Australian Government

Australian Transport Safety Bureau

Runway excursion and collision with terrain involving Van's RV-6A, VH-OAJ

Somersby (ALA), New South Wales, on 18 March 2018

ATSB Transport Safety Report

Aviation Occurrence Investigation

AO-2018-025

Final – 22 October 2019

Released in accordance with section 25 of the *Transport Safety Investigation Act 2003*

Publishing information

Published by: Australian Transport Safety Bureau
Postal address: PO Box 967, Civic Square ACT 2608
Office: 62 Northbourne Avenue Canberra, Australian Capital Territory 2601
Telephone: 1800 020 616, from overseas +61 2 6257 4150 (24 hours)
Accident and incident notification: 1800 011 034 (24 hours)
Facsimile: 02 6247 3117, from overseas +61 2 6247 3117
Email: atsbinfo@atsb.gov.au
Internet: www.atsb.gov.au

Addendum

Page	Change	Date

Safety summary

What happened

On 18 March 2018, the pilot of a Van's RV-6A aircraft, registered VH-OAJ, was conducting a private flight from Camden to Somersby, New South Wales. During landing, the aircraft initially touched down, then bounced several times, overran the end of the runway, and impacted the side of a watercourse. The aircraft sustained substantial damage. The pilot sustained serious injuries and succumbed to his injuries 2 days later.

What the ATSB found

The ATSB found that the aircraft touched down at a high speed and at a point on the runway that reduced the available stopping distance and there were no indications of an attempt at a go-around. As a result, the aircraft overran the runway and subsequently collided with terrain.

The ATSB also found that the aeroplane landing area had a watercourse at the end of the runway, which the aircraft subsequently impacted in the overrun. The presence of the watercourse increased the risk of aircraft damage and serious injury to the pilot by stopping the aircraft significantly faster than would be the case if the area were clear of obstacles.

The Civil Aviation Safety Authority's Civil Aviation Advisory Publication (CAAP 92-1(1)) on aeroplane landing areas provided guidance on obstacles rising above the runway end and adjacent to the runway. However, it did not contain guidance to airfield owners and pilots on safe runway overrun areas and their importance in the event of a runway excursion.

What has been done as a result

The ATSB had issued a safety recommendation to the Civil Aviation Safety Authority to publish guidance for the inclusion of a safe runway overrun area in their regulatory advisory document for Aeroplane Landing Areas.

Safety message

This investigation highlights the importance of pilot preparedness to conduct a go-around if the landing criteria are not met or if there are indications of an unstable landing.

Pilots should take into consideration the obstacles beyond the runway and assess how this may affect their preparedness for landing or conducting a go-around.

Where possible, ALA owners should also consider the inclusion of runway overrun areas. Obstacles in the overrun area at the end of the runway may increase the risk of aircraft damage and injury to persons should a runway excursion occur.

Contents

The occurrence

On 18 March 2018, at about 0909 Eastern Daylight-saving Time,[1] a Van's Aircraft Inc. (Van's) RV-6A aircraft, registered VH-OAJ (OAJ), departed from the Somersby aeroplane landing area (ALA), New South Wales. The pilot was the sole occupant on board for a 20 minute flight to Camden Airport. The pilot then conducted glider towing operations at the Camden Gliding Club from about 1100 that morning. Due to windy conditions, gliding operations were cancelled at about 1300.

During a telephone conversation with a friend, the pilot mentioned he had finished towing and was waiting at Camden Airport for the wind to subside around Somersby before returning. The friend recounted that the pilot was checking the weather for Mangrove Mountain ALA, an airfield 12 km north of Somersby that was equipped with a weather station. The most recent weather report indicated the presence of northerly winds at 24 kt. These conditions meant that the preferred runway at Somersby, runway 17,[2] would have a tailwind higher than 10 kt. The pilot commented to his friend that these conditions were higher than what he was comfortable with for landing on runway 17 in the RV-6A. The pilot also discussed the challenges of landing on the alternate runway, runway 35, due to the downward sloping ends of the runway, and trees around the airfield.

At 1543, the pilot filed a flight plan[3] for the return flight to Somersby. Several minutes later OAJ took off from runway 28 at Camden Airport and tracked to Somersby at around 2,000 ft. At 1605, the pilot made a broadcast on the common traffic advisory frequency to nearby traffic that he was 7 NM south of Somersby and estimated being overhead the airfield in 3 minutes. Approaching from the south, the pilot overflew the airfield before descending for a landing to the north on runway 35. At 1609, the pilot made a second broadcast on the frequency when he was downwind (Figure 1).

Figure 1: Flight path of OAJ from Camden Airport to Somersby

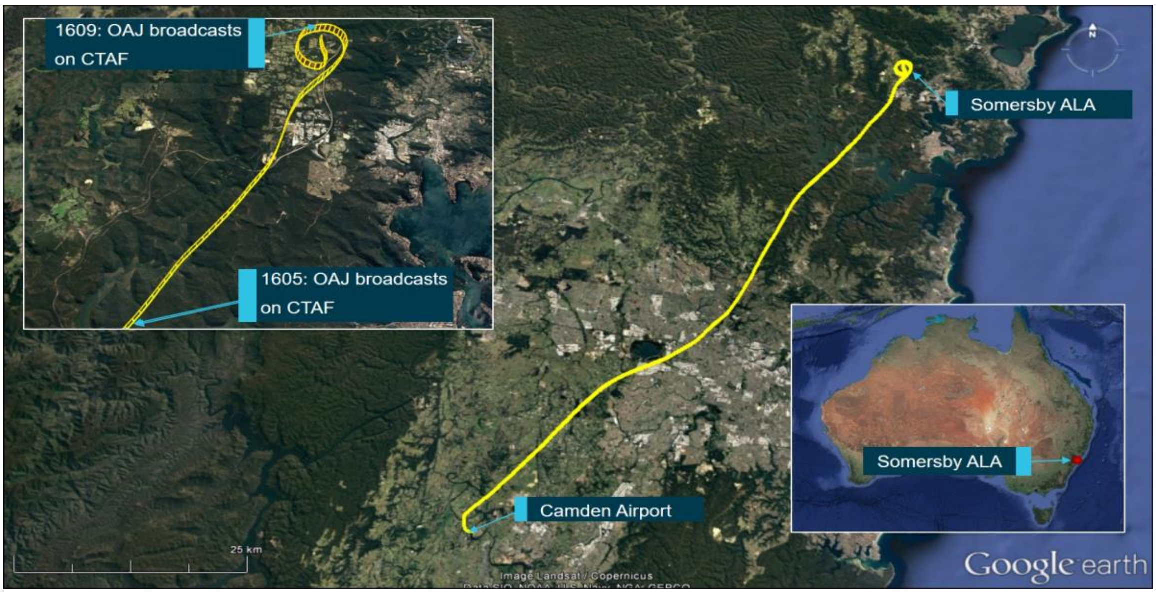


Image shows OAJ's flight path in yellow. The approach to the Somersby ALA and landing flight path are inset.
Source: Google earth and OzRunways, annotated by the ATSB

