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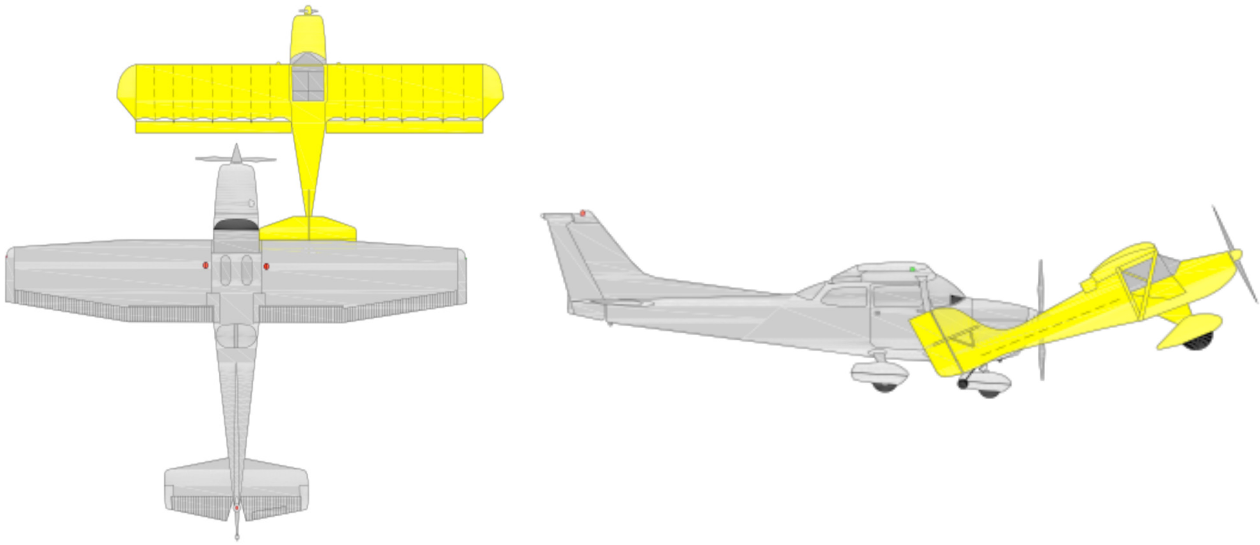

ATSB TRANSPORT SAFETY REPORT

Aviation Occurrence Investigation AO-2007-065

Final

Midair collision
Latrobe Valley Aerodrome, Victoria
1 December 2007
Cessna 172 VH-EUI & Avid Flyer 28-0929

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CONTENTS

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Figures 1 and 3: Background aerial pictures courtesy of Latrobe Regional Airport

Abstract

On 1 December 2007, a Cessna 172 aircraft and an Avid Flyer collided in midair while conducting circuit operations at Latrobe Valley Aerodrome, Victoria. The Cessna was being flown by a student pilot who was conducting a series of solo circuits and the Avid was being flown by an experienced pilot. The Cessna collided with the Avid from above and behind after both aircraft had turned onto the final leg of the circuit. The Avid descended uncontrolled and impacted the ground. The pilot was fatally injured. Although the Cessna sustained damage from the collision, the student pilot was able to land the aircraft.

The investigation revealed that the student pilot was unaware of the Avid's presence before turning onto final, even though both aircraft had been in the circuit for some time prior to the collision. Whereas there was no evidence that the common traffic advisory frequency procedures at the aerodrome were a factor in the occurrence, a radio broadcast that was made prior to the collision possibly contributed to the student becoming unaware of the position of the Avid.

The investigation also identified a safety issue in regard to the guidance contained in the flying school's operations manual. The flying school reported that, as a result of this accident, it has amended its operations manual to include guidance on competency-based training and risk management strategies for application to solo student flight operations. In addition, the flying school has implemented an electronic, competency-based training system and provided training on its use to the school instructors and students.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The Bureau 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 Commonwealth 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 fare-paying passenger operations.

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 safety factors related to the transport safety matter being investigated. The terms the ATSB uses to refer to key safety and risk concepts are set out in the next section: Terminology Used in this Report.

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 safety factor: a safety 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 safety factor would probably not have occurred or existed.

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

Other key finding: 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.

Safety issue: a safety factor that (a) can reasonably be regarded as having the potential to adversely affect the safety of future operations, and (b) is a characteristic of an organisation or a system, rather than a characteristic of a specific individual, or characteristic of an operational environment at a specific point in time.

Risk level: The ATSB's assessment of the risk level associated with a safety issue is noted in the Findings section of the investigation report. It reflects the risk level as it existed at the time of the occurrence. That risk level may subsequently have been reduced as a result of safety actions taken by individuals or organisations during the course of an investigation.

Safety issues are broadly classified in terms of their level of risk as follows:

- **Critical** safety issue: associated with an intolerable level of risk and generally leading to the immediate issue of a safety recommendation unless corrective safety action has already been taken.
- **Significant** safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable. The ATSB may issue a safety recommendation or a safety advisory notice if it assesses that further safety action may be practicable.
- **Minor** safety issue: associated with a broadly acceptable level of risk, although the ATSB may sometimes issue a safety advisory notice.

Safety action: the steps taken or proposed to be taken by a person, organisation or agency in response to a safety issue.

EXECUTIVE SUMMARY

On 1 December 2007, at about 1130 Eastern Daylight-saving Time, an Avid Flyer ultralight aircraft (Avid), registered 28-0929 and a Cessna Aircraft Co. 172 aircraft (Cessna), registered VH-EUI (EUI) were conducting circuit operations at Latrobe Valley Aerodrome, Victoria. Runway 09 was in use and the normal circuit direction was for left circuits.

The Avid was being flown solo by an experienced pilot and EUI was being flown solo by a student pilot. The student pilot had previously conducted three circuits with an instructor on board and, following those circuits, the instructor assessed the pilot as being at a standard that would allow him to conduct further solo circuits. That required a full stop landing and the student pilot to taxi clear of the runway for the instructor to exit the aircraft.

After the instructor left the aircraft, the student pilot took off and re-entered the circuit. The total circuit traffic at that time included: EUI; another Cessna 172, registered VH-UGO (UGO) with an instructor and student on board who were conducting circuits; a Jabiru ultralight aircraft (Jabiru), registered Jabiru 4497 that was also conducting circuits; and the Avid. Shortly after, another Jabiru, registered Jabiru 3587 broadcast that he was entering the circuit.

Sometime later, two aircraft simultaneously attempted to make a radio broadcast. The instructor in UGO reported that in response, he broadcast that there had been an overtransmission and that the transmission indicated that both aircraft were on final approach. It was reported that in response to that broadcast, the pilot of the Avid broadcast that ‘he had the other aircraft in sight’.

The instructor in UGO reported continuing the circuit and, while on the downwind leg, noting that there appeared to be two aircraft in close proximity on final approach to runway 09. Shortly after, EUI and the Avid collided on the final approach to runway 09.

The Avid was reported to have spiralled to the ground almost vertically, while the pilot of EUI continued the approach and landed safely. Subsequent examination of the wreckage of the Avid revealed that it was equipped with a ballistic parachute recovery system; however, the system was not deployed and had not been armed prior to the flight.

The student pilot had a total of 25 hours aeronautical experience. The pilot of the Avid had about 2,500 hours aeronautical experience. Both the pilot of the Avid and the student pilot were reportedly well rested before their respective flights, and there was no evidence that any physiological factor contributed to the accident.

The weather conditions in the area were suitable for visual flight and the investigation concluded that weather was not a factor.

Common traffic advisory frequency procedures were in use at the aerodrome at the time of the accident and were reportedly followed by all aircraft that were either in the circuit or arriving at the aerodrome. The investigation found that the procedures at the aerodrome did not contribute to the accident.

The Cessna was found to be airworthy with no maintenance issues that would have affected its performance. Despite some minor documentation issues in the Avid’s prior maintenance history, there was no evidence of any mechanical, aircraft performance or maintenance-related issues with the aircraft.

The investigation concluded that the student pilot of the Cessna was unaware of the presence of the Avid when that aircraft was turned onto the final approach leg of the circuit. The student's low level of experience and the subjective assessment of his competence to fly solo were identified as factors in the accident.

The flying school that was conducting the student pilot's training had not fully implemented a competency-based training syllabus and as a result, the assessment of the student relied on subjective methodologies. In addition, a safety issue was identified in respect of the flying school's operations manual and the risk management of early solo students.

The flying school reported that, as a result of this accident, it has amended its operations manual to include guidance on competency-based training and risk management strategies for application to solo student flight operations. In addition, the flying school has implemented an electronic, competency-based training system and provided training on its use to the school instructors and students.

