed the balloon off the tree and above the fog. The flight continued to an uneventful landing in a nearby paddock that was clear of fog. There were no injuries.						
OA2021-05671		**31 Dec 2021**	**2 NM 84 degrees from Lilydale**	**Nil**	**Serious incident**	**Wirestrike | Turbulence / Windshear / Microburst**
On descent to the landing paddock, the balloon encountered turbulence and struck a wire resulting in minor damage.						
OA2021-05672	**AO-2022-003**	**31 Dec 2021**	**2 km 169 degrees from Lilydale**	**Serious**	**Accident**	**Hard landing | Cabin injuries**
On 31 December 2021, a Kavanagh B-350 hot-air balloon, registered VH BSW and operated as a scenic charter flight by Picture This Ballooning (PTB), was being prepared near Glenburn, north of the Yarra Valley, Victoria, with one pilot and 16 passengers. The pilot conducted a pre-flight safety briefing and departed shortly after, intending to land near Yarra Glen. About 42 minutes into the planned						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
1-hour flight, the pilot received a report that the surface wind near the landing area was increasing. The pilot assessed multiple landing options over the next 17 minutes while the wind was increasing. The pilot then made an approach to a landing field and the balloon landed hard with 2 passengers seriously injured.						
OA2021-05712		**28 Dec 2021**	**8 NM 140 degrees from Melbourne Aerodrome**	**Nil**	**Serious incident**	**Collision with terrain**
During approach to a small landing area, the balloon struck a tree and building.						
OA2022-00243		**24 Jan 2022**	**3.5 NM 173 degrees from Essendon Aerodrome**	**Nil**	**Incident**	**Collision with terrain**
During landing, the balloon struck a pole on the edge of the race track resulting in minor damage to the balloon envelope.						
OA2022-01035	**AO-2022-015**	**27 Mar 2022**	**Moorabbin Aerodrome**	**Serious**	**Serious incident**	**Hard landing | Loss of control**

Section 21 (2) of the Transport Safety Investigation Act 2003 (TSI Act) empowers the ATSB to discontinue an investigation into a transport safety matter at any time. Section 21 (3) of the TSI Act requires the ATSB to publish a statement setting out the reasons for discontinuing an investigation. The statement is published as a report in accordance with section 25 of the TSI Act, capturing information from the investigation up to the time of discontinuance.

Overview of the investigation

On 28 March 2022, the ATSB commenced an investigation into a hard landing involving a E-240 Kavanagh balloon, registration VH-ZON, which occurred at Moorabbin Airport, Victoria, on 27 March 2022.

The balloon was being operated on a scenic passenger flight between Reservoir and Moorabbin Airport with a pilot and 10 passengers on board. The pilot provided the operator's standard safety briefing to the passengers before take-off, while the passengers were in the basket, to explain and demonstrate the position to adopt during normal landings and emergencies. The position was facing opposite to the landing direction, standing with slightly bent knees, holding on to the rope handholds in front, and back rested against padding on the basket. Passengers were to remain in that position until the basket stopped.

There were several other balloons operating the same scenic flight route, and the pilots had collectively decided the departure point and that the weather was suitable for their respective flights (all along the same route). The pilots reviewed several sources of weather information, including the Bureau of Meteorology aerodrome forecasts (TAF) for Melbourne, Essendon and Moorabbin. The Moorabbin TAF forecast the wind to be 11 kt from the north-east at the time the balloons were due to land.

The pilots had also obtained information about the actual wind conditions prior to departure by releasing 2 piballs[1] in different locations to assess the speed and direction of the wind at different levels. Following this assessment, the balloons departed at about 0700 local time.

The pilot had about 30 years' experience as a balloon pilot and had been operating balloons in the area for about 18 years, with extensive knowledge of the planned route.

On approach to Moorabbin Airport, VH-ZON was travelling in a south-easterly direction and was about 500 m to the west of the other balloons. The pilot obtained automatic terminal information by radio for Moorabbin, and it advised of a 4-kt north-easterly surface wind.