[1] Eastern Daylight-saving Time (EDT): Coordinated Universal Time (UTC) + 11 hours.
[2] The number represents the magnetic heading of the runway.
[3] Normally a flight plan would not be required, however, on this particular day there was an international summit in Sydney and entering the airspace required clearance.

The ALA owner (the only witness), who was also familiar with the aircraft, reported that he observed OAJ approaching to land on runway 35. He reported the aircraft appeared faster and higher than a normal landing on runway 35 and was airborne until the midpoint of the runway. The ALA owner stated that the aircraft contacted the runway adjacent to a break in the trees at about the midpoint of the runway, bounce and then contact the runway again, adjacent to a stand of trees on the eastern side (Figure 3). He recounted that, in his experience, this was too far down the runway to stop safely. Ground scars from the on-site examination found the aircraft first contacted the runway when 300 m from the runway's end. The final contact before the landing roll was 125 m from the end. The aircraft ran off the end of the runway before impacting the side of a small watercourse and coming to rest (Figure 2). The ALA owner reported that he was concerned that the pilot did not have enough runway length to stop the aircraft, so had turned to get in his car to assist and did not see the aircraft run off the runway end.

As a result of the impact, the pilot was hospitalised with serious injuries, including a dislocated neck and cardiac arrest. Two days later, the pilot succumbed to his injuries. The aircraft was substantially damaged.

Figure 2: View of the accident site showing OAJ, looking back along the runway

Source: ATSB

Context

Pilot information

The pilot held a Private Pilot (Aeroplane) Licence that was issued on 22 February 1971 and last completed a flight review on 2 May 2017 in OAJ, valid until 2 May 2019. At the time of the accident, the pilot had approximately 1,300 hours of aeronautical experience, of which about 194 hours were as pilot in command of OAJ.

The pilot held a valid Class 2 Aviation Medical Certificate and was required to wear distance vision correction and have vision correction available for reading while exercising the privileges of the licence. Around a week prior to the accident, the pilot began the process of renewing his aviation medical certificate. A review of the pilot's medical records found there was no information that indicated a medical event may have contributed to the accident.

Aircraft information

The Van's Aircraft Inc. (Van's) RV-6A is a kit-built, two-seat aircraft with a low-wing and fixed undercarriage. Construction of OAJ was completed in 1998 and it was first registered with the Civil Aviation Safety Authority (CASA) on 3 June 1998. The pilot purchased the aircraft from its builder and became the registration holder on 7 May 2007. The aircraft was hangared at Somersby. OAJ was fitted with a 150 hp Textron Lycoming O-320 piston engine.

A review of the aircraft's logbook and other related documentation indicated that OAJ was maintained in accordance with an approved CASA maintenance schedule. The last periodic inspection was conducted on 15 December 2017, where the airframe, engine and propeller had a total of 597.6 hours in-service. At the time of the accident, the transponder and cylinder head temperature probes were listed as unserviceable on the maintenance release. Neither of these defects were likely to have contributed to the accident.

Meteorological information

The Bureau of Meteorology provided the ATSB with data recorded by the two automatic weather stations closest to Somersby, Mangrove Mountain (around 12 km north-west) and Gosford (around 9 km south-east). Mangrove Mountain indicated that around the time of the accident (1612), the wind was 10 kt from 330°, gusting to 18 kt and the temperature was 35.6 °C. Gosford indicated that around the time of the accident, the wind was 7 kt from 350°, gusting to 21 kt and the temperature was 38 °C.

For a landing to the north, (350°), it was likely that there was a crosswind component of 3 to 6 kt from the left and a headwind of 9 to 17 kt based on the wind speed and direction obtained from the Bureau of Meterology.