FACTUAL INFORMATION

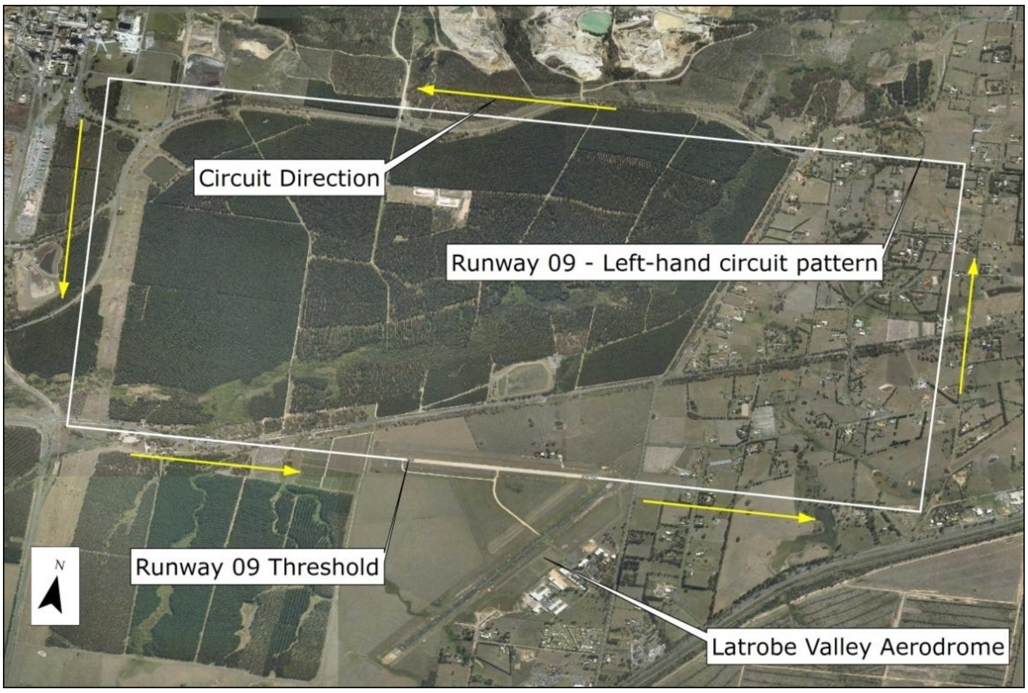
History of the flights

On 1 December 2007, at about 1130 Eastern Daylight-saving Time[1], an Avid Flyer ultralight aircraft (Avid), registered 28-0929 and a Cessna Aircraft Co. 172 aircraft, registered VH-EUI (EUI) were conducting circuit operations at Latrobe Valley Aerodrome, Victoria. Runway 09 was in use and the normal circuit direction on that runway was to fly a left-hand circuit (Figure 1). The Avid was being flown solo by an experienced pilot and EUI was being flown solo by a student pilot.

During the initial part of the flight, the student pilot conducted three circuits with an instructor on board. Following those circuits, the instructor assessed the pilot as being at a standard that would allow him to conduct further solo circuits. That required a full stop landing and for the student pilot to taxi clear of the runway in order for the instructor to exit the aircraft.

After the instructor left the aircraft, the student pilot took off and re-entered the circuit. At that time, there were three other aircraft in the circuit: another Cessna 172, registered VH-UGO; a predominantly white Jabiru aircraft (Jabiru), registered J4497; and the Avid.

Figure 1: Latrobe Valley Aerodrome – runway 09 normal circuit direction

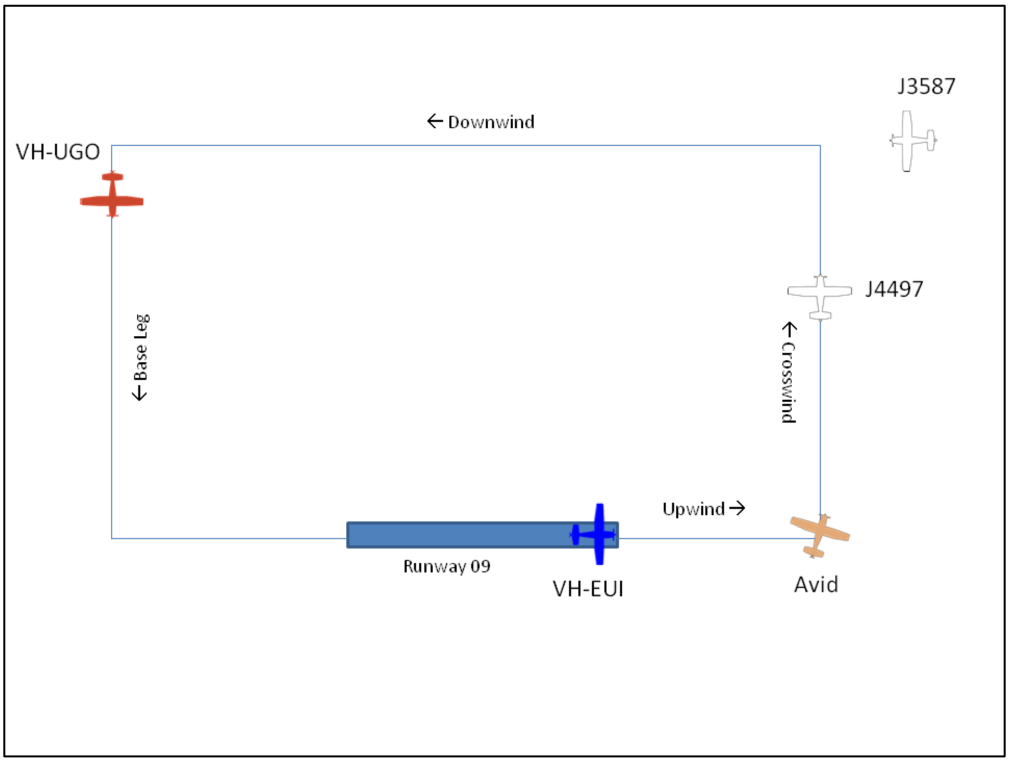


After the student pilot had flown one circuit and touch-and-go following the Avid, another predominantly white Jabiru aircraft, registered J3587 arrived at Latrobe Valley. The pilot of that aircraft broadcast that he would be entering the circuit on

[1] The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time (EDT), as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

the downwind leg (Figure 2). It was reported that the pilot of the Avid broadcast that he would adjust his circuit to accommodate the arrival of Jabiru 3587.

Figure 2: Likely positions of the circuit aircraft when Jabiru 3587 entered the circuit *(not to scale)*



Sometime later, two pilots simultaneously attempted to make a radio broadcast. The instructor in UGO stated that in response, he broadcast that there had been an overtransmission,[2] and that the combined transmission indicated that both aircraft were on final approach. It was reported that in response to that broadcast, the pilot of the Avid broadcast that 'he had the other aircraft in sight'.

The instructor in UGO reported continuing the circuit and, while on the downwind leg, noting that there appeared to be two aircraft in close proximity on final approach to runway 09. Shortly after, EUI and the Avid collided on final approach to runway 09 (Figure 3). The Avid aircraft was reported to have spiralled to the ground almost vertically, while the pilot of EUI continued the approach and landed.

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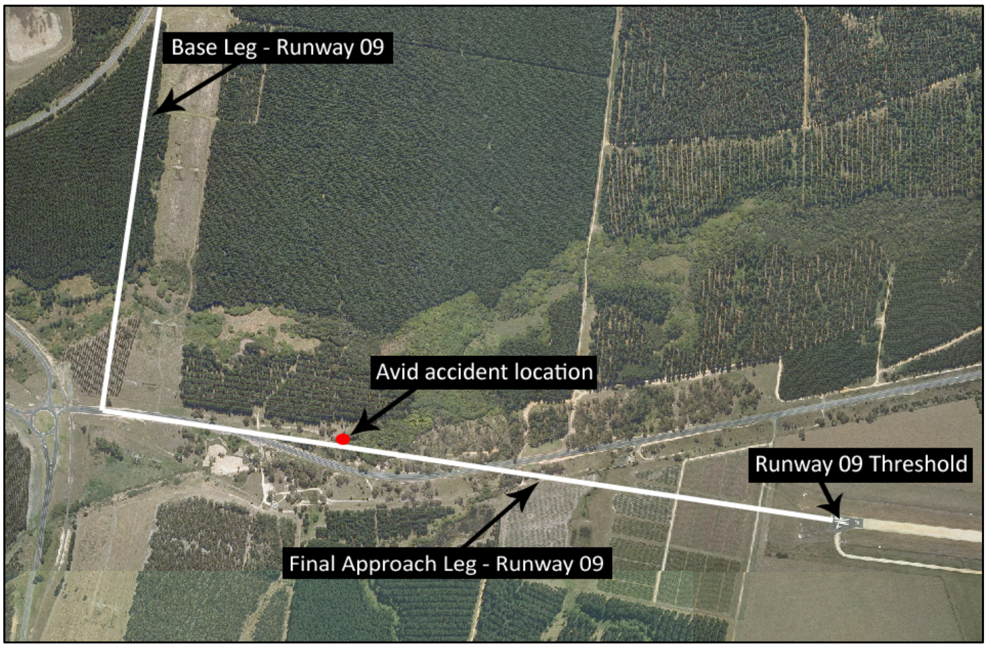
2 An overtransmission is when two aircraft attempt to broadcast at the same time and on the same frequency. The result is an unclear and broken transmission from both aircraft.

Figure 3: Avid accident location in relation to the base and final legs of the circuit



Witness information

Radio transmissions were not required to be recorded at Latrobe Valley Aerodrome. The radio broadcast information that follows is based on witness reports and recollections.

Instructor in UGO

The flying school's chief flying instructor (CFI) was performing instructional duties in UGO at the time of the accident. The CFI reported that he saw the Avid on the upwind leg of the circuit when EUI entered the runway to take off after the instructor sent the student pilot solo. He further reported hearing another aircraft making a radio broadcast that it was entering the circuit on an extended downwind leg and that, in response, the pilot of the Avid broadcast that he would extend his crosswind and downwind legs to accommodate the arriving aircraft.

The CFI flew a circuit with his student and conducted a touch-and-go. The CFI recalled that on the upwind leg of his next circuit, he heard two pilots overtransmit each other, and that he then made a broadcast to alert traffic of that overtransmission (Figure 4). In response to that alert, the pilot of the Avid broadcast that he had the other aircraft sighted. The CFI stated that he then heard the student pilot broadcast a 'base call'[3]. He could not recall hearing a 'final'[4] radio broadcast from the student pilot.

