



Australian Government

Australian Transport Safety Bureau

# Ground strike involving British Aerospace BAe 146-300, VH-SAJ

Brisbane Airport, Queensland, on 25 June 2024



## ATSB Transport Safety Report

Aviation Occurrence Investigation (Defined)

AO-2024-036

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# Investigation summary

## What happened

On 25 June 2024, a British Aerospace BAe 146-300, registered VH-SAJ, was being operated by ASL Airlines Australia on a freight flight from Sydney, New South Wales, to Brisbane, Queensland. On board the aircraft were the captain and first officer.

While on descent into Brisbane, the meteorological conditions worsened with visibility reducing to about 1,000 m in fog. The crew conducted an instrument approach for runway 19L, using the autopilot, and visually identified the high intensity approach lighting at about 220 ft. The first officer disconnected the autopilot at about 110 ft and made control inputs that resulted in an increasing aircraft pitch attitude with decreasing airspeed. The aircraft touched down with a high pitch angle and a vertical acceleration of about 2.4 g. The tail of the aircraft struck the runway, resulting in damage to the tail strike indicator and surrounding panels.

## What the ATSB found

The ATSB's investigation identified that the first officer likely became disoriented after disconnecting the autopilot and lost situation awareness. Consequently, they did not identify the increasing aircraft pitch attitude, decreasing airspeed, or low power setting and did not correct the resulting sink rate prior to touchdown. The captain prevented further rearward input by the first officer during the flare by placing their hand on the control column, likely reducing the severity of the tail strike.

It was also found that during the approach the captain became preoccupied with the remaining fuel on board and this likely limited their capacity to monitor other factors such as the first officer's ability to undertake the approach and the undesired state of the aircraft during the flare. The ATSB also identified that the captain's actions and communications during the approach likely increased the pressure on the first officer to commit to the landing.

Prior to joining the operator, the captain had predominantly flown single pilot operations in non-jet aircraft. They had been promoted to the position of captain early, which resulted in a missed opportunity to gain valuable experience within a multi-crew environment prior to commencing in the role. This limited multi-crew experience likely reduced the captain's capacity to include the first officer in the decision-making process during the approach or make an authoritative decision to assume the pilot flying role.

The ATSB identified that both the captain and first officer had been appointed to their respective positions despite not meeting the ASL Airlines Australia minimum experience requirements. This occurred without additional controls in place to manage the risk of lower experienced pilots and resulted in a reduction in the intended experience level on the flight deck for the incident flight.

## What has been done as a result

Following an internal investigation by ASL Airlines Australia the following safety actions have been taken:

- The upgrade or fleet transfer requirement of a minimum of 500 hours on a company type, or as deemed appropriate by the Director of Flight Operations contained in the operations manual was amended to a minimum of 500 hours on a company type, or similar type in terms of maximum take-off weight as deemed appropriate by the Director of Flight Operations, Head of Training and Checking and Director of Safety.
- Inexperienced flight crew that have been checked to line will not have their inexperienced status removed without a review of the candidate's progress by the Director of Flying Operations or Head of Training and Checking.
- The Planned Supervised Line Flying sectors for Captains – No Jet Experience listed in the OM-D – Training and Checking Manual have been increased from 30 to 36 sectors.
- Supervised Line Flying sectors for First Officers without previous jet experience has been increased from 30 to 36 sectors.
- The Fleet Training Manager will review a candidate's experience at the planning stage, and may elect to plan less, or more sectors, dependent upon the candidate's progress.
- Additional systems to track pilots with inexperienced status to avoid inadvertent rostering of inexperienced crew together.
- The operator's internal review identified an inconsistency between the operator's standard operating procedures and the manufacturer's recommendation with regard to which pilot (the pilot flying or the pilot monitoring) was to make an 'attitude' call when the aircraft pitch angle approaching landing increased above 5°.
- The BAe 146 standard operating procedures manual has been updated and aligns with the manufacturer's recommendation.
- The operator's internal review identified there was no policy stipulating that the captain must perform the landing when the weather conditions are below certain weather criteria.
- A policy has been developed and incorporated into the operations manual that states the captain must conduct the approach and landing with visibility within 1,000 m and cloud within 100 ft of the minima unless the pilot in command is a company approved training or check pilot.

## Safety message

Current shortages of aviation professionals, including pilots, have resulted in the need for operators to employ crew with less experience than has previously been expected. Operators are encouraged to review the employment and promotion processes for inexperienced crew, ensuring that additional training programs, or limitations on inexperienced crew and the pairing of less experienced crew during rostering are considered.

# The occurrence

## Overview

On 25 June 2024, a British Aerospace BAe 146-300, registered VH-SAJ, was being operated by ASL Airlines Australia on a freight flight<sup>1</sup> from Sydney, New South Wales, to Brisbane, Queensland. There were 2 flight crew on board. The captain was pilot monitoring, and the first officer (FO) was pilot flying.<sup>2</sup>

The aircraft departed Sydney at about 0415 with first light occurring at Brisbane at 0613. The forecast visibility for arrival at Brisbane was 10 km. While on descent to Brisbane, the meteorological conditions worsened with visibility reducing to about 1,000 m in fog. The crew conducted an instrument landing system (ILS) approach for runway 19L,<sup>3</sup> using the autopilot, and visually identified the high intensity approach lighting at about 220 ft.

The FO disconnected the autopilot at about 110 ft and made control inputs that resulted in an increasing aircraft pitch attitude with decreasing airspeed. The aircraft touched down with a high pitch angle and a vertical acceleration of about 2.4 g. The tail of the aircraft struck the runway, resulting in damage to the tail strike indicator and surrounding panels.

## Cruise and descent

At about 0457, while the aircraft was in cruise at flight level<sup>4</sup> (FL) 270 and approximately 350 km to the south of Brisbane, air traffic control (ATC) advised the crew to expect runway 19L for their arrival.

At about 0505, cockpit voice recorder (CVR) data indicated that the captain obtained the automatic terminal information service (ATIS)<sup>5</sup> for Brisbane Airport. The meteorological conditions at that time were reported as a wind from 190° at 8 kt, visibility greater than 10 km with showers in the area, cloud few<sup>6</sup> at 500 ft, scattered<sup>7</sup> at 3,000 ft, and a temperature of 14°C (see *Meteorological information*). The captain then completed the take-off and landing data (TOLD) card. This included calculated figures for fuel overhead the destination (Brisbane) of 2,400 kg and a minimum divert fuel of 1,700 kg.

The crew then conducted a briefing for the arrival into Brisbane and the ILS approach for runway 19L (see *Airport information*).

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<sup>1</sup> The flight was operated under Civil Aviation Safety Regulations Part 121 (Air transport operations – larger aeroplanes).

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

<sup>3</sup> Runways are named by a number representing the magnetic heading of the runway. Parallel runways are represented by an L for left and R for right.

<sup>4</sup> Flight level: at altitudes above 10,000 ft in Australia, an aircraft's height above mean sea level is referred to as a flight level (FL).

<sup>5</sup> ATIS: an automatic service which broadcasts airport specific information on the aviation VHF radio frequencies.

<sup>6</sup> Few: 1–2 okta of cloud cover. An Okta is a unit of measurement used to describe the extent of cloud cover (1–8).

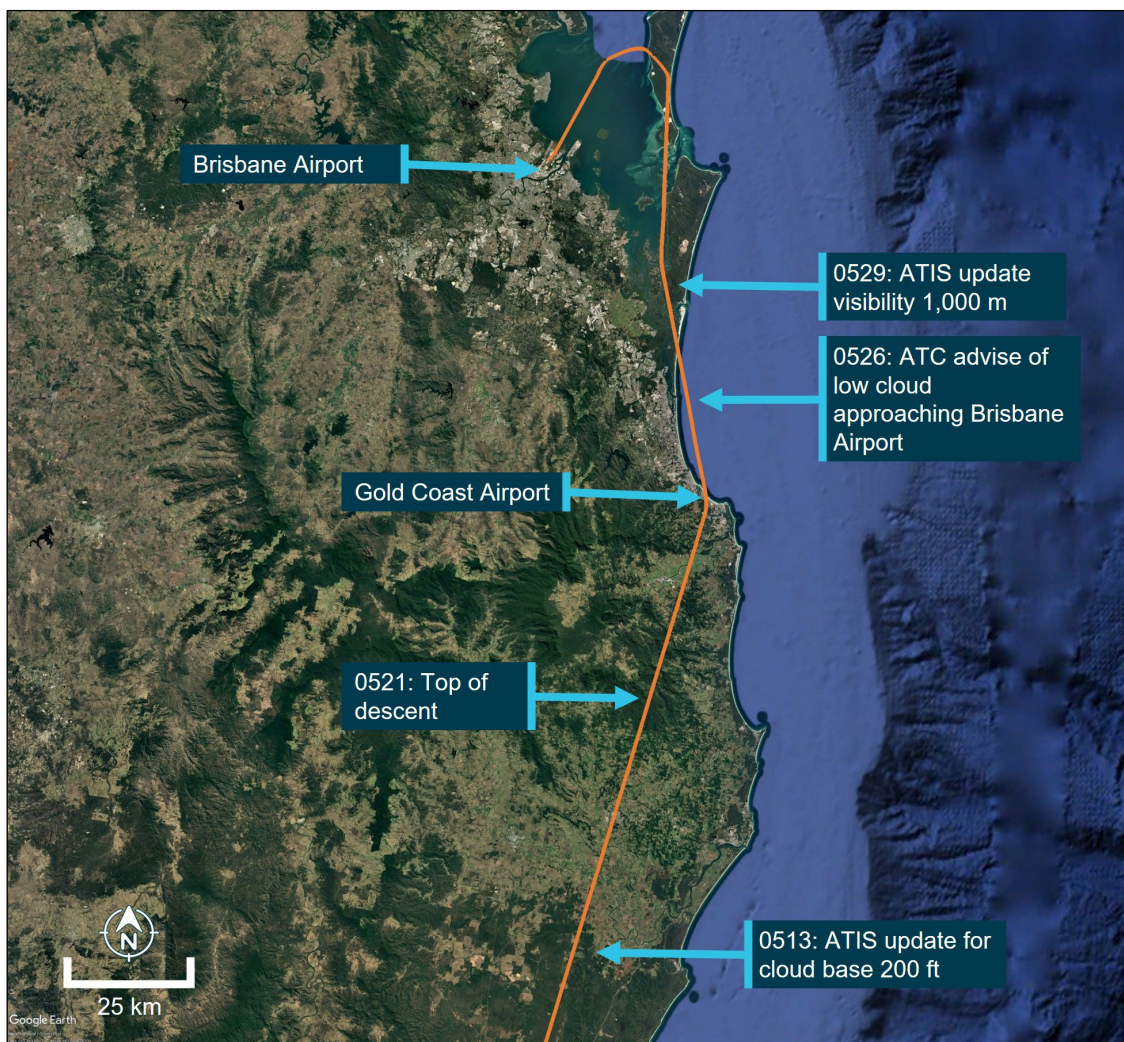
<sup>7</sup> Scattered: 3–4 okta of cloud cover. An Okta is a unit of measurement used to describe the extent of cloud cover (1–8).