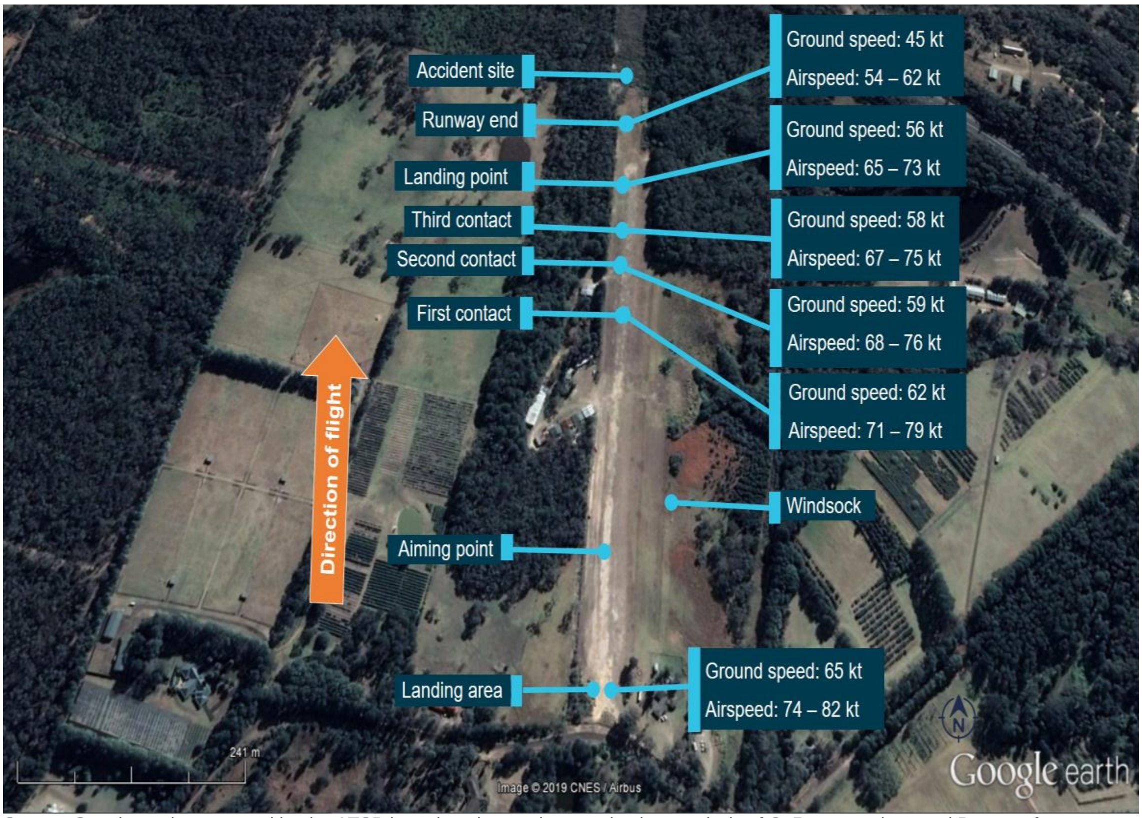
The ALA owner reported that, at the time of the accident the temperature was 34.8 °C in the shade, with 43 per cent humidity, and the wind was 15 kt from a northerly direction.

Recorded data

The pilot carried an iPad onboard the aircraft, for navigation and flight planning, using the OzRunways system. The OzRunways system stored GPS location and other flight planning data on the device. It also regularly transmitted aircraft data from the device to OzRunways, though at a lower resolution than the storage in the device. The ATSB obtained the recorded location data from both OzRunways and the device itself. That data contained the accident flight, as well as a number of previous flights.

From the data, it was found that the measured ground speed of the aircraft on final approach was 65 kt when entering the landing area. Factoring in the headwind component,[4] the airspeed was between 74 and 82 kt. Figure 3 shows the aircraft's ground speed and approximate airspeed on approach, and at various points during the landing.

Figure 3: OAJ's groundspeeds and approximate airspeeds during the landing



Source: Google earth, annotated by the ATSB based on the on-site examination, analysis of OzRunways data, and Bureau of Meteorology information

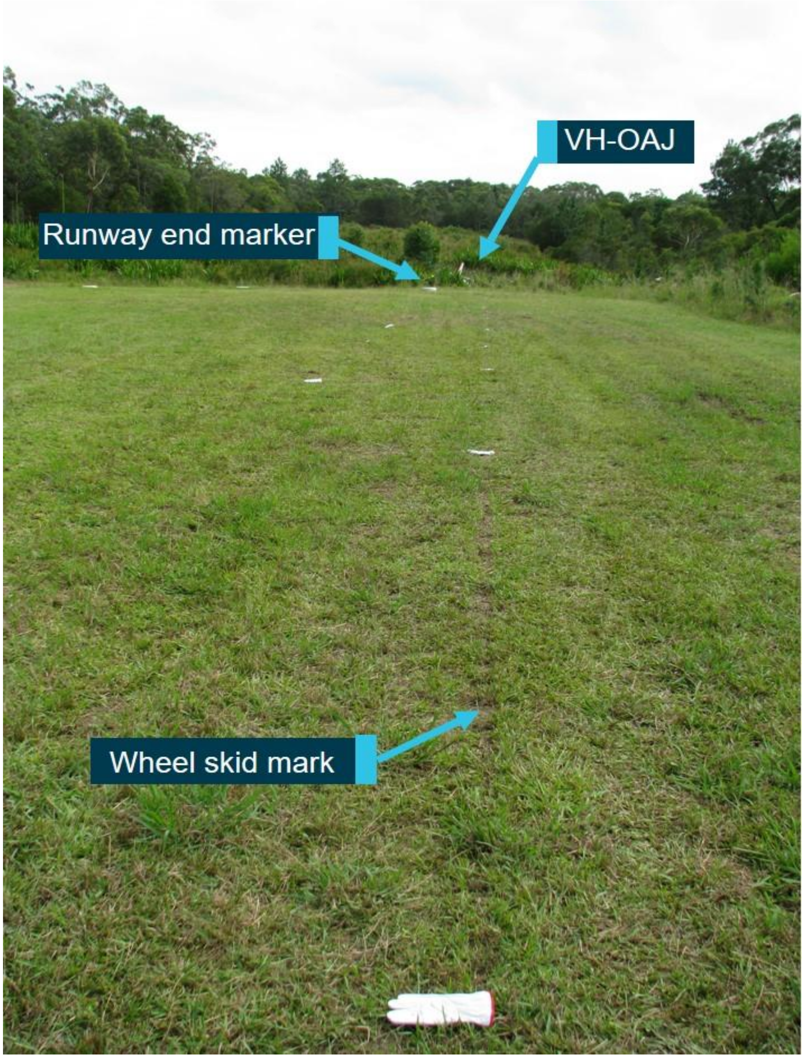
Wreckage and impact information

The aircraft wreckage was found in a small watercourse 20 m past the northern end of the runway where it came to rest in a right-wing low, nose-down attitude. The witness, who was also the first responder, reported that the master switch was on and the fuel selector switched to the right tank. He reported that he switched both of them off to ensure the safety of the accident site.

Marks on the runway consistent with the wheels on OAJ, were identified at the initial wheel contact, subsequent contacts, and landing point (as annotated in Figure 3 above) described by the witness. Multiple other marks consistent with the left and right wheels skidding were identified near the end of the runway (Figure 4). Damage to the vegetation between the end of the runway and the accident site were consistent with the propeller rotating as the aircraft passed.

[4] Maximum anticipated value based upon recorded gusts. Refer to *Meteorological Information*. The ranges of airspeed information was derived from OzRunways and Bureau of Meteorology data, and are approximate values only.