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
The pilot reported that they had commenced the descent into Moorabbin Airport after the other balloons and found the wind to be faster at the lower levels than expected. Data collected via another balloon pilot's navigation equipment post-accident showed the wind was about 38 kt at 1,400 ft and 35 kt at 1,000 feet, which was significantly faster than the pilots had anticipated. This meant that the pilot had to conduct a faster than usual descent to ensure they could land the balloon in a suitable area. When the balloon reached 300–400 ft, it travelled through a temperature inversion (where temperature increases with altitude, which is a reversal of typical atmospheric conditions) and the balloon rotated 120°. Although the passengers had been instructed to adopt the landing position, the pilot did not have time to rotate the balloon to the correct orientation (with the passengers facing opposite to the landing direction) before reaching the ground. On landing, the balloon impacted the front right corner of the basket and bounced. The basket was then dragged for a short distance, coming to rest in a culvert at the end of a runway within the airport boundary. As a result of the hard landing and the orientation of the basket, 1 passenger was seriously injured and 2 passengers received minor injuries. As part of its investigation, the ATSB interviewed the pilot and passengers and reviewed: • weather information including observations and forecasts used by the pilot • air traffic control recordings • recorded navigation information used in-flight by one of the other balloon pilots (data could not be retrieved from the equipment used on the accident balloon) • the operator's procedures for passenger briefings • photographs taken in-flight by the balloon operator and others that were provided by passengers and a witness on the ground. The ATSB notes that, due to unexpected wind speed on descent (which was much higher than the surface wind information that the pilot had previously obtained), and the limited landing site options, the pilot decided to land as soon as possible. This resulted in a faster and harder landing than normal. The balloon's abnormal orientation after passing through the temperature inversion meant that although the passengers were in the correct position for landing, there was a greater risk of injury. Reasons for the discontinuation Based on a review of the available evidence, the ATSB considered it was unlikely that further investigation would identify any systemic safety issues or important safety lessons from this specific occurrence. Consequently, the ATSB has discontinued this investigation. However, the ATSB is concerned about the number of accidents that have been occurring in commercial balloon operations and has listed the reduction of passenger injuries in commercial ballooning operations as one of its Safety Watch items. The evidence collected during the investigation involving VH-ZON will be used in a safety study further examining these types of accidents.						
OA2022-01466	**AO-2022-028**	**20 Apr 2022**	**14.6 km 314 degrees from Moorabbin Aerodrome**	**Minor**	**Serious incident**	**Forced / Precautionary landing | Collision with terrain | Flight controls**
On the morning of 20 April 2022, a Kubicek BB78Z hot-air balloon, registered VH-RJR and operated by Liberty Balloon Flights, was being prepared for a balloon transport flight for 13 passengers from Royal Park, Victoria. This was the first flight of the balloon since manufacture and the intended destination was Moorabbin Airport. The pilot did not observe any abnormalities during the pre-flight inspection, and after the passengers boarded, the balloon departed for an anticipated 1-hour flight. Shortly after departing, and while flying over the Melbourne Central Business District, the pilot noticed a small gap in the balloon's manually operated deflation system between the edge of the vent panel – a fabric panel used to						

ATSB Ref Number	Investigation Number (if app)	Occurrence Date	Location	Highest Injury Level	Occurrence Class	Occurrence Categories
vent air out of the circular opening at the top of the balloon (vent aperture) – and the vent aperture. This gap allowed hot air to leak out reducing the buoyancy of the balloon. The pilot was unable to seal the gap and descended the balloon to a lower altitude in search of a suitable landing location. The pilot decided to attempt a landing at Elwood Beach, with the basket impacting the roofs of 2 buildings on the way there. During the approach to the beach, the pilot descended the balloon through trees into a suburban street. The basket landed outside the entrance of an apartment building and the envelope deflated over the building's roof. The balloon and basket sustained minor damage during the forced landing, and 3 passengers sustained minor injuries.						
OA2022-02688		**15 Jul 2022**	**near Canberra Aerodrome**	**Nil**	**Incident**	**Forced / Precautionary landing | Other Weather**
During cruise, the wind became unpredictable and the pilot conducted a precautionary landing on the side of the road.						
OA2022-04444		**25 Nov 2022**	**6.7 NM 131 degrees from Essendon Aerodrome**	**Minor**	**Serious incident**	**Collision with terrain**
During landing, the balloon struck a tree resulting in minor damage to the envelope. One passenger sustained a minor injury.						
OA2022-04461		**18 Nov 2022**	**4.06 NM 42.07 degrees from Lilydale**	**Minor**	**Incident**	**Cabin injuries | Hard landing**
The balloon bounced and landed hard resulting in a passenger sustaining minor injuries.						
OA2022-04611		**21 Nov 2022**	**8.58 NM 160.07 degrees from Essendon Aerodrome**	**Nil**	**Incident**	**Collision with terrain**
During landing, the balloon basket came into contact with a sign.						
OA2022-04850		**4 Nov 2022**	**near Northam**	**Minor**	**Incident**	**Other Ground operations**
During inflation, the balloon envelope came into contact with a person and a fence.						

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 occurrence 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.