During the briefing, the FO noted the minima for the approach including a decision altitude (DA)<sup>8</sup> of 220 ft and visibility of 800 m, stating that conditions in Brisbane at the time were 'showers and wet'.

At 0513, ATC advised the crew that the ATIS had been updated, and the cloud was now few at 200 ft, scattered at 3,000 ft and the temperature was 13°C. At 0519, when the aircraft was about 125 km south of Brisbane, ATC issued the crew with a clearance to descend to FL 130. A short time later, the captain commented on the cloud at 200 ft to the FO. The FO stated that they had 20 minutes of fuel, which was enough for a second approach if needed. The captain replied with 'yeah, then we're landing anyway'. The crew then completed the approach checklist.

The captain later advised that they believed their comment was a standard operational comment based on fuel limits.

**Figure 1: VH-SAJ flight track for arrival to Brisbane Airport**



Source: Google Earth, annotated by the ATSB. \*Flight was conducted in darkness

<sup>8</sup> Decision altitude is a specified altitude in the precision approach at which a missed approach must be initiated if the required visual reference to continue the approach has not been established.

At 0521, the crew commenced the descent to FL 130. At 0525, ATC issued the crew with a further clearance to descend to 9,000 ft. A short time later, the crew were advised by ATC to expect the ILS approach for runway 19L.

At 0526, when the aircraft was about 67 km south-east of Brisbane, ATC advised the crew of low cloud south of the airport that was moving north and that they may be required to delay their arrival. On receipt of the meteorological information from ATC, the captain commented to the FO that they had 'no fuel'. The FO proposed that they had sufficient fuel to complete 2 approaches, declare minimum fuel, and complete a third approach. The captain commented that they would just land from the second approach as they would 'rather be on the ground', expressing concerns about the paperwork involved.

Over the following 2 minutes, the captain and the FO continued to discuss the options for the approach with the captain stating that, given the fuel state, conducting a go-around may result in a worse scenario as they expected the meteorological conditions at Brisbane to worsen. The crew did not discuss options for a diversion if they were required to undertake a go-around due to the meteorological conditions. The closest suitable airport was the Gold Coast (*see Gold Coast Airport meteorological conditions during flight*).

At 0529, ATC advised that the visibility had reduced to 1,000 m in fog, with a cloud base of 200 ft and that low visibility procedures were in force with the high-intensity approach and runway lighting operating.

At 0530 the crew discussed the changing meteorological conditions. During this discussion, the captain stated that the conditions would only get worse and if they could see the high-intensity approach lighting, then they were going to land. The FO agreed and stated that the captain should 'call it when you see it'.

At about 0531, the aircraft passed through 11,000 ft and, a short time later, the crew initiated the additional approach checks. At 0533, the crew were cleared to continue the descent to 4,000 ft.

There were 3 aircraft ahead of VH-SAJ on approach to land on runway 19L at Brisbane Airport. At about 0532, the first of the 3 preceding aircraft landed and reported becoming visual with the runway at the minima.

## Final approach

At 0534, ATC provided a clearance for the crew to undertake the ILS approach for runway 19L.

At 0536, the second aircraft in the sequence ahead of VH-SAJ conducted a go-around, later reporting to the ATSB that the combination of reduced visibility and low cloud prevented them from landing. At 0537, the captain of the third aircraft in the sequence declared to ATC, 'should we, we will require an immediate diversion to the Gold Coast'. However, the third aircraft landed successfully.

The CVR indicated on hearing the transmission from the aircraft advising a go-around, the captain stated 'we haven't got the fuel for this'. The captain later stated that their comment was over concern should multiple go-arounds be required.

At about 0539, VH-SAJ became established on the ILS for runway 19L. At about 0540, approximately 4 minutes prior to landing, the captain stated to the FO that they did not have enough fuel to divert to the Gold Coast. The FO queried if it was possible to recalculate if there was sufficient fuel to conduct the diversion to the Gold Coast, to which the captain responded 'not now on final, but let's try and get in'.

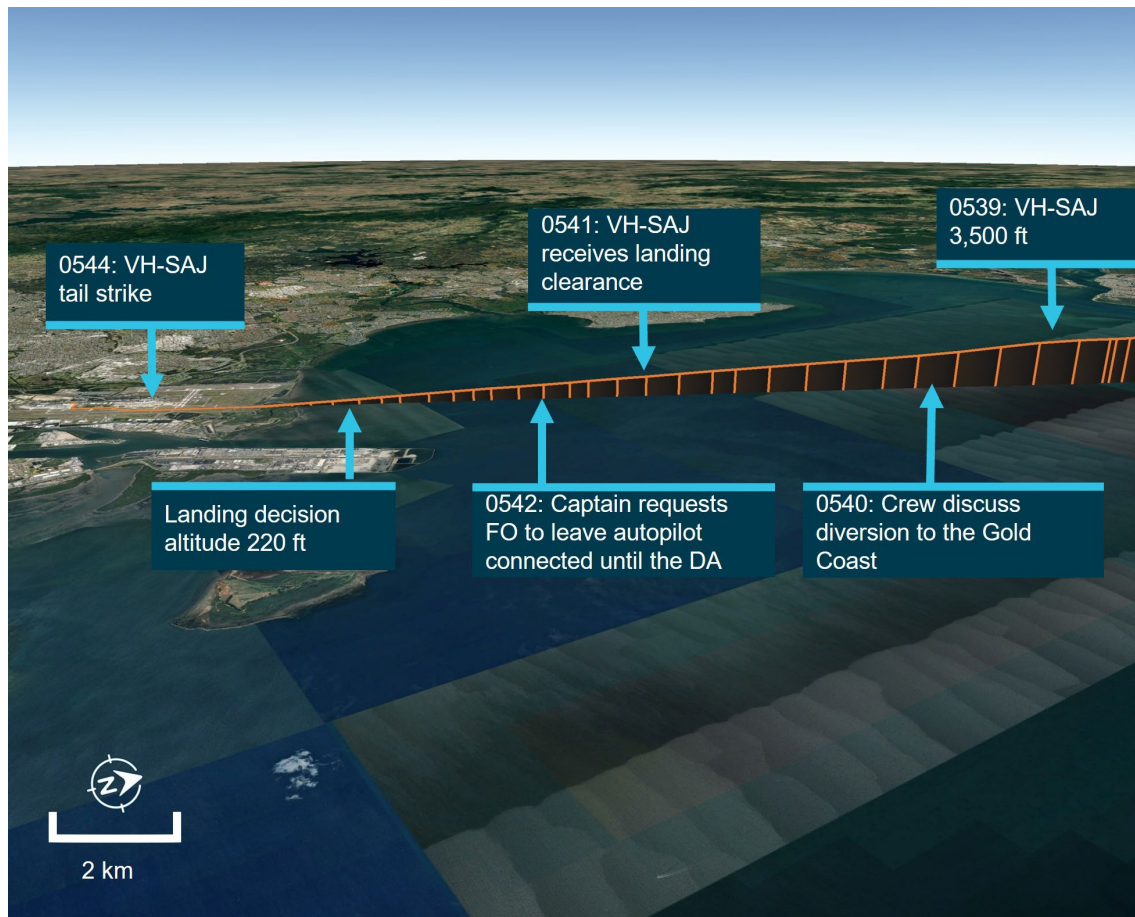
The captain later stated that they believed that it was not appropriate on final approach to calculate fuel for a diversion.

At 0541:28, the crew completed the landing checklist.

## Landing

At 0541:45, the crew were provided with a landing clearance from ATC (Figure 2) and were advised that the runway visual range<sup>9</sup> was 1,200 m at the touchdown zone, 1,200 m at the runway mid-point and 1,800 m at the end point of the runway.

**Figure 2: VH-SAJ final approach to Brisbane Airport**



Source: Google Earth, annotated by the ATSB. \*Flight was conducted in darkness

At 0542:05, the captain instructed the FO to leave the autopilot connected until the aircraft reached 220 ft (the BAe 146-300 minimum autopilot disconnect height is 60 ft). The captain later recalled to the ATSB that they did so to keep the aircraft on an accurate

<sup>9</sup> Runway Visual Range: measured using an electronic instrument RVR is the maximum distance at which the runway, or lights or markers delineating it, can be seen from a position above a specified point on its centreline.

approach to the runway. The FO confirmed they would leave the autopilot engaged but also stated they would disconnect it should they require a go-around. In response, the captain stated 'we don't want to go around. It's gonna be a world of hurt'. The FO responded 'but if we can't see, then we're gonna have to'.

The captain later responded after reviewing the draft report that their comment was over concern that a go-around may lead to a more dangerous fuel critical situation and recalled at the time they considered similar occurrences that had occurred to other operators.

At 0542:40, the aircraft descended through 1,000 ft and was about 7 km from the runway threshold. At the same time, the captain advised the FO that the aircraft was stable, with the missed approach altitude set and armed.

At 0543:05 and about 600 ft, the captain announced they were visual with the high intensity approach lighting, the FO responded that they could also see the lighting, however 'not super clearly'. At 0543:31 and about 350 ft, the captain instructed the FO to increase engine power.