Figure 4: Marks in the surface of the runway consistent with wheel skid



Note gloves placed by ATSB to indicate the start of the skid marks. The tail of OAJ is visible in the image beyond the end of the runway.
Source: ATSB

The on-site examination of the aircraft found that the flaps were in the fully deployed position (around 40º) and all flight controls were functional. The throttle was found in the high power (forward) position, however, it was feasible that it was moved during the impact or during the emergency response. The brakes were tested and found to be operational. Damage to the aircraft consistent with the impact sequence included:

- crushing damage to the forward portion of the aircraft including nose, landing gear, propeller and engine, and the outboard section of the right wing
- fracturing of the right wing flap control rod from overload failure
- buckling deformation of both sides of the fuselage behind the cockpit
- fracturing of the right wing fuel tank, resulting in a fuel leak.

The left wing fuel cap was found secured in place. However, the right wing fuel cap could not be located. The exact quantity of fuel on board at the time of the accident could not be determined due to leakage of some fuel, but both the left and right tanks were near full when examined. A fuel sample was taken from both wings. The samples were clear, and consistent in appearance and smell with aviation gasoline, with no signs of water contamination.

The damage to the aircraft was consistent with the engine and propeller operating under low power at the time of the collision (Figure 5). No evidence was identified on-site of any mechanical defect that would have precluded the normal operation of the aircraft.

Figure 5: Damage to OAJ

Note that the vegetation and aircraft was moved at time of the photograph. Source: ATSB

Survivability

The aircraft was fitted with two seats that had seat backs to shoulder height with no head restraint (head rest). Each seat was fitted with a 4-point harness for the waist and shoulders. The witness reported that the pilot was wearing his harness when he arrived at the aircraft.

After the accident, the pilot was admitted to hospital with a dislocated neck. He also went into cardiac arrest shortly after the impact. He succumbed to the injuries 2 days later. The post-mortem found that the cause of death was high cervical spine trauma.

Research in trauma biomechanics from aviation and road vehicle accidents (Clarke and others. 1971; Schmitt, Niederer, Muser & Walz 2009) has found that many frontal impact collisions result in cervical spine injuries (upper neck). When the torso is restrained (usually by a seatbelt), there will be forward bending (flexion) of the upper spine from forward head movement due to the sudden deceleration of the vehicle. Head restraints in vehicles are provided primarily for protection from injuries from rear-end collisions. In these collisions, the sudden acceleration from the rear means that the head, due to its weight, remains behind the neck, leading to rearward extension of the upper spine.

Based on road trauma research, it was likely the pilot’s neck dislocation was a result of the deceleration forces following the forward impact. As there was limited information available regarding the biodynamics of this accident, it could not be determined if that injury was aggravated from any increased rebounding head movement from a lack of a head restraint.

It was also noted that this aircraft did not have safety features such as airbags and crumple zones that reduce injury in forward collisions, nor was it a requirement.

Aerodrome information

Somersby aeroplane landing area

Physical description

Somersby ALA was an unregistered (and uncertified) airfield[5] with one 690 m gravel and grass runway orientated approximately north to south. The runway was around 15 m wide, with a runway strip of around 15 m on each side. Note that due to the grass on the runway, there was no clear delineation between these areas. Operations from the runway could be conducted in either a southerly or northerly direction, designated as runway 17 (170°) and 35 (350°), respectively. Runway 35 had a downward slope of approximately 2 per cent (1.15 degrees).

The area beyond the northern end of runway 35 was cleared of tall trees for approximately 160 m. The land in this area consisted of low vegetation over a sandy base with some undulation in the terrain. In this area, approximately 20 m beyond the runway end, a small watercourse ran roughly perpendicular to the runway. A depression in the terrain associated with this watercourse increased in depth from the western (left)[6] side to the eastern (right) side. The watercourse consisted of a shallow gully within the depression with vertical sides. This gully was covered by thick low-growing vegetation. The aircraft impacted, and came to rest by the side of the shallow gully (Figure 6). The ALA owner also stated that the 30 to 50 m before the final stopping point of OAJ had been considered clearway area by the operators at Somersby and not used for take-off or landing.

Figure 6: Side view of OAJ in the watercourse

Source: ATSB

[5] Somersby ALA is a privately-owned airfield and was not available to be used by the public unless prior permission to land was granted by the owner.

[6] With respect to looking north from the end of runway 35.

A line of trees ran adjacent to most of the western side and a small part of the eastern side of the runway, around 15 m from the edge of the runway (Figure 7). The tall trees were at the beginning of runway 35 over the road that ran perpendicular to the runway.

Figure 7: View of runway 35 from the south

Source: ATSB

Operations

Somersby ALA has been operational for over 60 years. The ALA owner stated that most landings were on runway 17, which was uphill and therefore, usually decreased the landing distance required for the aircraft unless a significant tailwind was present. The friend the pilot spoke to while at Camden also reported that the pilot had mentioned that he was comfortable with a maximum of a 10 kt tailwind for a landing on runway 17. Landing downhill on runway 35 would have increased the runway distance required unless encountering a strong headwind component. Consequently, landing on runway 35 was uncommon and only attempted when the weather was unsuitable for runway 17, as described above.

The witness also recalled a previous conversation with the pilot about aiming points on runway 35. The pilot agreed to aim to land at the first group of trees ('aiming point' shown in Figure 3) with the intention of being on the ground by the windsock. These aiming points would provide enough time to conduct a go-around.[7]

Operational information

The final approach speed is the airspeed to be maintained until crossing the runway threshold at a height of 50 ft in the landing configuration.[8] This speed is based on the reference landing speed (VREF), which is 1.3 times the stall speed with full landing flaps, plus corrections for operational factors including winds and gusty conditions. If the conditions were gusty and/or turbulent, a correction of one-half the gust factor could be added to the reference landing speed (Federal Aviation Administration 2015). This correction provides an additional margin above the stall for airspeed excursions as a result of these operational factors.

The flight manual for OAJ stated that the maximum permitted speed with wing flaps fully extended (40^{o}) was 81 kt. However, the manual did not specify a stall speed in this configuration. A review

---

7 Go-around: A standard aircraft manoeuvre which simply discontinues an approach to landing.

8 Landing distance information for this aircraft was not available in the flight manual.

of the flight manual for an exemplar RV-6A[9] found that, in a landing configuration with wing flaps fully extended, it had a stall speed of about 43 kt.