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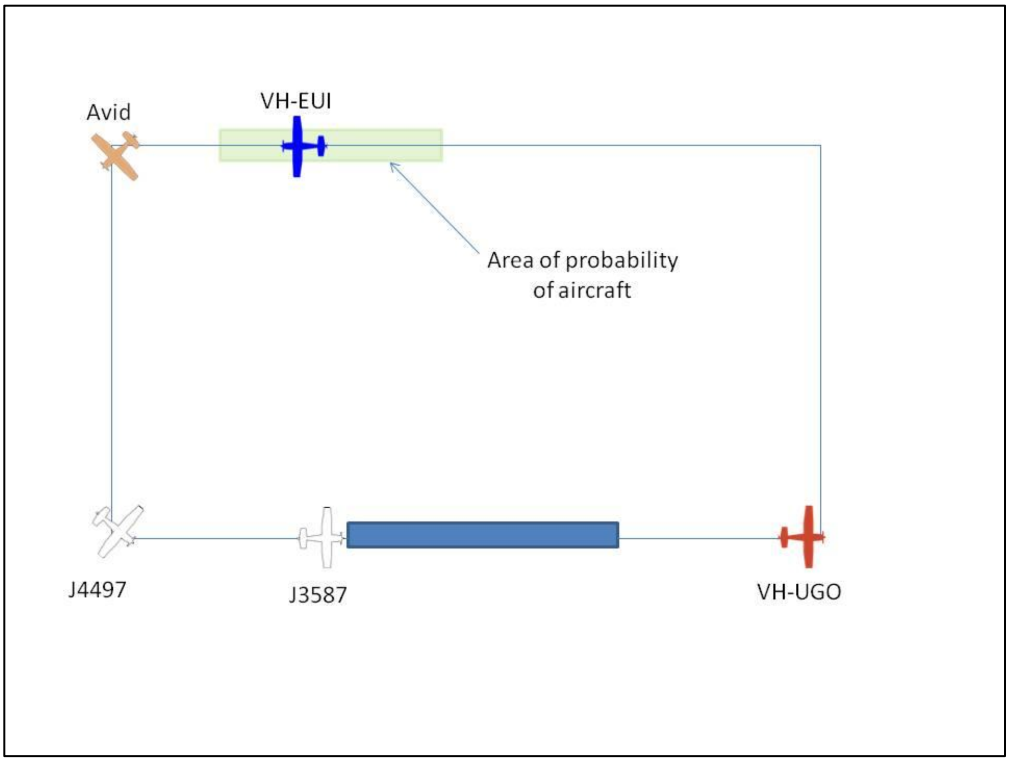
[3] Pilot radio broadcast to advise other circuit traffic that an aircraft is turning from the downwind leg of the circuit to establish that aircraft on the base leg (see Figure 2).

[4] Pilot radio broadcast to advise other circuit traffic that an aircraft is turning from the base leg of the circuit to establish that aircraft on the final approach leg (see Figure 3).

Figure 4: Estimated likely positions of the circuit aircraft at the time of the overtransmission *(not to scale)*



The CFI continued with a normal circuit and, when at a position on downwind that was estimated to be past the runway 09 landing threshold and almost abeam the subsequent collision point, he noticed two aircraft in close proximity on final approach to runway 09. The CFI reported that EUI appeared to have been above the Avid before impacting that aircraft's tail area. Following the collision, the Avid appeared to the CFI to spiral to the right and descend almost vertically.

The CFI advised that in his experience, there is no problem with ultralight aircraft and Civil Aviation Safety Authority (CASA)-registered aircraft flying together at Latrobe Valley. He reported that the flying school had a 'no overtaking' rule in the circuit, which teaches pilots to adjust their aircraft's speed to sequence with other circuit traffic.

Saturday mornings were the busiest day of the week and the CFI stated that it was normal for there to be a mix of ultralight and CASA-registered aircraft in the circuit and that they pose no problems for each other. He also reported that the maximum number of aircraft that he would expect to be conducting circuits simultaneously at Latrobe Valley was five.

Instructor in Jabiru J4497

The instructor in J4497 recalled that when EUI commenced flying circuits, it was ahead of his aircraft and that the Avid was following J4497. He reported that he heard the student pilot in EUI making a number of radio broadcasts, but that most were made by the instructor in that aircraft.[5] That included advice that EUI intended making a full stop landing, which was observed by the Jabiru instructor, before EUI was taxied off the runway.

The Jabiru instructor reported continuing flying circuits, with the Avid following. The instructor recalled that, when EUI entered the runway for takeoff, the Avid was ahead on a late crosswind position, and that his own aircraft was on mid-downwind.

After EUI rejoined the circuit and had flown one circuit, the Jabiru instructor reported hearing a broadcast from another aircraft that was entering the circuit. He reported that he sighted that aircraft (Jabiru J3587) and determined that he was able to fly a normal circuit to follow the arriving aircraft. The instructor indicated that, in response to the broadcast from the pilot of J3587, the pilot of the Avid broadcast that he had the other aircraft[6] sighted. There was no indication that the pilot of the Avid intended extending his circuit dimensions, and the instructor in J4497 did not have to adjust his circuit to follow J3587 as it entered the circuit.

The instructor in J4497 indicated that his student's base-to-final radio broadcast had overtransmitted the downwind-to-base broadcast from the pilot of the Avid. He was aware that this had happened as he knew the Avid pilot's voice and had just made out the last part of the Avid pilot's base turn radio broadcast. The instructor reported looking back towards the base turn area and observing the Avid '...in the position [that] he expected it to be'. He indicated that at that time, he had no idea where EUI was but did hear the broadcast from the CFI in UGO about an overtransmission, and heard the Avid pilot's broadcast that he had sighted the other aircraft. He did not report hearing any base or final turn radio broadcasts from the student pilot in EUI.

The instructor in J4497 further stated that the pilot of the Avid always added 'following the Jabiru' to the end of his radio calls. The instructor in J4497 indicated that, apart from the alert by the CFI in UGO in respect of the overtransmitted broadcast by two aircraft, there were no extraneous radio broadcasts made on the Common Traffic Advisory Frequency (CTAF) of 126.0 MHz.[7]

Saturday was reported by the instructor to be the busiest day of the week at the aerodrome and the instructor would only send a student solo if there were no more than two other aircraft in the circuit. He also advised that he would expect a maximum of five experienced pilots operating in the circuit at any one time.

The instructor stated that he had not experienced any problems with aircraft blending into the background on base and becoming difficult to see. He described the area beyond the base leg as relatively open fields.

Student pilot's supervising instructor

The supervising instructor of the student pilot in EUI reported that he had flown with the student pilot on a number of occasions prior to flying with him on the

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5 That contrasted with the CASA *Flight Instructor Manual*, which stated that 'Instructors must let the student make the radio calls. There can be a tendancy [sic] for instructors to over use the radio.'

6 The investigation could not determine to which aircraft the Avid pilot was referring at that time.

7 A designated frequency on which pilots make positional broadcasts when operating in the vicinity of a non-towered aerodrome.

morning of the accident. He indicated that the student had made the correct radio calls and was practicing clearing his turns.[8] He assessed that the student was safe for solo flight and commented that '...he would not have hesitated in sending him solo.'

The supervising instructor recalled that the traffic in the circuit during the flight with the student pilot was 'neat, orderly and well-spaced', and that all of the circuit traffic was making the required radio calls. He stated that at no stage did the student pilot catch up to the preceding aircraft.

After returning to the flying school, the supervising instructor heard the following radio broadcasts on the school's ground radio:

- the student pilot in EUI make a 'base call'
- two aircraft overtransmit each other
- the alert by the CFI of an overtransmission.

The supervising instructor reported going outside to watch the student in EUI perform the approach and landing. He noted EUI and the Avid in close proximity on final approach and that EUI was above the Avid. He described EUI descending into the Avid and then the Avid pitching up and to the right before descending vertically to the ground.

The instructor met EUI after the student pilot had landed and taxied back to the flight line immediately following the accident. He reported that the first words from the student pilot were 'What happened?'

Student pilot of EUI

The student pilot of EUI could only recall minimal information on the events leading up to and following the collision. He recalled that he was turning from the base to final leg of the circuit and was about halfway through his radio broadcast when he felt a vibration in the aircraft and then saw a yellow aircraft fly up in front and then to the left of his windscreen. He indicated that something had hit his aircraft but was not sure what it was, and realised that there was something wrapped around the left wing of his aircraft.

When asked, the student pilot was unable to recall the traffic sequence and which aircraft he was following at the time. Similarly, he could not recall seeing any other aircraft in the circuit, particularly on the base leg. He did recall being on the base leg of the previous circuit and hearing an aircraft make a 'downwind' radio broadcast, but could not recall any other radio broadcasts.

The student pilot indicated that he flew a normal circuit for a planned touch-and-go landing. That circuit was of the same dimensions as flown previously with the supervising instructor. The student stated that he made the normal downwind, base and final radio broadcasts.

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8 Ensuring that the airspace is clear in the direction of a turn is a normal part of threat and error management. For example, in a high-wing aircraft such as the Cessna, before turning to the left the pilot should be looking for traffic; to the right of the aircraft, in front of the aircraft, to the left of the aircraft and then lifting the left wing up slightly to ensure that there was no traffic, then finally looking behind the aircraft to the left before commencing the turn.

The student pilot was aware that the CFI was flying in another aircraft in the circuit but could not recall any details about the other aircraft that were flying in the circuit at the time. He described not knowing what had happened, and how he only realised that he had hit another aircraft after being told by the supervising instructor.

Jabiru J3587 pilot

The pilot of Jabiru J3587 reported making all of the appropriate radio broadcasts and that the pilot of the other ultralight responded that he had J3587 in sight. The pilot of J3587 initially indicated that he heard radio broadcasts from the Avid and the student pilot and that, based on those broadcasts, he estimated that they were behind his aircraft in the traffic sequence. In a later report, the pilot indicated that he heard a radio broadcast from someone with what was described as a foreign accent. That broadcast was reported to have indicated that the transmitting pilot intended extending his downwind leg to allow both Jabiru aircraft to land.

The pilot of J3587 recalled that, when he was on final approach, he heard two aircraft overtransmit each other, and that a third aircraft had alerted the circuit traffic of that overtransmission between two aircraft that were on final. He did not witness the collision.

Injuries to persons

The pilot of the Avid received fatal injuries. The student pilot of EUI did not report any injuries as a result of the accident.

Damage to the aircraft

Avid

The Avid was seriously damaged[9] by the impact with the ground and post-impact fire.