At 0543:45, the aircraft reached the DA and the FO announced they could see the high intensity approach lighting. Four seconds later, the captain announced 'there's the runway'. The captain later recalled to the ATSB that they had more visibility than they had expected.

At 0543:57 the captain instructed the FO to disconnect the autopilot, which occurred at about 110 ft and an airspeed of about 128 kt. The airbrake<sup>10</sup> was extended and fully deployed as the aircraft passed 80 ft. Several pitch adjustments were made by the FO after the autopilot was disconnected. The FO later described that from the DA until landing, their workload increased 'to a 9 or 10 out of 10', they became 'overwhelmed' and that their scan pattern had broken down. The CVR indicated that neither the FO nor the captain commented on workload during the approach.

At 0544:01, both the captain and the FO announced becoming visual with the PAPI lights.<sup>11</sup> The FO later recalled they could make out the runway edge lighting, however could not see the touchdown point.

Just prior to touchdown, the captain instructed the FO 'don't come back too far'. The captain later recalled to the ATSB that the FO had levelled the aircraft shortly after disconnecting the autopilot and began to flare<sup>12</sup> too early. They recalled that the aircraft became high, slowed and then developed a high sink rate. From previous experiences they anticipated that the FO would attempt to pitch the aircraft up to arrest the sink rate. As a result, the captain placed their hand on the control column to prevent the FO from pulling back too far without verbalising their intention (see *Operational policy and*

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<sup>10</sup> BAe 146 airbrake forms part of the aircraft's tail cone when in the closed position, two petals extend from the tail cone to provide aerodynamic resistance and slow the aircraft.

<sup>11</sup> Precision Approach Path Indicator (PAPI): a ground-based system that uses a system of coloured lights used by pilots to identify the correct glide path to the runway when conducting a visual approach. Four white PAPI lights on approach indicate the aircraft is too high.

<sup>12</sup> Flare: the final nose-up pitch of a landing aeroplane used to reduce the rate of descent to about zero at touchdown.

*procedures*). The FO also later recalled feeling the captain's pressure on the control to prevent further rearward input.

The captain recalled to the ATSB that it was a common reaction for less experienced pilots to pull back and increase the pitch when the aircraft experienced a drop, and that this is discussed during their command training.

At 0544:11 the aircraft main wheels contacted the runway. The onboard flight data recorder captured a vertical acceleration of 2.4 g at initial touchdown, an aircraft pitch attitude of about 5.3°, and an airspeed of 105 kt (see *Recorded information*).

The crew were unaware of the tail strike until the damage was discovered on the post-flight aircraft inspection. The tail contact with the runway damaged the tail strike indicator and surrounding fuselage skin panels (Figure 3).

**Figure 3: VH-SAJ damage to tail strike indicator and surrounding panels**



Source: ATSB

# Context

## Personnel information

### Captain

#### Experience

The captain held an air transport pilot licence (aeroplane), issued in October 2017, and a valid class 1 aviation medical certificate. At the time of the incident, the captain had about 7,500 hours total aeronautical experience, of which about 5,400 hours was multi-engine command. They had a total of 411 hours on the BAe 146, which included 198 hours as captain. The BAe 146 was the captain's first jet aircraft rating, having previously flown smaller twin turboprop aircraft mostly in single pilot operations before commencing employment with the operator.

#### Operator training

The captain joined ASL Airlines Australia in November 2022 as a first officer. They completed their type rating on the BAe 146 aircraft in early 2023 and they were checked to line as a first officer in July 2023. In October 2023, they were assessed and recommended to undertake command training. At that time, their total BAe 146 time was 155 hours.

Their command training commenced in November 2023 and involved simulator training and command checks. During this training, the captain's initial operator proficiency check (OPC) was assessed as unsatisfactory due to a breakdown in situation awareness during an instrument approach. Additional simulator training was provided, and the captain passed their OPC on 23 November 2023. The captain's subsequent command simulator training was also assessed as unsatisfactory and was required to be retaken.

On 4 December 2023, the captain commenced supervised line flying sectors. The captain completed 19 sectors before being recommended to undertake their check to line on 19 December 2023. The captain's check to line was assessed as unsatisfactory after the first sector. The captain was provided with additional simulator and ground school training support. The captain completed a further 8 supervised line flying sectors before being recommended to retake their line check. The captain successfully completed their line check on 15 February 2024.

The captain's command training consisted of 31 sectors and 58 hours of flying.

### First officer

#### Experience

The first officer (FO) held a commercial pilot licence (aeroplane), issued in March 2020, and a valid class 1 aviation medical certificate. The FO's total aeronautical experience was about 1,090 hours, including about 113 hours as an FO on the BAe 146. Prior to their employment with the operator, the FO had flown for a general aviation operator, flying mostly smaller, single-engine aircraft and operating under visual flight rules.

## Operator training

The FO joined ASL Airlines Australia in January 2024. They completed their type rating on the BAe 146 aircraft on 4 March 2024. They undertook 2 simulator sessions before successfully completing their OPC on 28 March 2024.

The FO commenced supervised line flying sectors in April 2024. The FO was assessed as achieving below the required standard in several areas including situation awareness, approach and landing. The FO undertook a simulator session on 8 May 2024 and an additional 16 supervised line flying sectors. The FO recalled that their simulator training included low visibility operations, but they had not previously landed an aircraft in foggy conditions.

On 28 May 2024 they were assessed as not proficient during their check to line. The FO was reassessed on 29 May 2024, 28 days prior to the incident and successfully completed their check to line.

The FO's training consisted of 51 sectors and 90 hours of flying.

## Fatigue

The ATSB considered the role of crew performance due to fatigue and found that, from the available evidence, fatigue was unlikely to have contributed to the incident (see *Fatigue*).

# Aircraft information

## General information

The BAe 146 (Figure 4) is a high-wing cantilever monoplane with a T-tail. It is powered by 4 Avco Lycoming ALF 502 turbofan engines mounted on pylons underneath the wings and had retractable tricycle landing gear.

The aircraft, serial number E3150, was a BAe 146-300 series aircraft manufactured in 1989 and configured for air freight operations. It was first registered in Australia as VH-SAJ on 24 October 2019. The last periodic inspection was completed on 12 June 2024 and on the day of the occurrence, the aircraft had accumulated 34,746 hours total time in service.

**Figure 4: VH-SAJ BAe 146-300**



Source: Jet photos, Cameron Roberts

## Aircraft operator

At the time of the incident, ASL Airlines Australia (previously Pionair) held an air operator's certificate issued by the Civil Aviation Safety Authority (CASA) on 14 May 2020 and valid until 1 December 2027, that authorised air transport in larger aeroplanes (CASR Part 121). ASL Airlines Australia operated a mixed fleet of aircraft that comprised 6 BAe 146s and 1 Boeing 737 aircraft, conducting mostly domestic air freight operations.

## Airport information

### Brisbane Airport

Brisbane Airport has 2 runways oriented 10°/190° magnetic (01L/19R and 01R/19L). At the time of the incident, aircraft departures and arrivals were taking place using runway 19L. The airport has a category 1 instrument landing system (ILS) on both runways. This landing system, combined with a 100% LED<sup>13</sup> category 1 lighting system,<sup>14</sup> including stop bar lighting, enables operations during low visibility events like fog.

### Instrument approach

The crew of VH-SAJ were flying an ILS approach for runway 19L. The minima for the approach included a decision altitude<sup>8</sup> of 220 ft, visibility of 800 m, and a runway visual range of 550 m (Figure 5).

<sup>13</sup> Light-emitting Diode: a semiconductor diode which glows when a voltage is applied.

<sup>14</sup> Category 1 (CAT I) lighting system: a CAT I lighting system normally consists of a row of lights on the extended centre line of the runway extending over a distance of 900 m from the runway threshold.

**USE QNH** **ILS OR LOC RWY 19L**

**8 SEP 2022** **BRISBANE, QLD (YBBN)**

**ATIS** 113.2 **125.5** **NORTH** 124.7 **SOUTH** 125.6 **FINALS** 119.25 **TWR** 01R/19L 120.5 01L/19R 118.0 **SMC** 121.7 **SOUTH** 122.25

**ATC APCH SPEEDS**

| NM    | FM | THR | SPEED KT |
|-------|----|-----|----------|
| BETSO |    |     | 185-160  |
| 5     |    |     | 160-150  |

**CAUTION:**  
SCALLOPING AND POSSIBLE FALSE COURSE CAPTURE OBSERVED BEYOND 9 BN BTN 330R AND 350R BN BLW 4000FT

**NOTES**

- SIMULTANEOUS APCH AUTHORISED WITH RWY 19R. SEE INDEPENDENT PARALLEL APCH USER INSTRUCTIONS.
- NO CIRCLING
- AD ELEV 15  
Bearings are Magnetic  
Elevations in FEET AMSL

| NM TO IBS DME      | 1.3 | 2   | 3   | 4    | 5.2  | 6    | 7    | 8    | 9    | 9.5  | 10   | 11   | 12.5 |
|--------------------|-----|-----|-----|------|------|------|------|------|------|------|------|------|------|
| ALT (3° APCH PATH) | 430 | 640 | 960 | 1280 | 1650 | 1920 | 2240 | 2550 | 2870 | 3020 | 3190 | 3510 | 4000 |

**MISSED APPROACH:**  
TRACK 196°  
AT BNEBH (2.2 IBS OUTBOUND) AND NOT BELOW 500FT  
TURN LEFT, TRACK 166°, CLIMBS TO 4000FT OR AS DIRECTED BY ATC.

**NOTES**

- MAX IAS: BETSO : 185KT.
- CAT D ACFT NO CIRCLING WEST OF 01R/19L BEYOND 7 DME BN.
- SPECIAL ALTN MNM 700/2.5 KM.
- ACFT MAY BE RADAR VECTORED TO FNA.

| CATEGORY    | A             | B             | C             | D             |
|-------------|---------------|---------------|---------------|---------------|
| S-I ILS     |               | 220 (209) 0.8 | 550 RVR       |               |
| S-I LOC     |               | 430 (415-1.4) |               |               |
| CIRCLING *  | 650 (635-2.4) |               | 780 (765-4.0) | 850 (835-5.0) |
| ALTERNATE ‡ | (1135-4.4)    |               | (1265-6.0)    | (1335-7.0)    |

Changes: GRID COORDS CORRECTION.