For the exemplar aircraft, the reference landing speed would have been about 56 kt. Based on the gusting wind conditions recorded at Mangrove Mountain and Gosford, this would have resulted in a gust factor of 4 kt and 7 kt respectively (refer section titled Meteorological information). Consequently, for another RV-6A aircraft, the estimated final approach speed would have been about 60-63 kt.

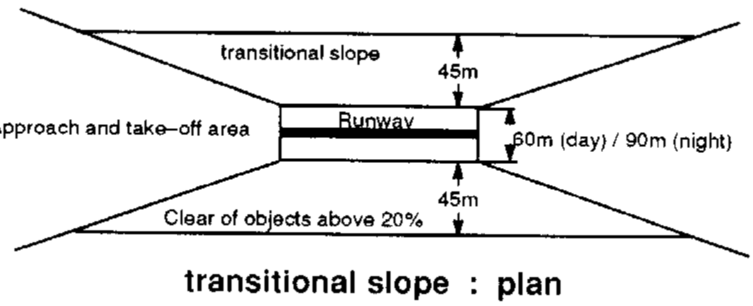
Aerodrome standards and guidance

ALA guidelines

The Civil Aviation Advisory Publication (CAAP) 92-1(1): *Guidelines for aeroplane landing areas* provided advisory information regarding suitability of a place for the landing and taking-off of aeroplanes. It recommended that ALAs are not used by aircraft with a maximum take-off weight greater than 5,700 kg, and only private, aerial work and charter operations could use an ALA. The CAAP also stated that ‘experience has shown, in most cases, that the application of these guidelines will enable a take-off or landing to be completed safely, provided that the pilot in command has sound piloting skills and displays airmanship’.

The CAAP also provided a definition for a lateral transitional slope. This is a ‘desirable area around all landing areas which provides greater lateral clearance in the take-off and landing area and may reduce windshear when the runway is situated near tall objects such as trees and buildings’. The dimensions of a suitable lateral area are as per Figure 8.

Figure 8: Recommended ALA dimensions for lateral clearance



Source: Civil Aviation Safety Authority

In terms of runway length, the CAAP stated that it should be equal to or greater than that specified in the aeroplane flight manual for the prevailing conditions. The longitudinal slope between the runway ends should not exceed 2 per cent, except that 2.86 per cent is acceptable on part of the runway so long as the change of slope is gradual.

The CAAP defined a fly-over area, which was a portion of ground on each side of the runway strip, which was free of tree stumps, large rocks, or stones, or fencing, wire and any other obstacles above ground but may include ditches or drains below the ground level.

It also defined an obstacle-free area as an area where there should be no wires or any other form of obstacles:

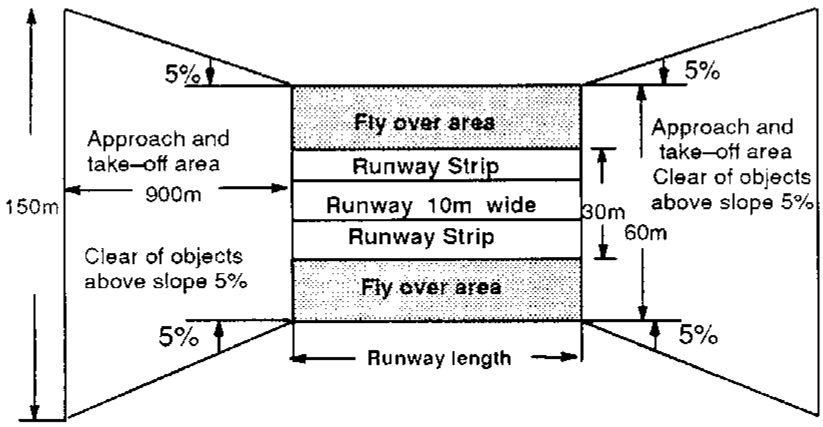
- above the approach and take-off areas
- above the runways
- above the runway strips
- in flyover areas.

[9] The stall speed for the exemplar RV-6A aircraft was from ATSB investigation AO-2017-001.

The CAAP recommended that both ends of a runway, not intended solely for agricultural operations, should have approach and take-off areas clear of objects above a 5 per cent slope for day and a 3.3 per cent slope for night operations. Other recommended landing area physical characteristics are shown on the following diagram (Figure 9).

The CAAP contained no recommendations or guidance regarding the suitability or nature of the ground under the approach and take-off areas similar to the requirement for obstacle-free areas above.

Figure 9: Recommended ALA dimensions for take-off and landing areas



Source: Civil Aviation Safety Authority

Certified aerodromes

Certified aerodromes are intended to accommodate aircraft with more than 30 passenger seats conducting air transport operations. As such, the requirements surrounding certified aerodromes are in excess of those for ALAs.

The International Civil Aviation Organization (ICAO) Annex 14: *Aerodromes*, stated that for non-instrument runways less than 800 m (code 1 runway), there *shall* be a runway strip[10] beyond the runway end of a distance of at least 30 m. It also recommended that a runway end safety area[11] of at least 30 m *should* be provided at each end of the runway strip.

Similarly, the CASA *Manual of Standards for Part 139 - Aerodromes* indicated that, for certified aerodromes, a runway strip shall extend at least 30 m from the end of the runway. However, the standards did not require a non-instrument code 1 runway to have a runway end safety area. The runway strip requirement was to ensure, in the case of a runway excursion (overrun and veer-off), the aircraft had enough room to stop, reducing the risk of damage to an aircraft and injury to occupants. These standards were not applicable for ALAs.