EUI

Cessna EUI received damage to the right wing and wing strut, the right horizontal stabiliser, the propeller and the left flap (see *Wreckage and impact information*).

Other damage

There was no other damage to property reported as a result of the accident.

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9 The *Transport Safety Investigation Regulations 2003* definition of 'serious damage' includes the destruction of the transport vehicle.

Personnel information

Avid pilot

The pilot of the Avid held a CASA-issued private pilot (aeroplane) licence (PPL(A)) and a Recreational Aviation – Australia Incorporated (RA-Aus) recreational aircraft pilot's certificate, with a flight radio authorisation, and a Level 2 maintenance authorisation. He was the registered owner and maintainer of the Avid.

At the time of the accident, the pilot did not hold a current CASA medical certificate. His last CASA medical certificate expired in December 1998 and had been marked 'renew by CASA only'. He presented for a medical examination to renew his medical certificate in September 2001; however, he did not provide the requested medical reports to CASA to allow the assessment and renewal of his medical. There were no further medical assessments of the Avid pilot recorded by CASA.

The RA-Aus Operations Manual required that to continue to exercise the privileges of a pilot certificate, pilots had to sign an annual declaration that their health standard was equivalent to that required for the issue of a private motor vehicle driver's licence. The pilot of the Avid completed an RA-Aus medical declaration on 29 January 2007. A signed, but undated medical declaration for the Avid pilot was also held by a local ultralight flying school. As a certificated recreational pilot, the pilot of the Avid required no other specific authorisation to fly his aircraft privately.

A review of the pilot's logbook revealed that he had logged 2,414.5 hours aeronautical experience, with the majority being in ultralight aircraft. He last completed a flight review with an RA-Aus instructor on 31 January 2007.

Family members reported that the Avid pilot's activities in the days leading up the accident were normal, and that he was adequately rested prior to commencing flying on the day of the accident.

Student pilot of EUI

The student pilot was undergoing training to obtain a PPL(A). He was a foreign national who was resident in Australia and enrolled in a local high school to complete his secondary school education.

The student pilot held a valid student pilot licence, a current Class 2 Medical Certificate with no restrictions and had been previously certified by the CFI of the flying school as competent to fly the Cessna 172 aircraft solo. He had logged 25.4 hours dual flying and 1.2 hours solo flying experience in Cessna 172 aircraft at the time of the accident.

An examination of the student pilot's logbook revealed that the majority of his dual training flights were conducted on Saturdays. The student's solo flight time was accrued in five separate flights, four of which were on a Saturday. Those solo flights all involved circuits at Latrobe Valley Aerodrome.

An examination of the student pilot's training records showed that, during the first 11 hours of his training, the item *'Radio Procedure known and followed'* was either blank or had been marked as 'not assessed'. The comments section of the student's records indicated that he commenced using the radio after 11 hours of training; however, there were no qualitative comments in the records regarding his performance in using the radio.

The student pilot's first solo achievement record indicated that he was competent to operate the radio. There was no documentation in the student pilot's file to indicate the means of that assessment.

Civil Aviation Regulation (CAR) (1988) 5.09 (1)[10] included the requirement that:

> CASA must issue a flight crew licence to an applicant if, and only if, the applicant:
>
> (a) possesses a knowledge of the English language that is sufficient to enable him or her to exercise safely the authority given by the licence;...

At the time of the accident, there was no formal CASA requirement for an assessment of a student pilot's English language proficiency. Any assessment was undertaken by a training school's CFI prior to completing a student's application for a student pilot licence. The CFI reported that he had no problems in communicating with or understanding the student pilot and that he assessed the student as having an acceptable level of English to meet the requirements of the CAR at that time. Similarly, when he had flown with the student, there had been no indication that the student pilot was experiencing difficulty understanding what was said on the radio. The student pilot stated that English was his first language (see also *English language proficiency requirements* later in this report).

The student pilot advised that he had rested and studied in the days leading up to the accident, and that he was adequately rested prior to commencing the flight.

It was also reported that the student was wearing a communications headset during the flight.

Student pilot's supervising instructor

The supervising instructor held a commercial pilot (aeroplane) licence and a grade 3 instructor rating. He held a valid Class 1 Medical Certificate with a restriction that reading vision correction was to be available while exercising the privileges of the licence. The instructor had 1,265.3 hours of total aeronautical experience and 291 hours of instructional experience at the time of the accident.

Civil Aviation Order (CAO) 40.1.7 listed the authority of the various instructor ratings. Pursuant to the written permission of the respective CFI, that included the ability of grade 3 instructors that had logged at least 100 hours of elementary instruction[11] to give flying training without direct supervision. In addition, such grade 3 instructors were also able to authorise students to fly solo in sequences in which the student had previously completed solo practice.

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[10] Civil Aviation Regulation (1988) No. 158 as amended up to SLI 2007 No. 171 – current at time of accident.

[11] Elementary instruction was defined in CAO 40.1.7 as instruction in any sequences other than navigational sequences that are relevant to the issue of a private pilot licence. In other words, basic flight sequences.

The supervising flying instructor had received that written permission and had completed a 12-monthly standardisation and proficiency flight with the CFI as required by CAO 40.1.7.

Aircraft Information

EUI

Cessna EUI was a high-wing aircraft with four seats. The aircraft was painted white with brown and grey stripes. The student pilot was seated in the front left seat.

At the time of the accident, the aircraft was serviceable and all applicable maintenance and airworthiness directives had been complied with. There were no reported problems with the aircraft or its radios.

Avid

The Avid was an amateur–built, high-wing aircraft with two seats, was painted bright yellow with a black stripe along the fuselage and was fitted with a ballistic parachute recovery system. The pilot was seated in the left seat.

The aircraft had been owned by three different people before it was purchased by the current owner/pilot in 2005.

Civil Aviation Order 95.55 detailed the airworthiness requirements for certain ultralight aircraft, including the Avid Flyer. That required maintenance to be carried out in accordance with the manufacturer's maintenance schedules. If those documents were not available to the owner/maintainer, the RA-Aus Technical Manual incorporated a comprehensive servicing schedule for use by owners/maintainers.

The RA-Aus Technical Manual section 4.2.4 dated July 2007, stated:

> Aircraft operated under the auspices of CAO 95.10, 95.32 and 95.55 shall be maintained in accordance with the manufacturer's maintenance manual. Where no manufacturer's manual exists the aircraft should be maintained to the schedules contained in this Manual.

An examination of the aircraft's logbooks revealed that, while maintenance was conducted on the aircraft, there was no record of the required maintenance schedule being utilised.

The original statement of compliance for the aircraft, which was completed at the time of the aircraft's construction in 1995, indicated that it was fitted with a Rotax 582 engine to which a 'PXD' propeller was fitted.

No maintenance history was available for the aircraft from February 1996 until November 1999.

The registration application for the aircraft in 1999 indicated that the aircraft was fitted with a Rotax 912UL engine. On-site examination of the engine revealed that this same engine model was fitted to the aircraft. However, no record could be found in the logbooks in respect of the installation of this engine.

At the time of the accident, the airworthiness status and the time in service of the aircraft's engine could not be determined from the available records.

Meteorological information

The weather conditions at Latrobe Valley Aerodrome at the time were forecast to include scattered[12] cloud at about 1,400 ft above ground level (AGL), and were forecast to improve during the day. The wind was forecast to be from 090° true (T) at 5 kts, increasing to 8 kts from 1100.

The Latrobe Valley automated weather observations at 1100 and 1130 indicated that the actual weather conditions were consistent with those forecast. The wind recorded at 1130 was from 060° T at 12 kts. The recorded cloud was scattered at 2,100 ft AGL at 1100 and scattered at 2,300 ft AGL at 1130. The recorded visibility was in excess of 10 km. These conditions were adequate to allow visual flight.

Position of the sun

The position of the sun at the time of the collision was established via the Geoscience Australia website at www.ga.gov.au as:

- elevation[13] - 63°
- azimuth[14] - 58°.

Aircraft flying on downwind for runway 09 would have had the sun in a position behind the aircraft and at a significant elevation. On the base leg of that circuit, the sun would have still been behind the aircraft.

Communications

Latrobe Valley Aerodrome was a non-towered aerodrome and used standard CTAF procedures. When aircraft were operating in the vicinity of CTAF aerodromes, pilots were required to make radio broadcasts at designated positions within the circuit and when arriving at the aerodrome. Radio transmissions were made on a discreet frequency of 126.0 MHz, and were not recorded.

CTAF procedures

On 24 November 2005, Stage 2c of the National Airspace System became effective and introduced changes to operations and procedures at non-towered aerodromes. The introduction of those procedures relied on the application by affected pilots of 'alerted see-and-avoid' for traffic management and avoidance. For more information on the see-and-avoid principle refer to the later section *See-and-avoid*.

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[12] Cloud amounts are reported in oktas. An okta is a unit of sky area equal to one-eighth of total sky visible to the celestial horizon. Few = 1 to 2 oktas, scattered = 3 to 4 oktas, broken = 5 to 7 oktas and overcast = 8 oktas.

[13] Elevation is the vertical angle in degrees from the horizon.

[14] Azimuth is the clockwise horizontal angle in degrees from true north.

The AIP defined alerted see-and-avoid as:

> A procedure where flight crew, having been alerted to the existence and approximate location of other traffic in their immediate vicinity, seek to sight and avoid colliding with those known aircraft.

Latrobe Valley Aerodrome, like the majority of aerodromes in Australia, was an uncontrolled aerodrome that was operating under CTAF procedures. CTAF relates to the application of a set of procedures and therefore has no physical vertical or lateral boundaries. Given the circumstance affecting a flight, CTAF procedures require a number of broadcasts to be made by pilots when operating in the vicinity[15] of a non-towered aerodrome, and at specified locations while operating in the circuit or on the ground at such aerodromes.

At the time of the accident, those broadcasts were highlighted in the Aeronautical Information Publication Australia (AIP) – EN ROUTE (ENR) section 21 *Radio communication and navigation requirements.* A broadcast was defined by the AIP as:

> 'Broadcast' means a radio broadcast from an aircraft on the appropriate frequency to provide advisory traffic information to other aircraft.