BBNII09-172

## Meteorological information

The captain and FO were issued with a flight briefing package at 0057 that morning, which included the current terminal aerodrome forecast (TAF)<sup>15</sup> that was valid between 0000 on 25 June and 0400 on 26 June for Brisbane Airport.

- wind 210° at about 4 kt
- visibility greater than 10 km

<sup>15</sup> TAF: a statement of meteorological conditions expected for a specific period of time in the airspace within a radius of 5 NM (9 km) of the aerodrome reference point.

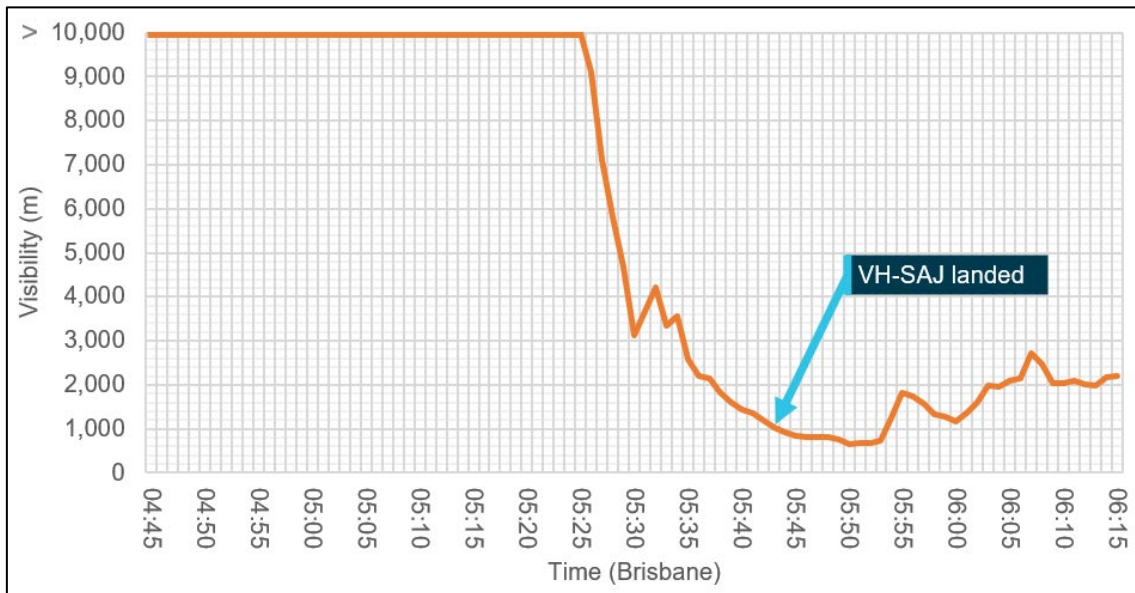
- cloud few at 2,000 ft and broken<sup>16</sup> at 4,000 ft
- active INTER<sup>17</sup> from 0000 through till 0400 for visibility of 3,000 m in showers of moderate rain and broken cloud at 1,500 ft.

Prior to their departure from Sydney, the crew checked the latest weather information for their arrival into Brisbane. The latest TAF had not extended the INTER period for showers beyond 0400.

### Brisbane Airport meteorological conditions during flight

The aircraft departed Sydney Airport at 0415, one hour and 15 minutes after the scheduled departure time and had an estimated time of arrival in Brisbane at 0555. Over the period 0500 to 0525 the visibility at Brisbane Airport remained greater than 10 km. From 0525 to 0550 the visibility reduced from greater than 10 km to 660 m due to the formation of advected fog.<sup>18</sup> The recorded visibility at the time VH-SAJ landed was 912 m (Figure 6).

**Figure 6: Brisbane Airport visibility 0445 to 0615 on 25 June 2024**



Source: Bureau of Meteorology, annotated by the ATSB

Closed circuit television (CCTV) recorded from the Brisbane air traffic control tower captured a progressive reduction in visibility that was consistent with the recorded meteorological information (Figure 7).

<sup>16</sup> Broken: 5–7 okta of cloud cover. An okta is a unit of measurement used to describe the extent of cloud cover (1–8).

<sup>17</sup> INTER: an intermittent deterioration in the forecast weather conditions, during which a significant variation in prevailing conditions is expected to last for periods of less than 30 minutes duration.

<sup>18</sup> Advection fog develops when warm moist air moves (advects) over a cooler surface resulting in the cooling of the air to below its dew-point temperature, and subsequent saturation and condensation.

**Figure 7: CCTV images from Brisbane Airport tower facing south**

Source: Brisbane Airport Corporation, annotated by the ATSB

### Gold Coast Airport meteorological conditions during flight

The closest alternate to Brisbane Airport was Gold Coast Airport which had a TAF issued at 0306 that contained an active TEMPO<sup>19</sup> for visibility of 4,000 m in showers of rain, with cloud scattered at 1,000 ft and broken at 2,000 ft.

At 0530, the Gold Coast meteorological aerodrome report (METAR) indicated visibility greater than 10 km and lowest cloud base of few at 6,100 ft. The subsequent METAR, issued at 0600, indicated visibility was still greater than 10 km with the lowest cloud base being scattered at 3,600 ft.

The Gold Coast Airport forecast was not issued to the crew as part of their flight briefing package and the crew did not obtain the Gold Coast Airport ATIS during the flight.

### Recorded information

The aircraft was fitted with an L3<sup>20</sup> F1000 flight data recorder and L3 FA2100 cockpit voice recorder. Both units were transferred to the ATSB technical facilities in Canberra, Australian Capital Territory, for download.

Recorded flight data during the approach phase indicated the aircraft was flown within the ASL Airlines Australia stabilised approach criteria. At a height of about 110 ft, approximately 13.5 seconds before the main gear touchdown, the data indicated the autopilot was disconnected. Immediately following the disconnection of the autopilot, over a period of 5 seconds, the aircraft pitch attitude increased from about  $-4.3^\circ$  to about  $0^\circ$  (Figure 8). At the same time the aircraft speed reduced from about 128 kt to

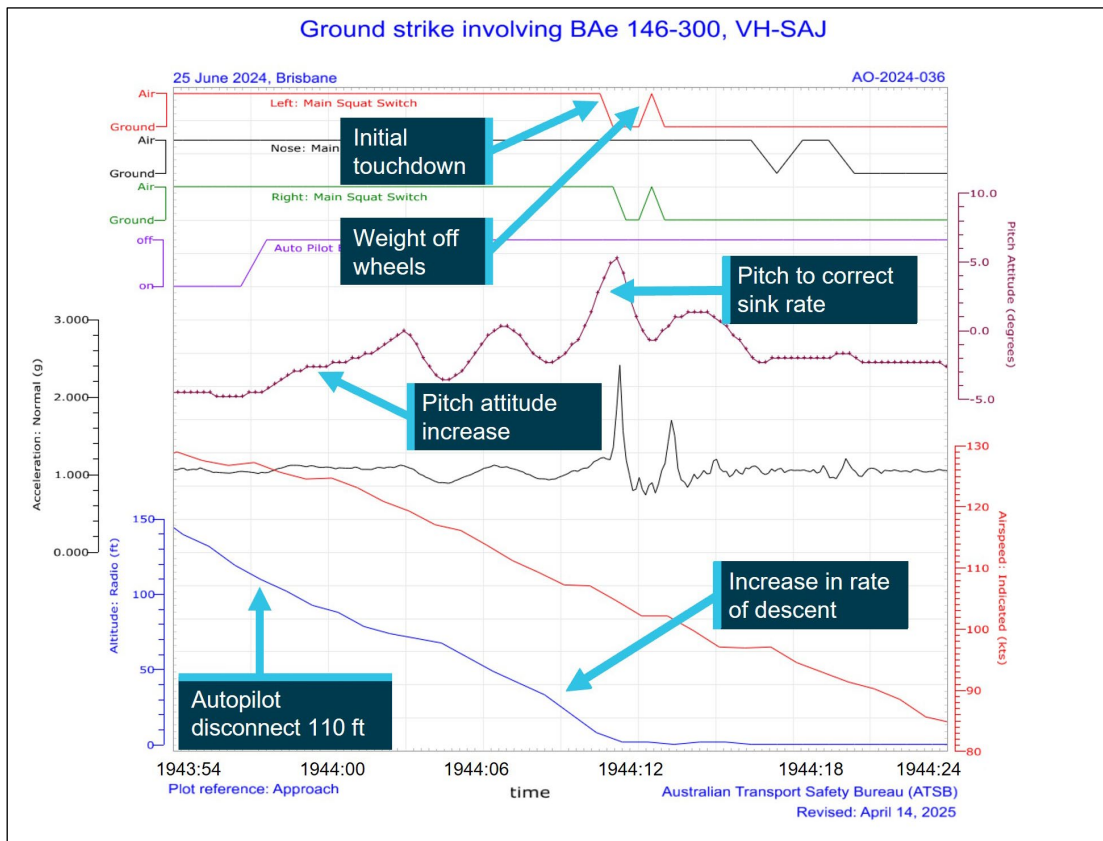
<sup>19</sup> Tempo: used to indicate significant temporary variations from the prevailing conditions of 30 minutes or more but less than 60 minutes.

<sup>20</sup> L3: now L3 Harris Technologies, Inc. Melbourne, Florida, USA.

about 120 kt. The crew had calculated the aircraft landing reference speed ( $V_{ref}$ )<sup>21</sup> to be 115 kt and the aircraft approach speed ( $V_{app}$ )<sup>22</sup> to be 120 kt ( $V_{ref} + 5$  kt).

The airbrake was deployed at a height of 100 ft and was fully extended when the aircraft reached 80 ft. ASL Airlines Australia standard operating procedures manual for the BAe 146 advised that the airbrake should be deployed on final approach once the landing was assured.