Runway illusion research

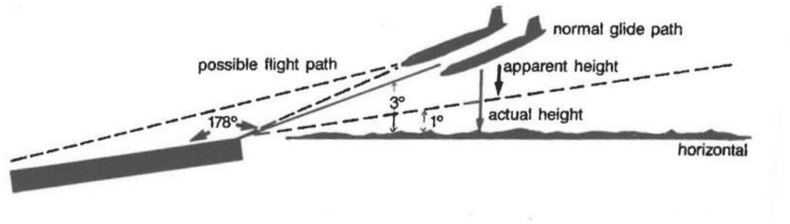
A normal approach has a 3º glide path to a level runway. Research (Hawkins 1987, Wickens and Hollands 2000) into approach and landing phases of flight has found that when flying over flat and level terrain before a down sloping runway, the pilot may interpret the visual scene as indicating that both these surfaces are flat and level. Consequently, the pilot may perceive they are low on approach and may climb to ‘correct’ their perceived height. This leads to a longer landing, or runway overshoot (Figure 10).

---

[10] Runway strip: A defined area including the runway and stopway, if provided, intended: a) to reduce the risk of damage to aircraft running off a runway; and b) to protect aircraft flying over it during take-off or landing operations.

[11] Runway end safety area: An area symmetrical about the extended runway centre line and adjacent to the end of the strip primarily intended to reduce the risk of damage to an aircraft undershooting or overrunning the runway.

Figure 10: Runway illusion for downward sloping runway



Example shows a 2 degrees runway slope. Note the Somersby runway slope was 1.15 degrees.
Source: Hawkins 1987

Similar occurrences

A search of the ATSB's aviation occurrence database found that, in between 2014 and 2018, there were 99 runway excursion (overruns and veer-offs) occurrences reported at ALAs[12] involving general aviation and charter operations. Of these, 10 occurrences resulted in injury (10 per cent). There were also 250 runway excursion occurrences at certified or registered aerodromes, with eight occurrences resulting in injuries recorded (3 per cent) involving general aviation, charter, and regular public service operations.

The database search also found there were 13 occurrences involving aeroplanes (VH- and RA-Aus registered) reported at Somersby since 1970. Three occurrences were runway excursions. Two of the runways excursions happened in the 1970s. One runway excursion occurred in 2012, where an aircraft encountered a wind gust and the pilot lost directional control, exited runway 17 and struck a parked road roller machine off the strip. Due to difficulties in obtaining the number of landings at Somersby, an analysis of the accident rate was not possible.

[12] Landing areas included in the search were either documented as either ALAs or airstrips.

Safety analysis

Introduction

On 18 March 2018, a Van's Aircraft Inc. (Van's) RV-6A, registered VH-OAJ, with one person on board overran the end of runway 35 at Somersby aeroplane landing area (ALA), New South Wales. After departing the end of the runway, the aircraft collided with the side of a small watercourse about 20 m beyond the runway end. The impact resulted in serious injuries to the pilot, to which he succumbed 2 days later. This analysis will examine the factors which resulted in the aircraft overrunning the runway and features of the area beyond the runway which increased the risk of injury to the pilot.

There were no indications of a technical issue with the engine, or aircraft. No mechanical fault was identified, there was enough fuel on board, and the brakes were functioning based on skid marks and on-site testing. The pilot's family did not report any time pressures for the pilot to land. While the pilot went into cardiac arrest after the impact, his previous radio calls had no indication of distress.

Overrun and collision with terrain

During landing, the aircraft landed long on the runway, at a high approach speed, and without any indications of a go-around. As a result, the aircraft ran off the runway end into a watercourse where the pilot sustained serious injuries, to which he subsequently succumbed.

According to the ALA owner, runway 17 was the preferred runway for landing. There were a number of factors that made landing on runway 35 more difficult. This runway had a downhill slope and there were tall trees before the beginning of the runway. The tall trees resulted in a displaced threshold, thereby reducing the landing distance available. While compensating for the perceived illusion from the runway slope may have also led to a longer landing.

The pilot elected to land on runway 35, likely due to the weather conditions at Somersby, with a prevailing north-westerly wind. While not considered to be the favoured runway for landing at the airfield given the downslope, runway 35 was assessed to be the most appropriate runway given the wind conditions at the time.

Runway slope has an impact on pilot's perceptions during landing. When approaching for a downhill landing, the slope of the runway can give the illusion that the aircraft is lower than the actual altitude and the pilot may increase the pitch angle, leading to a higher approach. The Somersby ALA had many cues available to the pilot to aim for, many of which were discussed with the witness including the trees and windsock. However, landing on runway 35 was not as common as runway 17 and it was unknown whether the pilot was focusing on the available cues at the time of landing and/or whether he responded to a perceived runway illusion. Alternatively, the pilot may have been focused on clearing the tall trees before the runway.

The aircraft approached the runway fast and did not appear to reduce speed on the final approach, despite the aircraft being in the landing configuration. According to the United States Federal Aviation Administration, 'An excessive amount of airspeed could result in a touchdown too far from the runway threshold or an after-landing roll that exceeds the available landing area'.

GPS data recorded that the approach speed was at about 65 kt ground speed (between 74 to 82 kt airspeed) when entering the landing area. The aircraft's maximum airspeed with full flap was 81 kt, indicating that the aircraft was around the maximum flap speed. This indicates the aircraft's approach speed was high. The aircraft's stall speed in this configuration was around 43 kt, which indicated that the aircraft could have approached the runway at a slower speed of about 1.3 times the stall speed plus a pilot assessed margin for wind gusts and turbulence. Further to the wind conditions at the time of landing, the direction of the wind may have increased the amount of mechanical turbulence[13] at low level from the tree line on the western side of runway 35. It was also possible that, when close to the ground below the tree line, the wind direction and strength could have varied subject to a wind shadow.[14]

The combination of features around the runway and the weather conditions on the day could have resulted in unstable and unpredictable wind conditions close to the ground, which had the potential to adversely affect landing performance.

By landing beyond the agreed aiming point and the middle of the runway, it reduced the amount of runway available to safely stop the aircraft before the end. After bouncing three times, when the aircraft touched down for the final time, there was only around 125 m of runway left to use. Further, the faster landing speed would have made stopping in the remaining runway further reduced the chance of stopping within the confines of the runway.

The expectation of the pilot and the ALA owner for landing was that if the aircraft was not on the ground by the windsock, then the pilot would conduct a go-around. The fact that the aircraft bounced three times indicates the pilot likely did not attempt to conduct a go-around. Other indications that the pilot did not attempt a go-around include:

- Braking skid marks were found towards the end of the runway, indicating the intention was to brake, rather than increase power.
- The engine and propeller were found to be operating at low power prior to the impact.
- GPS recording of decreasing ground speed until impact.