The radio broadcasts for application during circuit operations at the time of the accident are reproduced at Table 1.

Table 1: Summary of circuit broadcasts – all aircraft at non-towered aerodromes

Situation	Frequency to use	Remark
Entering the runway (with intentions)	CTAF	Broadcast
Turning downwind	CTAF	Broadcast
Turning base	CTAF	Broadcast
Turning final (with intentions)	CTAF	Broadcast
Clear of the runway	CTAF	Broadcast
Entering the circuit	CTAF	Broadcast

The intention of those broadcasts was to assist pilots to meet their obligations to avoid collisions with other aircraft under the CAR. In that respect, CAR 161(2) stated:

> ...nothing in the rules in this Division shall relieve the pilot in command of an aircraft from the responsibility of taking such actions as will best avert collision.

15 Civil Aviation Regulations (1988) – Part 12, Division 2, Regulation 166 defined in the vicinity of a non-controlled aerodrome as being within airspace that was not defined as controlled airspace but was within a horizontal distance of 10 NM (19 km) from the aerodrome and at a height above that aerodrome that could result in conflict with aerodrome operations.

In addition, CAR 162(3) stated:

> An aircraft that is being overtaken has the right-of-way and the overtaking aircraft[16], whether climbing, descending or in horizontal flight, shall keep out of the way of the other aircraft by altering its heading to the right, and no subsequent change in the relative positions of the two aircraft shall absolve the overtaking aircraft from this obligation until it is entirely past and clear.

The responsibility of flight crew to see-and-avoid other aircraft was specified in CAR 163A as follows:

> When weather conditions permit, the flight crew of an aircraft must, regardless of whether an operation is conducted under the Instrument Flight Rules or the Visual Flight Rules, maintain vigilance so as to see, and avoid, other aircraft.

At the time of the accident, AIP ENR section 1.4, paragraph 4.2.4 indicated that while operating under CTAF procedures, the responsibility for collision avoidance, sequencing, and knowledge of local procedures rested solely with the pilot in command.

Universal Communications

A radio communication service was also available at Latrobe Valley Aerodrome in the form of a Universal Communications (UNICOM) frequency. The AIP defined UNICOM as:

> ...a non-ATS communications service provided to enhance the value of information normally available about a non-towered aerodrome.

The AIP Part 1 GENERAL (GEN) section 3.3 UNICOM outlined the information provided on a UNICOM frequency. That did not include the provision to pilots of separation advice, and the use by pilots of information obtained from a UNICOM was at the discretion of the respective pilot.

The Enroute Supplement Australia (ERSA) aerodrome facilities entry for Latrobe Valley Aerodrome listed a UNICOM frequency of 126.0 MHz. Stations providing a UNICOM service were required to be licensed, and the aerodrome owner indicated that the UNICOM frequency was operated by the flying school at the aerodrome that was conducting the student pilot's training.

The flying school indicated that it used the UNICOM frequency to provide information on parking, taxiing and other operational information to school aircraft. The chief flying instructor indicated that the frequency was not used to provide a traffic separation service or to provide traffic information.

The flying school did not, and was not required to record transmissions made on the Latrobe Valley UNICOM frequency.

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[16] CAR 160 defined an overtaking aircraft as: '...an aircraft that approaches another from the rear on a line forming an angle of less than 70° with the plane of symmetry of the latter, that is to say, an aircraft that is in such a position with reference to another aircraft that at night it would be unable to see either of the forward navigation lights of the other aircraft.'

Aerodrome information

Latrobe Valley Aerodrome had two runways, one oriented in the 09/27 or east to west direction[17] and the other in the 03/21 or north-north-east to south-south-west direction. The airfield was used by CASA-registered and ultralight aircraft on a regular basis.

A number of quantitative criteria for the provision of air traffic services at aerodromes had been established by CASA.[18] Those criteria were based on the number of movements at an aerodrome as follows:

Annual Aircraft Movements – exceed 50,000 movements

Annual Air Transport Aircraft Movements – exceed 10,000 movements

Total Annual Passenger numbers – exceed 0.25 million passengers

According to the Latrobe Regional Airport website,[19] the aerodrome has about 25,000 aircraft movements a year. Of those, about 9,000 are charter/hire/aerial work flights, 12,500 involve flying training, 2,000 are community service aircraft movements and 1,500 are private or business flights. No air transport aircraft movements were listed.

Latrobe Valley Aerodrome did not meet the CASA criteria for the provision of an air traffic service.

Size of the circuit pattern

The size of a circuit pattern can vary and is dependent on a number of factors, including:

- the aircraft type and its performance
- the operational circumstances
- pilot experience and competence
- the nature of the flight
- any training requirements affecting the flight
- traffic sequencing
- the weather conditions
- any airspace limitations
- the impact of terrain.

As a result, the dimensions of respective aircraft's circuit patterns can vary in any circuit airspace at any given time. In practice, two aircraft that are of similar

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17 Runway direction is referenced to the runway's magnetic heading, with the runway number indicating that heading to the nearest 10°.

18 CASA Office of Airspace Regulation – *Option Paper on Criteria for the establishment and dis-establishment of CTAF (R)* – http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_90469 – retrieved 3 June 2009.

19 http://www.latrobe.vic.gov.au/EconomicDevelopment/Airport/Statistics/ - retrieved 29 May 2009.

performance may conduct circuit operations using different circuit dimensions. Conversely, two aircraft that have varying performance may have to conduct similar-sized circuits as a result of the factors listed above.

A number of instructors at Latrobe Valley reported that the depiction of the circuit dimensions in Figure 1 was consistent with what they considered to be a 'normal' runway 09 circuit pattern. The November 2005 CTAF procedures required ultralight aircraft with a speed of greater than 55 knots, such as the Avid, to fly a circuit that was appropriate to the performance of the aircraft. It was reported that, in meeting that requirement, the Avid normally flew a circuit that was comparable with that of the Cessna 172.

A normal aeroplane circuit pattern at a CTAF aerodrome was flown at a height of 1,000 ft AGL. After takeoff, an aircraft would normally reach a height of 700 ft AGL[20] on the upwind leg of the circuit, before commencing a turn onto the crosswind leg. While on the crosswind leg, the pilot would normally continue climbing the aircraft to 1,000 ft AGL. The downwind leg of the circuit was flown at 1,000 ft AGL and on late downwind just prior to turning onto base, the pilot would commence reconfiguring the aircraft for the descent to the landing threshold. That normally meant configuring the aircraft for a rate of descent such that the turn on to the final leg of the circuit would be completed no lower than 500 ft AGL. The pilot would also configure the aircraft's airspeed on base and final to establish the aircraft at the final approach speed after completing the turn onto final.

Table 2 compares the performance of the Avid and Cessna 172.

Table 2: Comparative aircraft performance

Aircraft	Altitude	Climb	Downwind	Base	Final
Avid	1,000 ft AGL	60 kts	70 kts	60 kts	60 kts
Cessna 172	1,000 ft AGL	65-70 kts	95 kts	75 kts	65-70 kts

The performance of the Avid and Cessna 172 were applied to the dimensions of the normal circuit pattern as agreed by the Latrobe Valley instructors in order to understand the time taken to fly that pattern. The resulting estimated normal circuit times for the both aircraft are listed in Table 3.[21]

[20] The changes to the CTAF procedures on 24 November 2005 changed the height of the turn from the initial leg of the circuit onto crosswind from 500 to 700 ft AGL.

[21] Time taken to fly the upwind, crosswind, downwind, base and final legs. The time spent on the runway was unable to be estimated with any degree of accuracy.

Table 3: Approximate circuit times

Aircraft	Time (min:sec)
Avid	5:29
Cessna 172	4:42

Recorded radar information

The circuit area at Latrobe Valley Aerodrome was below the radar coverage of any radar facility. There was no recorded radar information for either aircraft leading up to the collision.

Wreckage and impact information

Avid

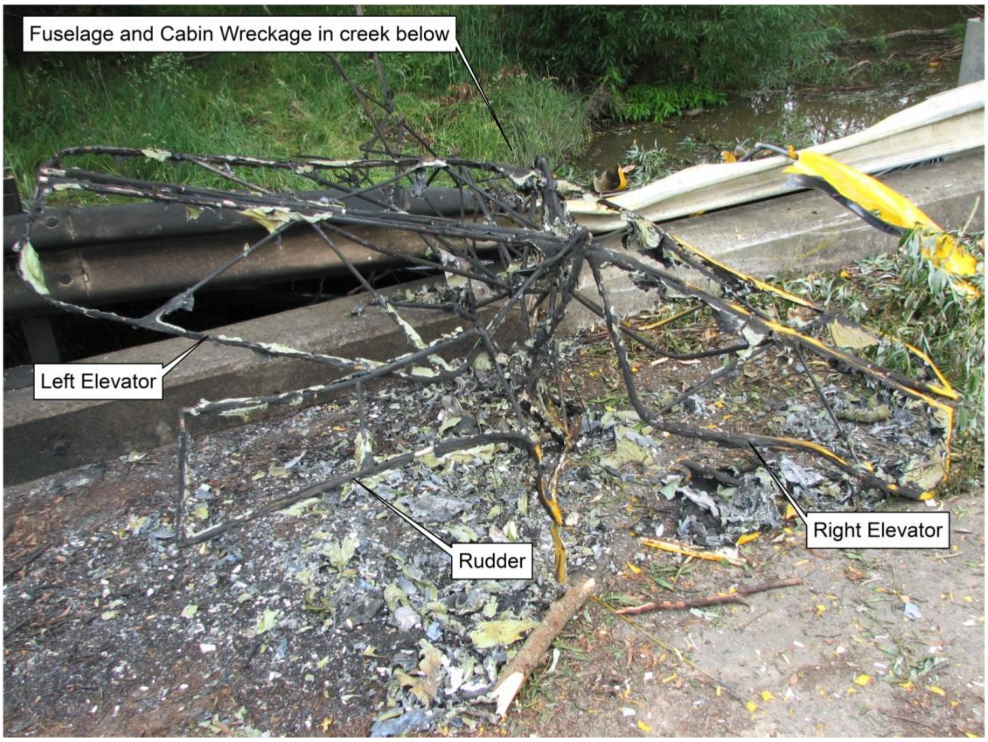
Wreckage trail

The Avid wreckage trail was aligned in a generally west-to-east direction along the Old Melbourne Road, with the heaviest items located at the eastern end of the trail. The lightweight items at the western end of the trail consisted of low density foam filling from the aircraft's flaperon[22], fabric strips from the wing covering and a number of small pieces of aluminium sheet that were later identified as belonging to the Avid's left flaperon. Marks on those pieces of aluminium were consistent in size and shape with contact with the Cessna's propeller tips. A detached section of the Avid's vertical fin was recovered along the wreckage trail about 250 m from the main wreckage.