**Figure 8: Recorded flight data**



Source: ATSB

At a height of about 65 ft, the aircraft decelerated through 117 kt with a pitch attitude of about  $-3.6^\circ$  and an increasing rate of descent. Several further pitch attitude adjustments were recorded as the aircraft continued to descend.

At a height of about 30 ft, the pitch attitude decreased to about  $-2.3^\circ$ , airspeed reduced to about 109 kt and the rate of descent increased. Shortly after, the pitch attitude increased to a maximum of about  $5.3^\circ$  coincident with main gear touchdown. The vertical acceleration at main gear touchdown was 2.4 g and the airspeed was 105 kt. The aircraft engine power throughout the landing sequence was about 37% N1<sup>23</sup> and there was no recorded increase in power prior to contact with the runway. About 4 seconds after the initial touchdown the main gear momentarily recorded a weight off wheels followed by a vertical acceleration of 1.7 g, indicating a possible bounce.

<sup>21</sup>  $V_{ref}$ : reference landing speed calculated on the aircrafts gross weight for landing.

<sup>22</sup>  $V_{app}$ : reference approach speed when the flaps are in landing configuration and the landing gear extended.

<sup>23</sup> N1: presents the rotational speed of the low pressure (low speed) engine spool.

The aircraft manufacturer advised that a tail strike in a BAe 146-300 would occur on a hard landing, when the main gear oleos<sup>24</sup> had fully compressed, at a pitch attitude of 6.9° or higher. The difference between the values provided by the manufacturer and the recorded data were likely due to a combination of the flight data recorder sampling rate for the pitch attitude parameter (4 times a second) and the overall system accuracy (+/- 1.34°).

## Operational information

### Flight plan

ASL Airlines Australia operations provided the flight plan as part of the flight briefing package. The flight would depart Sydney and climb to FL 270. The track would take the flight overhead Newcastle, Grafton, Lismore and the Gold Coast, before landing at Brisbane. The flight was scheduled to continue from Brisbane with a planned landing in Townsville before the crew would end their duty period in Cairns.

### Fuel planning

On departure from Sydney, the onboard fuel load was recorded as 5,800 kg with a planned trip fuel of 3,332 kg, including taxi fuel. ASL Airlines Australia operations had planned the flight with an additional 30 minutes of holding fuel due to the forecast INTER, planned between midnight and 0400 in Brisbane, which was later cancelled. A delay due to an engine vibration warning light resulted in an additional fuel burn, however the crew determined that as the INTER had been removed, that they had sufficient fuel for the sector. After discussion with the engineering team, the warning light was deemed to be a faulty indicator and the aircraft cleared to depart.

The operator's fuel policy required a fixed final reserve fuel of 30 minutes as well as an additional 15 minutes of holding fuel when no alternate was required. This was a provision for weather, GPS RAIM<sup>25</sup> outage, traffic, or beginning of daylight. A contingency fuel margin of 5% of the trip fuel was also required to compensate for unforeseen factors.

VH-SAJ landed in Brisbane with about 2,300 kg of fuel remaining, which equated to about 72 minutes of flight time that included the use of reserve fuel. The ATSB was advised that ASL Airlines Australia had undertaken an internal review of the flight and that this review determined that the aircraft had sufficient fuel to conduct a missed approach at Brisbane and then divert to the Gold Coast before having to utilise the final reserve fuel margin.

### Weight and balance

The operator's load and trim sheet records indicated the aircraft was within the weight and balance limitations for the intended flight.

<sup>24</sup> Oleo: an oleo strut is a pneumatic air-oil hydraulic shock absorber used on the landing gear of most large aircraft

<sup>25</sup> RAIM: receiver autonomous integrity monitoring – used to assess the integrity of individual signals collected by a GPS receiver.

## Preflight briefing

At the beginning of the duty period, the operator's policy was for flight crew to conduct a 'big picture briefing'. This was an opportunity to discuss any significant factors that may affect the planned operation and to focus on underlying threats or unusual factors and to discuss any means of mitigating those threats.

During the big picture briefing conducted prior to flight, the captain and FO recalled that they discussed that they had not previously flown together, and the captain communicated that they were open to receiving any criticisms or concerns regarding their operating practices. The captain recalled assuming that the FO was new to the position, but they were unaware of the FO's previous flying experience and were also unaware they had not previously landed in low visibility conditions.

## Operational policy and procedures

### Flight crew experience requirements

#### Legislative requirements to be qualified as pilot in command

Civil Aviation Safety Regulation (CASR) part 121.495 required the following pilot in command experience:

- (1) A pilot is qualified as pilot in command for a flight of an aeroplane if:
  - (a) the pilot meets the minimum flying experience requirements specified, in accordance with subregulation (2), in the aeroplane operator's exposition for the aeroplane; and
  - (b) the pilot has successfully completed command training that complies with regulation 121.565 for the aeroplane operator and an aeroplane; and
  - (c) the pilot is:
    - (i) if the aeroplane is an Australian aircraft—authorised to pilot the aeroplane during the flight as pilot in command under Part 61; or
    - (ii) if the aeroplane is a foreign registered aircraft—authorised to pilot the aeroplane during the flight as pilot in command by the aeroplane's State of registry.
- (2) For the purposes of paragraph (1)(a), the aeroplane operator's exposition must include minimum flying experience requirements for all aeroplanes operated by the operator for Part 121 operations.

#### Operator's documented requirements

The ASL Airlines Australia operations manual (OM-A) version 5.5, which was current when the flight crew were checked to their positions, contained the minimum experience requirements to be met before an FO could be considered for promotion to the position of captain (pilot in command). The stated experience requirements were:

- meet all regulatory requirements
- minimum of 3000 hours aeroplane
- minimum of 500 hours on a company type, or as deemed appropriate by the GMFO [General manager of flying operations]
- minimum of 500 hours multi-engine PIC [pilot in command] or ICUS [in command under supervision]
- Australian ATPL [air transport pilot licence] or CPL [commercial pilot licence] with exam credit in all required examination subjects may be acceptable if the company is able to arrange/conduct an ATPL flight test as part of the upgrade training program.

The OM-A also contained the minimum experience required for the employment of a first officer. The stated experience requirements were:

- minimum total time of 1000 hours
- minimum of 500 hours in multi-engine aircraft
- a current Australian CPL [commercial pilot licence] or ATPL [air transport pilot licence].

The OM-A permitted the employment or promotion of crew below the prescribed minimum hours in 'exceptional circumstances', with the specific approval of the director of flight operations (DFO). It stated:

All crew seeking positions as pilots with Pionair are to comply with the Australian CASR Part 61 requirements with respect to licencing. Flight crew experience criteria for the various categories are as detailed below. These criteria may be varied, with the specific approval of the Director of Flight Operations to cater for exceptional circumstances.

There was no definition of what would be considered 'exceptional circumstances' within the OM-A.

### **Incident flight crew engagement**

Neither the captain nor the FO met the documented minimum requirements to hold their assigned positions at the time of the occurrence.

The FO had about 106 hours of multi-engine experience at the time of their engagement with ASL Airlines Australia and about 219 hours of multi-engine experience at the time of the incident. The OM-A minimum multi-engine experience requirement for the position was 500 hours.

The captain completed their command check to line in February 2024. At that time, they had accumulated about 213 hours on the BAe 146, of which 155 hours were as FO and an additional 58.7 hours in command under supervision as part of their command training course. At the time of the incident, they had accumulated about 411 hours total flying in the BAe 146 as FO and captain. The minimum company type experience requirement for the position was 500 hours.

The DFO was interviewed by the ATSB and described the captain as having 'significant operational experience in night freight operations and the ability to manage fatigue with appropriate rest which was a very important but often overlooked skill for a new captain.

The DFO also recalled that the FO had previously been an airline cadet (for a major carrier) and had performed well in their interview.

No evidence of the 'exceptional circumstances' that led to the promotion of the captain or the employment of the FO was provided or identified by ATSB. There was also no evidence that ASL Airlines Australia had considered and managed the risks associated with the engagement of flight crew that did not meet the stated minimum requirements.

The DFO explained that during the period after COVID-19, other airlines were recruiting significant numbers of flight crew and that ASL Airlines Australia had less opportunity to recruit for experienced crew during that time.

The Australian Government's Aviation White Paper released in 2024 cited that a shortage of aviation professionals, including flight crew, was worsening, with job vacancies having more than tripled since 2019. The report also identified the effect a pilot shortage has on regional airlines and smaller operators, as crew leave these

organisations to progress their careers with larger airlines, resulting in a higher turnover and a pool of less experienced applicants during recruitment.

## Rostering of 'inexperienced' flight crew

The ASL Aviation Australia OM-A contained a policy to prevent 'inexperienced' flight crew being rostered together for a flight. It stated:

A flight crew member is deemed to be 'inexperienced' following completion of a type rating or command course until achieving the following additional experience on the type in their respective flight crew role after a successful check-to-line:

- a. 100 flying hours and 10 operational sectors, within a consolidation period of 60 days; or
- b. 150 flying hours and 20 operational sectors (with no time limit).

The policy further stated:

The OCC [Operations Control Centre] must ensure that inexperienced flight crew are not rostered together. In exceptional circumstances on Day of Operations the Director of Flight Operations may approve a crew complement that does not meet the above minimum experience requirements. To ensure compliance with current Regulations the Director of Flight Operations must ensure that, at an absolute minimum, the above minimum hours and sectors have been met when considering a crew member's total type experience (including line training).

The captain had accumulated 198 hours since their successful check to line in February 2024 and was not considered inexperienced.

The FO had accumulated a total of 113 hours total time on the BAe 146 including their line training. Since their successful check to line on 29 May 2024, they had flown about 25 hours and completed 15 sectors as FO and was still considered 'inexperienced' according to the operator's policy.

The policy did not have a provision for crew members that had been promoted to their position below the operator's minimum prescribed hours.

## Operational restrictions for 'inexperienced' flight crew

CASA acceptable means of compliance guidance material regarding pilot experience, stated:

The operator should consider any operational restrictions to be placed on an 'inexperienced' crew member after the completion of the conversion training or post command line check. These considerations may include cross wind limits, aerodrome limits and weather minima limits if the operator assesses these limits as suitable for their operation.