Overall, there was insufficient evidence to determine why the pilot did not conduct a go-around despite the cues available to indicate the landing was longer than expected.

Somersby ALA safety characteristics

After departing the end of runway 35, the aircraft impacted the side of a small watercourse that was located about 20 m from the end of the runway. The watercourse had resulted in a depression in the undulating terrain that started about 5 m beyond the runway end marker. When the aircraft ran off the end of the runway, still under power, the depression in the ground resulted in the aircraft coming to a sudden stop. Given the proximity of the watercourse and associated depression in the terrain at the end of the runway, the feature directly influenced the rate of deceleration in this accident and would likely be hazardous in any runway excursion from runway 35.

In addition, a tree line ran along most of the western side and a small part of the eastern side of runway 35. The Civil Aviation Safety Authority's Civil Aviation Advisory Publication (CAAP) 92-1(1): *Guidelines for aeroplane landing areas,* specified that an ALA has a lateral transitional slope of at least 45 m on the side of the runway. The location of these trees, around 15 m from the runway's edge could also increase the risk of occupant injury in the case of a collision following an off-centre landing or go-around. Greater lateral transitional slope clearance can reduce mechanical turbulence and windshear[15] associated with crosswind landings, which may increase aircraft stability in critical phases of flight.

Somersby ALA was not a certified aerodrome and it was not required to comply with a documented standard. This ALA was also not available for public use and the owner's permission was required to use the ALA. However, there was guidance available from Civil Aviation Safety Authority (CASA) to assist ALA owners in providing suitable take-off and landing areas.

---

[13] Mechanical turbulence: Winds blowing around the man-made or natural contours causing airflow to churn from its natural path.

[14] Wind shadow: A phenomenon occurring when the wind air flow encounters an obstacle.

[15] Windshear: A change of wind velocity with distance along an axis at right angles to the wind direction.

Civil Aviation Safety Authority ALA guidance material on overrun areas

Guidelines for Aeroplane Landing Areas 92-1(1) was released in 1992 by Civil Aviation Safety Authority (CASA) and provided guidance for pilots operating at an ALA. It also outlined considerations for ALA owners relating to obstacle clearance in the proximity of the runway surface area. The guidelines included details of obstacle clearance required at angles above the take-off and approach area of the runway. It also included clearance considerations from the adjacent sides of the runway. However, there were no guidelines regarding obstacles beyond the runway end. In this occurrence, the watercourse at the end of the runway increased risk of aircraft damage and occupant injury in the event of a runway excursion.

The international standard for aerodromes from the International Civil Aviation Organization (ICAO) states there should be at least 60 m (30 m runway strip plus 30 m RESA), and must be at least 30 m, clear at the end of the runway in case of an overshoot or undershoot for smaller runways similar to ALAs. For certified aerodromes, CASA's *Manual of standards for aerodromes* states that there shall be at least 30 m left clear at the end of the runway. These requirements were designed to reduce the risk of damage and injury involved with runway excursions at certified aerodromes. While they were not mandatory for ALAs, similar measures could help reduce the equivalent risk associated with runway excursions at ALAs. There are over 2,000 ALAs in Australia, compared with around 300 certified or registered aerodromes. Although there were more runway excursions reported to the ATSB at certified aerodromes between 2014 and 2019, there was three-times the chance of an injury during a runway excursion at an ALA. One possible reason for this may be related to the lower requirements for safety areas surrounding runways of ALAs.

Although it is an advisory document, the CAAP provides guidance to ALA owners on the factors that may be used to provide a suitable place for the safe landing and taking-off of aircraft. The CAAP is the main guidance available for owners of ALAs use when building or maintaining an ALA. Without specific guidance about clear and flat runway overrun areas, this key safety feature can easily be overlooked. The omission of this consideration increases the risk of aircraft damage and serious occupant injury in the event of a runway excursion at the ends of the runway.

Findings

From the evidence available, the following findings are made with respect to the runway excursion and collision with terrain involving a Van's RV-6A, registered VH-OAJ that occurred at the Somersby aeroplane landing area, New South Wales, on 18 March 2018. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

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

Contributing factors

- For reasons that were not conclusively determined, the aircraft landed at a higher than normal airspeed and at a late touchdown point on the runway. No go-around was attempted and the aircraft overran the runway and impacted the watercourse.
- Features surrounding the runway, including undulating terrain and a small watercourse immediately at the end and trees at the edge, increased the likelihood and severity of occupant injury in the case of a runway excursion.

Other factors that increased risk

- **The Civil Aviation Advisory Publication for Aeroplane Landing Areas (92-1(1)) did not have guidance for the inclusion of a safe runway overrun area. [Safety issue]**

Safety issues and actions

The safety issues identified during this investigation are listed in the Findings and Safety issues and actions sections of this report. The Australian Transport Safety Bureau (ATSB) expects that all safety issues identified by the investigation should be addressed by the relevant organisation(s). In addressing those issues, the ATSB prefers to encourage relevant organisation(s) to proactively initiate safety action, rather than to issue formal safety recommendations or safety advisory notices.

Depending on the level of risk of the safety issue, the extent of corrective action taken by the relevant organisation, or the desirability of directing a broad safety message to the [aviation, marine, rail - as applicable] industry, the ATSB may issue safety recommendations or safety advisory notices as part of the final report.

CASA ALA guidance on runway overrun areas

Safety issue number:	AO-2018-025-SI-01
Safety issue owner:	Civil Aviation Safety Authority
Operation affected:	Aviation: General aviation
Who it affects:	All owners and users of ALAs

Safety issue description:

The Civil Aviation Advisory Publication for Aeroplane Landing Areas (92-1(1)) did not have guidance for the inclusion of a safe runway overrun area.