The aircraft came to rest upright on the side of a bridge that crossed a small creek, with the tail and left wing of the aircraft on the bridge and the remainder of the wreckage located in a creek alongside the bridge (Figure 5). All of the aircraft's components were accounted for either at the main wreckage location, or along the wreckage trail.

22 Aircraft control surface that combines the roll-control function of an aileron, with the increased lift and drag function of a flap.

Figure 5: Main wreckage



Aircraft damage

The aircraft impacted the ground while in a nose-down attitude and travelling from east to west through the trees that surrounded the accident site. All of the aircraft items that were located remote from the main wreckage displayed evidence of gross overload failure consistent with the aircraft's impact with the terrain or trees.

There was no evidence of an in-flight fire, whereas a post-impact, fuel-fed fire resulted in fire damage to most of the aircraft's structures. The extent of the fire damage indicated that a reasonable quantity of fuel was on board the aircraft at ground impact.

An initial examination of the wreckage revealed that the aircraft's ballistic parachute recovery system had not deployed prior to impact. A subsequent examination of the wreckage revealed that the safety pin for the system was still in the 'safe' position, rendering the system inoperative in flight.

Impact damage to the upper surface of the stabiliser spar tube and elevator hinge points was identified that had occurred prior to the fire. The upper part of the vertical fin was not identified with the main wreckage and the remnants of the vertical fin's attachment structure exhibited deformation in a downwards direction. There was no similar downwards bending of the aircraft structure surrounding the fin's attachment point, suggesting that the damage to the vertical fin occurred before ground impact.

The left horizontal stabiliser and elevator frame and structure showed no evidence of contact with the propeller of the Cessna[23] (Figure 6).

Figure 6: Left horizontal stabiliser and elevator frames

Both wings were severely fire damaged, with the fabric covering and the majority of the wings' internal wooden structures consumed by fire. The left wing had detached from the airframe and examination of the remaining structures revealed evidence of contact on the rear spar tube with an object prior to the fire. The right wing had broken into two pieces with the outboard section located in the tree canopy above the accident site. The remaining inboard section remained attached to the aircraft.

The engine and propeller were severely damaged by the ground impact and fire. The fuel selector for the engine was in the ON position.

The cockpit area and the associated instruments and radios were severely damaged by the ground impact and fire, precluding an in-depth examination of those systems and components.

There was evidence that the pilot of the Avid was wearing a headset at the time of the collision and that his harness was secured.

EUI

Aircraft Damage[24]

The aircraft was secured in a hanger by the flying school after it landed and was subsequently examined by the Australian Transport Safety Bureau (ATSB). The damage to EUI was predominantly on the right side of the aircraft, and included

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23 For an engine speed of 1,500 RPM, which was considered to represent a normal approach power setting for the Cessna 172, a two-bladed propeller such as in the Cessna would produce propeller slash marks about 5 to 10 cm apart when the aircraft was travelling at a relative speed of between 5 to10 kts different to that of another aircraft (that is, a closure or separation speed of 5 to 10 kts).

24 Damage locations and paint transfer are described as being viewed while seated in the cockpit of the aircraft looking forward.

bending of the right wing strut, with additional damage on the lower surface of the strut. There was a hole measuring about 10 cm by 20 cm in the leading edge of the right wing (Figure 7) and damage to the lower surface of the left wing flap. In addition, there was indentation damage and yellow paint transfer to the wing and the aircraft's propeller spinner[25].

The damage to the right wing strut was directly below the hole in the leading edge of the right wing. When examined, the bending of the strut and of the wing structure surrounding the hole were found to be the result of a force being applied in an upwards direction.

Figure 7: Damage to VH-EUI's right wing and strut

Damage to the leading edge and face of one of the aircraft's two propeller blades included a witness mark from what appeared to be a wire cable (Figure 8). That mark was later found to be consistent with the internal wire bracing structures of the Avid's left wing. There was also impact damage on the leading edges of both propeller blades consistent with striking a hard object or objects.

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25 Streamlined fairing over the propeller hub.

Figure 8: Propeller damage and wire imprint

An examination of the yellow paint transfer and damage to the underneath of the aircraft's left flap revealed that an object had impacted the joint between the flap body and its trailing edge flutes. A piece of lead was subsequently recovered from the flap. Spectrographic analysis of the composition and paint covering of the piece of lead revealed that it was identical to the lead from the Avid's left flaperon mass balance weight.

Paint transfer

There were multiple yellow paint transfer marks on EUI, including on the leading edge of the right wing and strut, the right horizontal stabiliser, the propeller and spinner, and the left wing root leading edge (Figure 9).There was also yellow paint transfer on the underneath surface of the left flap, and on the upper surface of the leading edge of the left wing, about 2.7 m outboard from the wing root. Finally, there was yellow paint transfer on the right side of the windscreen, and on the fuselage below the windscreen (Figure 10).

Figure 9: Right side areas of paint transfer

Figure 10: Windscreen paint transfer

A section of the Avid's left wing flaperon was observed by witnesses to have been wrapped around EUI's left wing root after the student pilot landed the aircraft. An examination of that flaperon showed the transfer of red paint to the flaperon. During a reconstruction of the collision (see the following discussion titled *Collision damage reconstruction*), the area of the flaperon that exhibited red paint transfer aligned with the position of EUI's left wing fuel cap, on the upper surface of that wing.

Collision damage reconstruction

To further evaluate the collision damage to EUI, an exemplar Avid aircraft,[26] was used to reconstruct the positions of both aircraft at the point of collision. Those positions were as reported by witnesses, with both aircraft on a similar heading and the Avid to the right of EUI's centreline (Figure 11).

The reconstruction showed that the impact damage to EUI's wing strut and the hole in the leading edge of the right wing aligned with the Avid's vertical fin. In that relative position, the Avid's left horizontal stabiliser would have contacted the right side of the fuselage and windscreen of EUI, coincident with the yellow paint transfer in that area.

Figure 11: Alignment of an exemplar Avid with the damage to EUI

When the aircraft were in that position, the Avid's left flaperon was still about 1m forward of EUI's propeller. The reconstruction revealed that the damage to the Avid's left flaperon aligned with the arc of EUI's propeller tip, and that the damage to the left underneath surface of EUI's flap was in line with the position of the Avid's left flaperon mass balance weight.

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[26] The only geometric differences between the accident and exemplar Avids were that the accident Avid had a rectangular fin and rudder and longer flaperons, while the exemplar Avid had a rounded fin and rudder and shorter flaperons. All other aircraft dimensions were the same.

Figure 12: Reconstructed alignment of the Avid's damaged left flaperon and EUI's propeller arc

The dimensions of the exemplar Avid's horizontal stabiliser were measured and it was found that the elevator hinge positions and dimensions lined up with similar markings on both sides of the hole on the leading edge of EUI's right wing.

Medical and pathological information

The Avid pilot's post-mortem examination revealed no evidence of incapacitation prior to the collision. Toxicology testing detected levels of ethanol in samples taken from the pilot. The post-mortem report contained the following statement:

> Toxicological analysis detected the presence of ethanol in both blood and vitreous humour at a level of .02 gram/100 mL. Whilst this is below the legal level for driving a motor vehicle, it indicates that the deceased has consumed ethanol [alcohol] in the hours prior to flying and may have been subject to post alcohol impairment or the hangover effect.

The Avid was being operated under CAO 95.55, which defined certain exemptions to the CARs. There were a number of exemptions to specific regulations listed in CAO 95.55, but that did not include an exemption to the requirements of CAR 256. CAR 256 (3) related to the consumption of alcohol by flight crew prior to flight, stating that a person shall not consume alcohol in the 8-hour period prior to commencing a flight.

The pilot's family reported that the only time he consumed alcohol was with his evening meal.

Organisational and management information

Student pilot licence

The requirements for the issue of a student pilot licence are listed in the CARs. In that respect, CAR (1988) 5.65 stated that:

> For the purposes of subregulation 5.09 (1), a person is qualified to hold a student pilot licence if the person is at least 16 years old.

A licensed student pilot was authorised by CAR (1988) 5.66 (1) to fly an aircraft as pilot in command (PIC) subject to additional requirements. Those requirements were listed under regulation 5.66 (2) and included that:

> (2) A student pilot must not fly an aircraft as pilot in command if each of the following requirements is not satisfied:
>
> (a) an authorised flight instructor gives the student permission to conduct the flight as pilot in command;
>
> (b) the student conducts the flight in accordance with that permission and any conditions subject to which the permission is given.

Prior to flying an aircraft as PIC, a student pilot was required to undergo specified training as outlined in the CARs and expanded upon in a relevant syllabus. The relevant sections of CAR 5.67 stated that:

> (1) An authorised flight instructor must not permit a student pilot to fly an aircraft as pilot in command if each of the following requirements is not satisfied:
>
> (a) the student pilot has received flying training from an authorised flight instructor in the type of aircraft concerned;
>
> (b) the student pilot has satisfied the requirements of the flight radiotelephone operator licence syllabus that are relevant to the proposed flight;
>
> (c) if the aircraft is an aeroplane — the student pilot has satisfied the requirements of the aeroplane syllabus that are relevant to the proposed flight;
>
> ...
>
> (g) the student pilot can safely fly the aircraft as pilot in command on the proposed flight.