ASL Airlines Australia reported that it did not have a policy that restricted 'inexperienced' FOs landing in adverse weather and raised concern that this would reduce the exposure of FOs to less than desirable weather conditions.

The ATSB interviewed the captains of 2 of the 3 aircraft that were on approach to Brisbane ahead of VH-SAJ. These aircraft were being operated by the same CASR Part 121 operator. Both captains advised that the FO on board was originally the pilot flying for that sector. However, if the visibility was less than 2,000 m or if the cloud was within 200 ft of the minima,<sup>26</sup> their operator's policy was that the captain was required to conduct the approach and landing. Both captains reported that as the visibility on the ATIS was reported as 1,000 m and the cloud height at 200 ft, both had assumed the pilot

<sup>26</sup> Minima: landing minima consist of both visibility and/or RVR, and cloud base elements.

flying roles of their respective aircraft prior to landing in accordance with their operator's captains only approach procedure.

The ATSB reviewed expositions from 6 CASR Part 121 operators and found that 5 out of 6 operators had restrictions on FO's conducting take-offs and landings in adverse weather conditions, including reduced visibility, low cloud and strong winds.

## Responsibility for control of the aircraft

The ASL Airlines Australia OM-A stated:

The authority and responsibilities of the captain are crucial for the safe operation of an aircraft. The captain holds ultimate authority over the aircraft, maintains discipline, and is responsible for ensuring the safety of individuals and cargo onboard, as well as the overall safe operation of the aircraft.

During interview with the ATSB, the FO recalled that as the approach continued, they became uncomfortable with the reduced visibility and described feeling overwhelmed by the conditions. However, the cockpit voice recording indicated the FO did not advise the captain of this, and they continued the approach as pilot flying. The FO recalled that, in hindsight, they should have requested control handover to the captain when they started feeling uncomfortable. Additionally, the captain also reported that in hindsight they should have assumed control and landed the aircraft.

The ASL Airlines Australia OM-A required:

Handover of control from one pilot to another must always be conducted in a positive manner. To minimise confusion or operational risk, the PF must not relinquish control until the PM has advised that they have taken control of the aircraft. NOTE: The standard phraseology to be used for handover/takeover procedures is: "You have control" and "I have control".

- In non-normal situations or when required, the Captain must initiate the takeover procedure.
- If corrected responses are not achieved from control inputs, control should be handed over to another flight crew member.
- In critical phases of flight, Captains must be in a position to enable rapid takeover of controls.

## Standard calls

ASL Airlines Australia operations manual B (OM-B) for the BAe 146 detailed the required standard calls for flight crew during an approach. Cockpit voice recorder information indicated that the crew missed several required calls (Table 1).

**Table 1: Standard calls on descent BAe 146**

| Event                                | Standard call                                                                 | Call event description           |
|--------------------------------------|-------------------------------------------------------------------------------|----------------------------------|
| Gear extension                       | PF : Gear Down<br>PM : Speeds Checked ... Selected ...<br>Gear Down, 3 Greens | Speed checked not called         |
| ILS glideslope<br>Alt/distance check | PM : (Position) ____ (Altitude)<br>PM : ____ DME ____ (Altitude)              | Not called                       |
| 100 ft above<br>minima               | PM : Approaching Minimum<br>PF: Check                                         | Not called                       |
| Minima                               | PM : Minimum<br>PF : Continue; or Go-Around                                   | Continue or go-around not called |

In addition to the standard calls, the ASL Airlines Australia OM-B for the BAe 146 stated that during landing the:

PF/PM must monitor the attitude – if the nose up attitude becomes excessive on the ADI the PF should stop the increase in pitch attitude and consider a go-around if necessary. Recommended attitudes at which an “attitude” call should be made by the PF are:

...

- BAe146-300: 5°

The cockpit voice recording indicated that no attitude call was made by the crew when the aircraft pitch attitude increased above 5° just prior to main gear touchdown.

## Fatigue

### General

Fatigue affects everyone regardless of skill, knowledge and training and its effects can be particularly dangerous in the transportation sector, including the aviation industry.

The International Civil Aviation Organization (ICAO, 2015) defined fatigue as a physiological state of reduced mental or physical performance capability resulting from sleep loss, extended wakefulness, circadian phase, and/or workload (mental and/or physical activity) that can impair a person’s alertness and ability to perform safety related operational duties. Fatigue can have a range of adverse influences on human performance. These include:

- slowed reaction time
- decreased work efficiency
- increased variability in work performance
- lapses or errors of omission (Battelle Memorial Institute, 1998).

### Duty period and sleep obtained

ASL Airlines Australia exposition stated that when flight crew are rostered to begin a duty period between 0000 and 0459 and scheduled to fly 4 sectors, the maximum duty period is 9.5 hours. If both flight crew agree, the duty may be extended by 1 hour during the duty period.

The captain recalled not being rostered on for the previous 72 hours before they signed on for their duty period in Melbourne at about 0015. They reported that, on the Samn-Perelli scale of alertness,<sup>27</sup> they felt fully alert, however at the time of the occurrence, reported they felt ‘okay, somewhat fresh’. The captain reported having about 5 hours sleep in the 24 hours prior to their duty period and about 12 hours of sleep in the past 48 hours.

The FO recalled not being rostered on for the previous 72 hours before starting their duty. They reported having about 9 hours sleep in the past 24 hours prior to their duty period and about 17 hours in the past 48 hours and that they felt ‘a little tired, less than fresh’ at the time of the occurrence.

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<sup>27</sup> The self-report instrument utilised the Samn-Perelli Fatigue Checklist, which utilises a 7-point scale ranging from “1 – Fully Alert, Wide Awake” to “7 – Completely Exhausted, Unable to Function Effectively” (Samn & Perelli, 1982).

The ATSB assessed that both crew had sufficient sleep opportunity prior to commencing their duty.

Adequate sleep is an obvious prerequisite for alertness during duty. The concept of adequate sleep however is subject to individual variability with inconsistencies in amount and quality.

### Window of circadian low

The duty period required working through the time in the circadian body clock cycle when self-rated fatigue and mood are worst (Salas & Maurino, 2010). According to ICAO (2015) there are 2 times of peak sleepiness within a 24-hour cycle. The main peak is in the early morning between 0300-0500 known as the window of circadian low (WOCL), another smaller peak is around 1500-1700 known as the afternoon nap window (International Civil Aviation Organisation, 2015). For each individual this time can vary. The incident occurred at 0544 which was close to the WOCL, which would have had some impact on their alertness levels as seen in their subjective alertness ratings above.

However, the FO's alertness was possibly heightened (Causse and others, 2024) due to their unfamiliarity with the unforecast conditions and as a result this would likely have counteracted any effect of fatigue.

### Operator's biomathematical model of fatigue

The operator provided the ATSB with a summary of the June 2024 report from its fatigue management software which uses biomathematical modelling to predict fatigue risk from the roster times and duty periods. The results did not identify fatigue risk had occurred with either crew member. However, the model does not account for individual susceptibility or resilience to fatigue.

### Fatigue summary

The ATSB considered the role of crew performance due to fatigue and found that the available evidence indicated that fatigue was unlikely to have contributed to the incident. However, the captain's self-reported amount of sleep in the 24 hours prior to their duty period is below the guidelines for recommended hours (Hirshkowitz and others, 2015).

## Related occurrences

### Tail strike – Brisbane Airport, Queensland, 23 October 2008 ([AO-2008-74](#))

On 23 October 2008 at 2357 Eastern Standard Time, a BAe 146-300 aircraft, registered VH-NJM, operating a freighter flight, had a tail strike on landing at Brisbane Airport, Queensland. The aircraft and crew had commenced duty earlier that evening at Adelaide, South Australia, and had flown via Sydney, New South Wales, to Brisbane. The aircraft and crew then did the reverse sectors back to Adelaide. It was only after landing at Adelaide that the crew became aware of the tail strike. Damage to the aircraft consisted of abrasion to the tail strike indicator through to the fuselage skin and abrasion to the fuselage skin. There was also damage to the aircraft's structural frame under the tail strike indicator. The aircraft manufacturer had identified an increase in the number of BAe 146-300 tail strikes and has recommended a number of procedural changes for

flight crew. The aircraft operator has implemented those changes and issued notices to flight crew highlighting the risks and conditions for tail strike.

**Tail strikes during landing involving Bombardier DHC-8 402, VH-QOT and VH-QOS, Brisbane Airport, Queensland, on 5 November 2013 and Roma Airport, Queensland, on 11 December 2013 ([AO-2013-201](#))**

On 5 November 2013 and 11 December 2013, 2 Dash 8-400 aircraft, registered VH-QOT and VH-QOS, were being operated by QantasLink on scheduled passenger flights from Roma to Brisbane and Brisbane to Roma, Queensland, respectively. Both flights were crewed by a training captain, operating as pilot monitoring, and a trainee first officer, operating as pilot flying.

Although the 2 approaches utilised different flap settings, both were conducted using a propeller setting of 1,020 RPM. The early, initial and final stages of the approaches were unremarkable. Both training captains reported that as the aircraft approached the flare, they thought that the respective trainees had handled the approach well.

During landing, both trainees arrested the descent rate by raising the nose of the aircraft. In both cases the maximum pitch attitude was exceeded and the aircraft's tail contacted the runway. Each aircraft sustained impact and abrasion damage to the fuselage skin and buckling of internal structures in the area of the tail strike sensor.

# Safety analysis

## Introduction

On 25 June 2024, a British Aerospace BAe 146-300, registered VH-SAJ, was being operated by ASL Airlines Australia on a freight flight from Sydney, New South Wales to Brisbane, Queensland. There were 2 flight crew on board. The captain was pilot monitoring (PM), and the first officer (FO) was pilot flying (PF).

While on descent to Brisbane, the meteorological conditions worsened with visibility reducing to about 1,000 m in fog. The crew conducted an instrument landing system (ILS) approach for runway 19L, using the autopilot, and visually identified the high intensity approach lighting at about 220 ft. The FO disconnected the autopilot at about 110 ft and made control inputs that resulted in an increasing aircraft pitch attitude followed by several corrections and continued decreasing airspeed. The aircraft touched down with a high pitch angle and a vertical acceleration of about 2.4 g. The tail of the aircraft struck the runway, resulting in damage to the tail strike indicator and surrounding panels.