Response to safety issue

With the impending regulatory change with Part 91 (General operating and flight rules) of the Civil Aviation Safety Regulations (CASR) 1998 and subsequent regulation, CAAP 92-1(1) will require review. The Civil Aviation Advisory Publication (CAAP) was written prior to the introduction of Part 139 of the CASR 1998 and associated Manual of Standards (MOS). It should be noted the cost and impact of requiring the 30 m runway strip end, and potential runway end safety area (RESA), may be difficult for industry.

ATSB comment in response

The ATSB notes the Civil Aviation Safety Authority's intention of revising the Civil Aviation Advisory Publication. The ATSB will monitor the Civil Aviation Safety Authority's progress and assess the safety issue on completion of amendments made to this publication.

ATSB safety recommendation to the Civil Aviation Safety Authority

Action number:	AO-2018-025-SR-012
Action status:	Released

The ATSB recommends the Civil Aviation Safety Authority publish guidance for the inclusion of a safe runway overrun area in their regulatory advisory document for Aeroplane Landing Areas.

Status of the safety issue

Issue status:	Safety action pending

General details

Occurrence details

Date and time:	18 March 2018– 1612 EDT	
Occurrence category:	Accident	
Primary occurrence type:	Runway excursion	
Location:	Somersby (ALA), New South Wales	
	Latitude: 33° 22’05.30”S	Longitude: 151°18’02.86”E

Pilot details

Licence details:	Private Pilot (Aeroplane) Licence, issued April 1971
Endorsements:	Single-engine aeroplane (SEA), tail wheel undercarriage (TWU), manual pitch propeller control (MPPC), retractable undercarriage (RU).
Ratings:	Nil
Medical certificate:	Class 2, valid to May 2018
Aeronautical experience:	Approximately 1,292.7 hours
Last flight review:	2 May 2017

Aircraft details

Manufacturer and model:	Van’s RV-6A	
Year of manufacture:	1998	
Registration:	VH-OAJ	
Operator:	Private	
Serial number:	Q126	
Total Time In Service	602 hours	
Type of operation:	Private	
Persons on board:	Crew – 1	Passengers – 0
Injuries:	Crew – 1 (fatal)	Passengers – 0
Damage:	Substantial	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- Witnesses and next of kin
- OzRunways
- Civil Aviation Safety Authority
- AvData
- Airservices Australia
- Bureau of Meteorology

References

Civil Aviation Safety Authority 1992, *Guidelines for aeroplane landing areas* (Civil Aviation Advisory Publication 92-1(2)). Retrieved from https://www.casa.gov.au/rules-and-regulations/standard-page/civil-aviation-advisory-publications

Civil Aviation Safety Authority 2017, *Manual of Standards 139 - Aerodromes.* CASA: Canberra. Retrieved from https://www.legislation.gov.au/Details/F2017C00087

Clarke, TD, Dee Gragg, C, Sprouffske, JF, and Trout, EM, Zimmerman, RM, and Muzzy, WH 1971, Human head linear and angular accelerations during impact (No. AMRL-TR-71-95). Air Force Aerospace Medical Research Lab: Ohio.

Federal Aviation Administration 2015, *Airplane Flying Handbook,* Oklahoma: FAA.

Hawkins, F 1987 *Human factors in flight,* Aldershot: Ashgate.

International Civil Aviation Organization 2016, Annex 14 to the Convention on International Civil Aviation - Aerodromes: Volume I Aerodrome Design and Operations. ICAO: Montréal.

Schmitt, KU, Niederer, PF, Muser, MH, and Walz F 2009, *Trauma biomechanics: accidental injury in traffic and sports* (2nd edition)*.* Berlin: Springer.

Wickens CD and Hollands JG 2000, *Engineering psychology and human factors,* New Jersey: Prentice-Hall, pp. 143.

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the *Transport Safety Investigation Act 2003* (the Act), the Australian Transport Safety Bureau (ATSB) may provide a draft report, on a confidential basis, to any person whom the ATSB considers appropriate. Section 26 (1) (a) of the Act 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 airfield owner and Civil Aviation Safety Authority.

Submissions were received from the airfield owner and Civil Aviation Safety Authority. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Australian Transport Safety Bureau

The ATSB is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within the ATSB's jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

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

Purpose of safety investigations

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine 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.

Developing safety action

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. The ATSB prefers to encourage the relevant organisation(s) to initiate proactive safety action that addresses safety issues. Nevertheless, the ATSB may use its power to make a formal safety recommendation either during or at the end of an investigation, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation.

When safety recommendations are issued, they focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on a preferred method of corrective action. As with equivalent overseas organisations, the ATSB has no power to enforce the implementation of its recommendations. It is a matter for the body to which an ATSB recommendation is directed to assess the costs and benefits of any particular means of addressing a safety issue.

When the ATSB issues a safety recommendation to a person, organisation or agency, they must provide a written response within 90 days. That response must indicate whether they accept the recommendation, any reasons for not accepting part or all of the recommendation, and details of any proposed safety action to give effect to the recommendation.

The ATSB can also issue safety advisory notices suggesting that an organisation or an industry sector consider a safety issue and take action where it believes it appropriate. There is no requirement for a formal response to an advisory notice, although the ATSB will publish any response it receives.

Terminology used in this report

Occurrence: accident or incident.

Safety factor: an event or condition that increases safety risk. In other words, it is something that, if it occurred in the future, would increase the likelihood of an occurrence, and/or the severity of the adverse consequences associated with an occurrence. Safety factors include the occurrence events (e.g. engine failure, signal passed at danger, grounding), individual actions (e.g. errors and violations), local conditions, current risk controls and organisational influences.

Contributing factor: a factor that, had it not occurred or existed at the time of an occurrence, then either:

(a) the occurrence would probably not have occurred; or

(b) the adverse consequences associated with the occurrence would probably not have occurred or have been as serious, or

(c) another contributing factor would probably not have occurred or existed.

Other factors that increased risk: a safety factor identified during an occurrence investigation, which did not meet the definition of contributing factor but was still considered to be important to communicate in an investigation report in the interest of improved transport safety.

Other findings: any finding, other than that associated with safety factors, considered important to include in an investigation report. Such findings may resolve ambiguity or controversy, describe possible scenarios or safety factors when firm safety factor findings were not able to be made, or note events or conditions which ‘saved the day’ or played an important role in reducing the risk associated with an occurrence.