English language competency requirements

At the time of the accident, there were no formal English language proficiency requirements. In 2008, CASA introduced English language proficiency testing requirements for aviation licence holders. Student pilots were initially not included in those requirements but were included 9 months later. Initially, student pilots were required to demonstrate general English language proficiency only, followed by aviation-specific English language proficiency prior to the issue of a private pilot licence or higher.

The proficiency testing requirements for student licence holders were strengthened to include new formal, standardised requirements. One of those was that if the person applying for the student licence was enrolled in a secondary school, where the primary language of instruction was English, then they qualified at Level 4 English language testing for the purposes of the student licence. The student pilot of EUI met that criterion.

Pilot training

National competency standards

Pilots undergoing flying training for the issue of a pilot licence in Australia train under the Day Visual Flight Rules (VFR) syllabus, which was introduced by CASA in December 1992. In accordance with Australian Government policy, in July 1999 the syllabus was updated by the introduction of the Australian National Competency Standards for Private and Commercial Pilots, which were jointly developed by the Australian National Training Authority (ANTA), CASA and the flying training industry. The application and use of those standards became mandatory for flying schools on 1 September 1999.

The syllabus that was current at the time of the accident included a section on practical flying training that contained an abbreviated form of the national standards, and included the following statement:[27]

> It is vital that Chief Flying instructors and Approved Testing Officers should be familiar with the National Standards document because it contains additional information which will assist in interpretation of the standards and is essential for the accurate assessment of pilot competency. Copies of the national standard are available from Airservices Australia Publications Centre.

The original national standards document was titled *TIPS158 – Units of Competency for Aeroplane Pilots* and was published by ANTA. It contained an explanation of competency-based training and expanded on how the standards were to be used in practice. The original competency standards and syllabus did not contain any discreet units on situational awareness, instead including aspects of situational awareness as part of ‘Airmanship’ in other sections.

In March 2003, the competency standards relating to piloting an aeroplane were consolidated in a training package that was produced by the Department of Education Science and Training and was titled *TDA03 – Aviation Training Package.* The package contained revised aviation competency standards, in addition to a number of standards relating to other areas of the transport industry. Those standards included the unit *Manage situation awareness in aircraft flight.* The performance criterion for a related element of that competency standard was titled *Maintain situation awareness*, and included the requirement that:

> 1.1 Continuous monitoring is demonstrated of all critical factors relevant to the safe progress of a flight

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[27] Day (VFR) Syllabus Issue 3.2 – May 2007.

1.2 All relevant indications of a trend to an unsafe situation are recognised and appropriate corrective action is employed in accordance with workplace procedures and regulatory requirements

1.3 Inaccurate situation awareness is identified by the recognition of unexplainable discrepancies or events, timing errors, unexpected results, communication mismatches or disturbing intuitive feelings.

1.4 Breakdown in situation awareness is rectified by maintaining control of the aircraft or situation and identifying and achieving a goal that will ensure immediate safety.

1.5 Following a breakdown in situation awareness, appropriate information is gathered to enable an appropriate analysis of the present situation and the implementation of a new plan that results in ongoing safety and re-establishment and maintenance of situation awareness.

The Day VFR syllabus was updated in April 2008, with the introduction of a number of units including *Threat and Error Management [TEM] and Single Pilot Human Factors (Manage Flight)*. Those units were introduced as a result of recommendations from the International Civil Aviation Organization (ICAO) and were intended to enhance flight safety. In addition, the introduction of TEM concepts into the Day VFR syllabus was expected to provide for a more objective assessment of an individual's competency in airmanship.[28]

The competency standards were further revised, and an updated set of standards was released in August 2008 titled *AVI08 - Aviation Training Package*. In addition to the revision of the standards, the syllabus was revised to include the competency standards in an abbreviated form. This continual review and updating of competency standards was in accord with accepted competency-based education and training practices, underlining that knowledge and expertise continually change and grow (Harris, Guthrie, Hobart & Lundberg, 1995).[29]

Following the introduction of the competency standards, CASA provided assistance to the flying training industry to assist them in introducing competency-based training (CBT). All flying training organisations were provided by CASA with a compact disc read-only memory (CD-ROM) containing training material on how to develop the necessary documentation to implement competency-based training in their organisations. That included sample training matrices, sample lesson and training plans, sample training records and reference material relating to competency-based training. The material was also made available for download from the CASA website at www.casa.gov.au

CASA has recently completed a regulatory change project to introduce additional CBT material to flying training schools in the form of Civil Aviation Advisory Publication (CAAP) – CAAP 5.59A-1(0) *Competency Based Training in the Aviation Environment*. A further regulatory change project is underway to introduce additional CBT for flying instructors,[30] as CASA has recognised that in some cases, it is still not being implemented correctly. CASA is attempting to reduce the

[28] ICAO defined airmanship as 'The consistent use of good judgement and well developed skills to accomplish flight objectives.'

[29] Harris, J., Guthrie, H., Hobart, B., & Lundberg, D. (1995). *Competency-based Education and Training: Between a Rock and a Whirlpool*. South Yarra, Vic: Macmillan.

[30] Project FS 09/08 – CAAP 5.14-1(0) Flight Instructor Training.

likelihood of any ineffective training, which increases the safety risk in the aviation environment.[31]

Following the accident, the CFI and the supervising instructor advised that they were unaware of the existence of the Australian National Competency Standards, and that the flying school did not have copies of that document. Information from the aviation industry indicated that was not an unusual situation, as many flying schools were unaware of the existence of the national standards documents.

Competency-based assessment

A cornerstone of a CBT system is the:[32]

> ...rigorous and objective assessment of the trainee against valid standards.

Errors in the competency assessment process, or the incorrect attribution of competency can lead to persons who lack the required competency, or have not yet displayed competence in all expected conditions, taking part in the aviation environment. In consequence, those persons can pose a safety risk to other members of the industry, as well as to themselves.[33]

When assessing a person's competency, the assessment needs to ensure that the person is not only competent during the assessment, but also into the future. In guidance material provided to the vocational education industry, Foyster (1990) commented:[34]

> When we certify we are in fact predicting the future – at least to the extent that we invite anyone looking at a certificate to infer something about the future performance of the person to whom the certificate applies. The prediction can only be valid if the assessment is, in the technical sense, valid.

While Foyster may have been addressing the assessment of competence at the completion of a training course, the assessment of a student pilot to fly solo represents the completion of the first achievement record for the Day VFR syllabus, and is therefore a significant assessment milestone. The supervising instructor, apart from the required principles and methods of instruction theory that was contained in his initial instructor's rating, had not undergone any training in the conduct of pilot assessments. This was similar across all of the instructors in the school.

The conduct of a competency-based assessment is one of the areas that have been recognised by practitioners as needing improvement in a competency-based system.[35]

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[31] Background to Project FS 09/05 – *Competency Based Training and Assessment in the Aviation Environment*.

[32] Civil Aviation Safety Authority, (2009). *Civil Aviation Advisory Publication 5.59A-1(0): Competency Based Training and Assessment in the Aviation Environment*, CASA: Canberra.

[33] Mitchell, L. (1995). The definition of standards and their assessment, in *Competency Based Education and Training,* Burke, J. ed., Routledge Falmer: London.

[34] Foyster, J., (1990). *Getting to grips with competency-based training and assessment*. Commonwealth Department of Employment, Education and Training: Canberra.

[35] Harris, J., Guthrie, H., Hobart, B. & Lundberg, D. (1995). *Competency-based Education and Training: Between a Rock and a Whirlpool*, Macmillan: South Yarra.

Civil Aviation Safety Regulation Part 61 – Flight crew licensing

The development of Civil Aviation Safety Regulation (CASR) Part 61 – *Flight crew licensing* is ongoing. CASR Part 61 will set the requirements and standards affecting the issue of flight crew licenses, ratings and authorisations and will define the privileges, limitations and conditions of those authorisations.

Competency-based training standards in support of those qualifications, ratings and authorisations will be incorporated in a supporting Manual of Flight Crew Licensing Standards. In addition, CASR Part 61 will place greater emphasis on teaching how to train, and will include elements of the Australian National Training Authority Certificate IV in Workplace Training and Assessment.

At the time of drafting this report, an implementation date for CASR part 61 was yet to be promulgated.

Assessment and achievement record

The Day VFR syllabus contained an achievement record for various phases of flight training, one of which was for a student's first solo flight. That achievement record outlined the units and elements of competency that must be achieved before undertaking a first solo flight. Student competence in each of the units and elements was assessed against a specific achievement standard.

The achievement standards for a first solo flight and the general flying progress test (GFPT) were not necessarily as high as those required for the issue of the licence. The standards were listed on a scale of 1 to 4 as follows:

> 1 - Achieved standard required for Commercial Pilot as detailed in the Australian National Competency Standards for Private and Commercial Pilots.
>
> 2 - Achieved standard required for Private Pilot as detailed in the Australian National Competency Standards for Private and Commercial Pilots.
>
> 3 - Able to achieve the private pilot standard on the majority of occasions; safe to operate under direct supervision.
>
> 4 - Has received training in the element but not able to consistently achieve the PPL standard.

A note below those standards stated that:

> The word "safe" used in standard 3 [as listed above] means that the pilot may achieve the required standard on the majority, but not necessarily on all occasions. However the student should be able to recognise a situation where the desired outcome of a manoeuvre may be in doubt and take appropriate corrective action to recover.

The introduction of formalised competency standards was intended to ensure that any assessment was rigorous, objective and made against valid documented and industry-accepted standards.