This analysis will explore the operational considerations pertaining to flight crew experience and training, situation awareness, command decision-making and crew communication.

## Loss of situation awareness

The FO was new to their position with ASL Airlines Australia, having been checked to line 28 days prior to the incident. During their line training, the FO required additional simulator and supervised line flying sectors to achieve the required standard associated with situation awareness, approach and landing. At the time of the incident, the FO had accumulated a total of 113 hours of flying on the BAe 146.

The meteorological conditions at Brisbane at the time of the approach included reduced visibility due to the formation of advected fog. At the time the crew reached the ILS decision altitude (DA) for runway 19L, the visibility was recorded as 912 m. Although this exceeded the minimum required for the approach, the FO had only experienced flying in reduced visibility during their BAe 146 simulated training, and they had not previously landed an aircraft in foggy conditions. (The FO's experience prior to employment with the operator had predominately been flying smaller single engine aircraft in visual meteorological conditions).

The presence of low cloud or fog can create a false visual reference which can result in a pilot orientating the aircraft to the fog layer, rather than the ground references (Federal Aviation Administration). The FO recalled that the low cloud and fog created a sight picture that they had not previously experienced in the aircraft and that following the transition to visual flying, their instrument scan pattern broke down as their attention shifted to outside the aircraft as they attempted to make sense of the landing environment.

Research by Garland et al, (1999) identified that high mental workload can negatively impact situation awareness, as only a subset of the available information can be processed and acted upon. Situation awareness can be defined as 'the perception of the

elements in the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future' (Endsley, 1988). The maintenance of a high level of situation awareness is a critical feature of a pilot's role (Garland et al, 1999).

The combination of degraded visibility, potential visual illusion, high workload, and inexperience operating in similar meteorological conditions likely resulted in the FO losing situation awareness of the aircraft state. Consequently, the FO did not effectively manage the aircraft following the disconnection of the autopilot resulting in the aircraft initially becoming high on the approach.

A short time later, the FO likely became aware of the high profile and attempted to correct the height with several pitch attitude changes. However, the FO's attention was outside the aircraft at this time and their instrument scan had broken down.

Consequently, they were likely not monitoring aircraft airspeed and did not command any change to the engine power settings. As a result, the airspeed reduced and the aircraft's rate of descent increased. The FO likely identified the increased rate of descent as the aircraft neared the runway, as a large pitch attitude increase was recorded just prior to touchdown. However, these actions were not sufficient to arrest the high rate of descent and this, in combination with the high pitch attitude, resulted in the tail of the aircraft striking the runway surface.

#### **Contributing factor**

The first officer became disoriented after disconnecting the autopilot on short final and likely lost situation awareness. Consequently, they did not identify the increasing aircraft pitch attitude, decreasing airspeed, or low power setting and did not correct the resulting sink rate prior to touchdown.

## **Captain's focus on remaining fuel**

As a consequence of the unforecast reduction in visibility, with no original requirement to plan an alternative airport, the captain became increasingly concerned about the fuel state as the aircraft continued on the approach.

It was also an expectation of the captain that the visibility would deteriorate further, commenting to the FO that if they were to conduct a go-around this could potentially leave them in a worse situation. During the approach, the captain also made several remarks about committing to a landing including that if they could see the high-intensity approach lighting, then they were going to land. About 2 minutes prior to landing, the FO expressed concern regarding the autopilot usage stating that they would disconnect it should a go-around be required. In response, the captain stated 'we don't want to go around. It's gonna be a world of hurt'.

Prior to their descent into Brisbane, the crew had calculated the minimum fuel to divert to the Gold Coast was about 1,700 kg. The aircraft landed at Brisbane with about 2,300 kg of fuel on board, indicating there was sufficient fuel to conduct a go-around at Brisbane and safely divert the aircraft to the Gold Coast.

The captain's preoccupation with the aircraft fuel state, combined with the expectation of worsening conditions, led to an increased desire to land the aircraft on the first approach and avoid conducting a go-around which they perceived would have resulted in an approach in conditions that would likely deteriorate further.

#### Contributing factor

The captain became preoccupied with remaining fuel. This combined with an expectation of worsening visibility resulted in a sense of urgency to land off the first approach.

## Continued communication regarding fuel

Brisbane air traffic control (ATC) had alerted the crew to the approaching low cloud bank about 18 minutes prior to landing. From the time of the alert until the landing, the CVR recorded continued concern from the captain.

This concern included that they had 'no fuel' and 'we haven't got the fuel for this' as well as concern with the conditions stating, 'the weather will only get worse' and 'if we can see the HIAL's,<sup>28</sup> we're going to land'.

About 4 minutes prior to landing, the FO asked if it was possible to calculate the fuel needed to divert to the Gold Coast, to which the captain responded 'not now, on final, but let's try and get in'. Shortly after the FO discussed the go-around procedure in preparation for the DA, to which the captain reinforced their intention to land.

Although there was continued communication regarding the fuel state and visibility, no discussion was recorded regarding diversion plans to an alternative airport until established on the final approach. Additionally, the crew did not proactively obtain the weather conditions for alternate aerodromes, in the event that they were required to conduct a go-around without a planned diversion, limiting the crew's options to return to conduct a second approach in Brisbane, further exacerbating the expectation of landing off the approach.

In contrast, the crew of the preceding aircraft on the approach prior to VH-SAJ, advised that there was sufficient time during descent to plan for a diversion on receipt of the weather changes. Subsequent ATC recordings indicated that this crew also advised ATC of their intention to divert to the Gold Coast, if a go-around was required.

The FO had no previous experience in a multi-crew environment and had only recently been checked to line. According to Fabre (2022), when a newly appointed FO is paired with a captain that they consider as experienced, the captain's opinion strongly influences the FO's decision-making and significantly increases the likelihood of the crew attempting a moderate to high-risk landing scenario. The FO's limited experience in the position and in a multi-crew environment likely meant they were more susceptible to the captain's pressure to land and less likely to voice any concerns.

<sup>28</sup> HIAL's: high intensity approach lighting.

The continued verbal concern over landing off the approach compounded pressure on the FO, which likely compelled them to commit to a landing on reaching the DA.

#### Contributing factor

Repeated communications from the captain regarding the need to land off the first approach likely increased pressure on the first officer to commit to a landing.

## Crew appointments

The ASL Airlines Australia operations manual outlined the minimum experience requirements for the appointment of captains and first officers. However, neither the captain nor the FO met these requirements at the time of their engagement, nor at the time of the incident.

In 'exceptional circumstances', the ASL Airlines Australia operations manual permitted the variance of the experience requirements with the specific approval of the director of flight operations.

There was no evidence that ASL Airlines Australia had considered the hazards associated with the appointment of pilots that did not hold the required level of experience, nor was any control put in place to manage the risks. Such controls could have included, but were not limited to, operational limitations for low experience crew. The ATSB reviewed expositions from 6 CASR Part 121 operators and found that 5 had restrictions on FOs conducting landings in marginal meteorological conditions, including reduced visibility and low cloud.

ASL Airlines Australia did not have such a policy, and it reported that having similar limitations could lead to FOs being promoted to captain without having acted as pilot flying in adverse weather conditions. However, the FO's limited experience in marginal meteorological conditions likely contributed to the tail strike incident. Had a similar limitation been in place, it would likely have resulted in the captain assuming control when the crew were alerted to the low visibility at Brisbane Airport.

ASL Airlines Australia had a rostering policy that prevented crew who had not accumulated 100 hours in their positions from being rostered together. However, there was no consideration made for crew who had been provided early promotion to their positions. As a result, the captain, promoted early to their position and at the time of the occurrence had not yet attained the minimum experience requirements to hold the position, was paired with an inexperienced FO. Without administrative controls in the rostering policy to prevent unsuitable pairing of crew without requisite experience, the result was a reduction in the intended experience level on the flight deck for the incident flight.

#### Contributing factor

**ASL Airlines Australia employed and promoted pilots earlier than the prescribed minimum experience hours without additional controls in place to manage the risk of lower experienced pilots on the flight deck. (Safety issue)**

## Captain's multi-crew experience

The captain commenced with ASL Airlines Australia in November 2022, initially as a FO, before undertaking command upgrade training after 155 hours. They had held the position since February 2024 and had accrued 198 hours as a captain at the time of the incident. Prior to joining ASL Airlines Australia, the captain had not flown a jet aircraft and had mostly flown in single pilot operations. As discussed above in *Crew appointments*, the captain had been nominated for command upgrade training below the required 500 hours, and this reduced their opportunity:

- to gain valuable exposure operating in a multi-crew environment
- to model behaviour on experienced captains' decision making prior to commencing in the captain role themselves.

The missed opportunity to gain valuable multi-crew experience likely impacted the captain's capacity to include the FO in the decision-making process and limited the effectiveness of the crew during the approach. Although the captain was not the PF during the approach, the ultimate responsibility for the safety of the aircraft lay with them. The cockpit voice recording indicated that, although it was reasonable for the captain to assume the FO was competent in flying the ILS, they did not ask the FO if they were comfortable to continue the approach after being alerted to the low cloud, fog and changing weather conditions. Likewise, while the FO did not advise the captain that they were experiencing difficulties during the approach, the captain did not recognise other cues, such as the FO's response when requested to disconnect the autopilot at the DA, their ability to clearly see the approach lighting on short final, or their obvious discomfort with the approach.

It is likely that the captain's limited command multi-crew experience may also have reduced their ability to establish an appropriate 'cockpit gradient' following advice that the meteorological conditions at Brisbane Airport were deteriorating. The term 'cockpit gradient' describes the level of authority that exists between the crew members, and the way this authority influences communication and decision-making. Although the pilot in command has ultimate responsibility in terms of decision-making, depending on the cockpit gradient, other crew members can be either encouraged or discouraged from influencing these decisions through their own inputs.

A 'steep' cockpit gradient exists when the pilot in command has an overwhelming influence in decision-making, with little input sought from other crew members. A steep gradient can 'inhibit communication, coordination and the cross-checking of errors' (Harris, 2011). The cockpit voice recording indicated a steep cockpit gradient existed during the approach phase, with the captain dismissing the FO's request to recalculate diversion fuel or plans in the event of a go-around, thereby reducing the effectiveness of the decision-making process.

The captain provided control input instructions to the FO during the final stages of the approach. Likely due to their limited experience in the captain role, they did not recognise that the approach would have been better handled by a more experienced crew member who had previously encountered comparable conditions. Consequently, no authoritative decision was made by the captain to assume the PF role or to command a go-around when the aircraft entered an undesired state after autopilot disconnection.

### Contributing factor

The captain's limited command experience in a multi-crew environment likely reduced their capacity to include the first officer in the decision-making process, consider the need to assume the pilot flying role or command a go-around when the aircraft entered an undesired state during landing.

## Captain's control input

The captain reported that as the high sink rate developed, they anticipated the FO's reaction and placed their hand on the control column to prevent any further increase in the aircraft's pitch during the landing. This likely reduced the severity of airframe damage caused by the tail strike.

ASL Airlines Australia procedures stated that any control handover must be conducted in a positive manner to minimise confusion and operational risk. The FO recalled feeling the captain's pressure on the control column preventing further rearward input, but the captain did not verbalise their actions at the time. While the control column input from the captain may have prevented further damage to the aircraft, it also risked confusion about who was in control of the aircraft during a critical stage of flight.

### Other finding

The captain prevented further rearward input by the first officer during the flare by placing their hand on the control column. While this action is not usually completed without the required takeover procedure it likely reduced the severity of the tail strike.

# Findings

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

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

From the evidence available, the following findings are made with respect to the ground strike involving British Aerospace BAe 146-300, registered VH-SAJ on 25 June 2024.

## Contributing factors

- The first officer became disoriented after disconnecting the autopilot on short final and likely lost situation awareness. Consequently, they did not identify the increasing aircraft pitch attitude, decreasing airspeed, or low power setting and did not correct the resulting sink rate prior to touchdown.
- The captain became preoccupied with remaining fuel. This combined with an expectation of worsening visibility resulted in a sense of urgency to land off the first approach.
- Repeated communications from the captain regarding the need to land off the first approach likely increased pressure on the first officer to commit to a landing.
- **ASL Airlines Australia employed and promoted pilots earlier than the prescribed minimum experience hours without additional controls in place to manage the risk of lower experienced pilots on the flight deck.** (Safety issue)
- The captain’s limited command experience in a multi-crew environment likely reduced their capacity to include the first officer in the decision-making process, consider the need to assume the pilot flying role or command a go-around when the aircraft entered an undesired state during landing

## Other findings

- The captain prevented further rearward input by the first officer during the flare by placing their hand on the control column. While this action is not usually completed without the required takeover procedure it likely reduced the severity of the tail strike.

# Safety issues and actions

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

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

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

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

## Employment and promotion of pilots earlier than company minimum hours

### Safety issue description

ASL Airlines Australia employed and promoted pilots earlier than the prescribed minimum experience hours without additional controls in place to manage the risk of lower experienced pilots on the flight deck.

|                             |                                                                                                                                                                                                    |
|-----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Issue number:               | AO-2024-036-SI-01                                                                                                                                                                                  |
| Issue owner:                | ASL Airlines Australia                                                                                                                                                                             |
| Transport function:         | Aviation: Air transport                                                                                                                                                                            |
| Current issue status:       | Closed – Adequately addressed                                                                                                                                                                      |
| Issue status justification: | The additional controls introduced by the operator for the employment, promotion and rostering of pilots were considered positive actions to address the risks involved with inexperienced pilots. |

### Response by ASL Airlines Australia

The upgrade or fleet transfer requirement of minimum of 500 hours on a company type, or as deemed appropriate by the Director of Flight Operations contained in OM-A – Operations Manual has been amended to minimum of 500 hours on a company type, or similar type in terms of MTOW as deemed appropriate by the Director of Flight Operations, Head of Training and Checking and Director of Safety.

The Inexperienced Flight Crew section contained in OM-A – Operations Manual has been amended to include *Flight crew who are CTL will not have their 'inexperienced status' removed without a review of the candidates progress by the Director of Flight Operations or Head of Training and Checking. This review will be conducted after the minimum 100 hours and 10 sectors is completed.*

The Planned Supervised Line Flying sectors for Captains – No Jet Experience listed in the OM-D – Training and Checking Manual have been increased from 30 to 36 sectors

The Planned Supervised Line Flying sectors for First Officers – No Jet Experience listed in the OM-D – Training and Checking Manual have been increased from 30 to 36 sectors

The Supervised Line Flying and Line Check section in OM-D – Training and Checking Manual has been amended from *The Fleet Training Manager may review a candidate's experience at the planning stage, and may elect to plan less, or more sectors than in the table above* to *The Fleet Training Manager will review a candidate's experience at the planning stage, and may elect to plan less, or more sectors than in the table above*

'Green' Roster group added to allow tracking of green status and avoid inadvertent rostering of green on green

A policy has been developed and incorporated into OM-A – Operations Manual that states the Captain must conduct the approach and landing with visibility within 1,000 m and cloud within 100 ft of the minima unless the PIC is a company approved training or check pilot.

### **Additional safety action by ASL Airlines Australia**

The operator's internal review identified an inconsistency between the operator's standard operating procedures and the manufacturer's recommendation with regard to which pilot (the pilot flying or the pilot monitoring) was to make an 'attitude' call when the aircraft pitch angle approaching landing increased above 5°.

ASL Airlines Australia's internal investigation of the occurrence will be incorporated into the relevant sections of the ASL Airlines Australia HF/NTS training.

A summary of the internal investigation will also be included in the operator's internal safety publication.

# General details

## Occurrence details

|                        |                                               |                        |
|------------------------|-----------------------------------------------|------------------------|
| Date and time:         | 25 June 2024 05:50 E. Australia Standard Time |                        |
| Occurrence class:      | Serious incident                              |                        |
| Occurrence categories: | Ground strike, Unstable approach              |                        |
| Location:              | Brisbane Airport                              |                        |
|                        | Latitude: 27.3842° S                          | Longitude: 153.1175° E |

## Aircraft details

|                         |                                                                                    |                |
|-------------------------|------------------------------------------------------------------------------------|----------------|
| Manufacturer and model: | BRITISH AEROSPACE (COMMERCIAL AIRCRAFT) LIMITED BAE 146 SERIES 300                 |                |
| Registration:           | VH-SAJ                                                                             |                |
| Operator:               | ASL Airlines Australia                                                             |                |
| Serial number:          | E3150                                                                              |                |
| Type of operation:      | Part 121 Australian air transport operations - Larger aeroplanes-Standard Part 121 |                |
| Activity:               | Commercial air transport-Scheduled-Scheduled freight only                          |                |
| Departure:              | Sydney Airport, NSW                                                                |                |
| Destination:            | Brisbane Airport, Qld                                                              |                |
| Persons on board:       | Crew – 2                                                                           | Passengers – 0 |
| Injuries:               | Crew – 0                                                                           | Passengers – 0 |
| Aircraft damage:        | Minor                                                                              |                |

# Glossary

|       |                                                          |
|-------|----------------------------------------------------------|
| ATC   | Air traffic control                                      |
| ATIS  | Automatic terminal information service                   |
| CAA   | Civil Aviation Authority (UK)                            |
| CASA  | Civil Aviation Safety Authority                          |
| CASR  | Civil Aviation Safety Regulations                        |
| CCTV  | Closed circuit television                                |
| CVR   | Cockpit voice recorder                                   |
| DFO   | Director of flight operations                            |
| DA    | Decision altitude                                        |
| FO    | First officer                                            |
| ILS   | Instrument landing system                                |
| LED   | Light-emitting diode                                     |
| METAR | Meteorological aerodrome report                          |
| OPC   | Operator proficiency check                               |
| PAPI  | Precision approach path indicator                        |
| PF    | Pilot flying                                             |
| PM    | Pilot monitoring                                         |
| TAF   | Terminal area forecast                                   |
| TEMPO | Temporary significant variation to prevailing conditions |
| WOCL  | Window of circadian low                                  |

# Sources and submissions

## Sources of information

The sources of information during the investigation included:

- ASL Airline Australia flight records from the occurrence aircraft
- ASL Airlines Australia Operations Manuals and Standard Operating Procedures for the BAe 146
- the captain and first officer of the occurrence aircraft
- the director of flying operations, ASL Airlines Australia
- Civil Aviation Safety Authority
- BAE Systems
- Airservices Australia
- cockpit voice recorder and flight data recorder
- Brisbane Airport Corporation CCTV images
- the captains from the 2 preceding aircraft to VH-SAJ
- Bureau of Meteorology
- Flight Radar24
- Google Earth

## References

- Australian Transport Safety Bureau. (2009). *Tail Strike, Brisbane Airport, Queensland, on 23 October 2008, VH-NJM, British Aerospace BAe 146-300*. Retrieved from [https://www.atsb.gov.au/publications/investigation\\_reports/2008/air/ao-2008-074](https://www.atsb.gov.au/publications/investigation_reports/2008/air/ao-2008-074)
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## Submissions

Under section 26 of the *Transport Safety Investigation Act 2003*, the ATSB may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. That section allows a person receiving a draft report to make submissions to the ATSB about the draft report.

A draft of this report was provided to the following directly involved parties:

- Director of Safety, ASL Airlines Australia
- the captain
- the first officer
- Civil Aviation Safety Authority
- Air Accidents Investigation Branch, United Kingdom
- Part 121 aircraft operator (party with involvement)
- Bureau of Meteorology
- Airservices Australia.

Submissions were received from:

- the captain
- ASL Airlines Australia
- Civil Aviation Safety Authority
- Bureau of Meteorology.

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

## About the ATSB

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

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

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

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

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

## Purpose of safety investigations

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

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

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings.

At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

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

## About ATSB reports

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

Reports must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner

An explanation of ATSB terminology used in this report is available on the [ATSB website](#).