The CFI had assessed the student as competent to fly the Cessna 172 aircraft solo and had made an entry in the student's logbook in accordance with CAO 40.1.7 - Appendix III. The student pilot's achievement record for his first solo flight indicated that he had been assessed as meeting the required standard on all of the applicable units. That included the operation of the aircraft's radio and control of the aircraft in normal flight (which included circuits and complying with airspace requirements).

The student had signed the bottom of the document, acknowledging that he had completed the required training for the elements listed in the achievement record. The achievement record indicated that the student had been certified at the level 3 standard for those units.

Flying school operations manual

Civil Aviation Regulation 215 required an operator to provide an operations manual for the use and guidance of its staff and for an operator's staff to comply with the requirements of that manual. Section E of the flying school's operations manual contained the syllabus and supporting documents for training courses provided by the school, including training for the (PPL(A)). Contained in that section of the operations manual was the statement:

> All training to Private Pilot Licence standard shall be in accordance with the requirements of CAR Part 5, Divisions 4 & 5, and the VFR (Day) Aeroplane Syllabus and Australian National Competency Standards.

Annex 2 of the operator's manual contained a copy of the Day VFR Syllabus - Issue 2.2.1 of 1 November 1999. At the time of the accident, the current version of that syllabus was issue 3.2, dated May 2007.

The section of the operations manual that outlined the syllabus for the PPL(A) was divided into two sections:

- GFPT. In the section on training leading up to the GFPT standard, flight training sequences were listed with basic training objectives and suggested flight times outlined. There were no competency standards listed for each flight sequence, no sample lesson plans, and no performance standards listed for each of the flight sequences.
- GFPT to PPL(A). In the section on training from the GFPT to the issue of the PPL(A), training objectives were outlined, along with pre-flight briefing sequences, in-flight training sequences and performance standards for each sequence, and suggested flight times. The performance standard for each sequence was listed at Appendix E3-5 to the manual.

An examination of Appendix E3-5 titled *Aeronautical Knowledge Check Sheets* revealed no information pertaining to in-flight performance standards. Further examination of the manual did not reveal any guidance information on the definition of performance standards.

The operations manual did contain copies of the Day VFR syllabus achievement records and the requirements for solo flight by student pilots. Those requirements largely repeated the regulatory requirements. The only operator-stipulated criteria for assessing the conditions under which student pilots could be sent on solo flights was a restriction on the crosswind limit. There was no requirement for instructors to consider the likely level of traffic prior to authorising a student to fly solo.

In contrast, appropriate guidance in respect of the risks that should be considered by instructors when assessing and authorising students for solo flight has been in existence for many years. The *Instructor's Handbook of Elementary Flying*

Training - AP1732a (1943)[36] was one of the first known references to apply a risk-based approach to solo flight authorisation. Similar guidance is contained in other instructor manuals, including CASA's *Flight Instructor Manual*.

Additional information

Situational awareness

In simple terms, situational awareness can be described as knowing what is going on around you.[37] More formally, situational awareness has been defined as:[38]

> ...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.

Maintaining a high level of situational awareness is essential to flight safety. In practice, that means that a pilot must continuously monitor his or her environment, and be alert for any significant changes and the possible effect they might have on flight safety.

Developing and maintaining situational awareness involves three aspects:

- perception - gathering relevant information
- integration - interpreting the information
- projection - anticipating future states.

For example, a pilot may receive information from an instrument scan, from looking out for conflicting traffic, from radio communications, and from other sources. He/she must then process that information to make sense of it, and then plan and prioritise their subsequent actions in order to maintain situational awareness.

Factors that can influence situational awareness

Situational awareness is very context specific, relating to a particular task and operating environment. The maintenance of situational awareness is dependent on a pilot's attention and working memory. Therefore, factors such as workload, fatigue, stress, and distraction can have a detrimental effect on situational awareness. Good task management is essential to minimise the effect of workload or distraction, and fitness for duty is essential to minimise the possible effects of fatigue or stress on pilot performance.

A pilot's level of experience can also affect their ability to maintain situational awareness. More experienced pilots are better able to recognise what information it is important to seek or to attend to; to integrate various pieces of information to understand the 'big picture'; and to anticipate likely outcomes and hence stay

36 Air Ministry (1943) *Instructor's Handbook of Elementary Flying Training* – Air Publication 1732a.

37 Endsley, M., & Garland, D. (2000). *Situation Awareness: Analysis and Measurement*. Mahwah, NJ: LEA.

38 Endsley, M. (1995). Towards a theory of situation awareness. *Human Factors*, 37, 32-64.

‘ahead of the aircraft’.[39] In addition, more experienced pilots need to devote less conscious effort to the primary flight tasks, freeing up mental resources that can be used to maintain situational awareness.

Training and assessing situational awareness

Effective situational awareness is a skill that must be developed and practiced.

Efforts to improve situational awareness through training can take one of two approaches. On one hand, training can be aimed at raising pilots’ general awareness of the factors that can influence situational awareness. Alternatively, and more effectively, training can be context specific - that is, directly relate to a particular type of flight operation or environment. Ideally, situational awareness training should follow a pattern that includes information, demonstration, practice, and feedback.[40] Any concepts introduced in the classroom should be practiced, assessed by an appropriately-trained instructor, and then the trainee should be provided with structured feedback.

Feedback is an essential element of any learning process. It is particularly difficult for less experienced pilots to gauge their own situational awareness in normal flight. Therefore, feedback from an instructor during training is an important element in alerting a trainee pilot to any deficiencies in their situational awareness, and to how they might address those shortcomings.[41]

Situational awareness skills specific to a particular operation can be assessed using behavioural markers, either during a training flight or in a simulator. For example, an assessment of a pilot’s situational awareness in the circuit area might rate aspects such as whether the pilot:

- conducts frequent scans of the circuit area
- increases the frequency of monitoring in response to changing operational conditions
- anticipates future operational states and responds appropriately.

An example of a comprehensive situational awareness training regime is the European Enhancing Safety Through Situation Awareness Integration (ESSAI) in Training project. ESSAI combines aspects of situational awareness training with threat management techniques (see http://essai.nlr.nl).

Student pilot of EUI circuit situational awareness training

The CFI and supervising instructor reported that a student’s situational awareness grew as the student’s experience level increased. They indicated that neither of them simulated situations to assess students’ situational awareness. Instead, each

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39 Endsley, M., Garland, D., Shook, R., Coello, J., & Bandiero, M. (2000). *Situation Awareness in General Aviation Pilots*. NASA-Ames Research Center Contract NAS2-99073 Report SATECH-00-01. Marietta, GA: SA Technologies.

40 Prince, C. (2000). *Guidelines for Situation Awareness Training*. NAWCTSD/UCF/FAA Partnership for Aviation Training.

41 Endsley, M., & Robertson, M. (2000). Training for situation awareness in individuals and teams. In M. Endsley, & D. Garland (Eds.), *Situation Awareness: Analysis and Measurement*. Mahwah, NJ: LEA.

took opportunities as they arose to question and assess a student's situational awareness. The supervising instructor commented that there had not been a lot of emphasis on teaching situational awareness during his instructor training.

The student pilot of EUI reported that in his previous flying, his instructors had not questioned him about the position of other circuit aircraft on receipt of radio calls from the pilots of those aircraft. He reported that when he heard radio calls, he just looked up to search for the relevant aircraft. He reported being able to see the other aircraft 'most of the time' when he did this. He did indicate that instructors had taught him about traffic sequencing while in the circuit.

The only problems that the student pilot reported in relation to the use of the radio was that at times, some calls were difficult to hear because of problems with the other aircraft's radio. He could not recall if there were any such calls on the morning of the accident.

An examination of the student's training records revealed no qualitative comments regarding the student's level of situational awareness. Any comments in the records related primarily to the student's flying motor skills.

The operator's training records included the assessment of four aspects of flying for each exercise; general flying ability, checks and procedures, radio procedure and airmanship. The assessment was on a sliding scale from 'not assessed' to 'excellent'. There was no guidance in the training records or in the operations manual on what each level indicated in terms of a performance standard. On a number of the student pilot's instructional flights, none of those aspects were recorded as having been assessed.

The assessment of a student's situational awareness appeared to be covered under 'airmanship' although, as previously stated there was no guidance in the training records or operations manual to confirm this. There were no objective measures of airmanship against which the assessment could be made.

The student pilot had passed a written pre-solo exam before his first solo flight. One of the questions in that exam was intended to assess a student's knowledge of the rules of the air in respect of the prevention of collisions, and queried:

> If two aircraft are on an intercepting course, what action should the pilot take?

In response, the student pilot indicated that he would:

> Give in [sic] the radio call and ask for instructions or go above the aircraft to avoid collision.

The question had been marked as correct; however, the student pilot's response did not accord with CAR 161(1), which stated that:

> An aircraft that is required by the rules in this Division to keep out of the way of another aircraft shall avoid passing over or under the other, or crossing ahead of it, unless passing well clear.

Another question in the exam related to conflict avoidance with other circuit aircraft in the following scenario:

> You have departed runway 03 and are about to turn crosswind when you hear another aircraft call joining crosswind. Describe the action you would take.

The student answered the question as follows:

> I'll ask permission to turn to my downwind first.

This response had been marked as incorrect, and it appeared that the correct response had been discussed with the student by the instructor that supervised the exam. The question on conflicting circuit traffic was reported by the CFI to be the only question in the examination that was intended to specifically relate to situational awareness.

The pre-solo written exam was the only objective evidence available to the investigation that related to the student's level of situational awareness and knowledge of procedures.

Aviation industry - situational awareness flight test results

The office of Flight Training and Testing (FTTO) was established by CASA in 2008. That office was responsible for conducting and monitoring flight testing for the issue of a pilot licence or rating in the Australian Aviation Industry.

Data from the FTTO on the results of private pilot licence flight tests indicated that failure to maintain situational awareness was the second most common item that resulted in a fail assessment.[42] That was also the case in respect of the results of commercial pilot licence flight tests.[43]

Threat and error management

There are two distinct skill sets required to fly an aircraft. The first is the technical skill of hand/eye coordination to manipulate the controls of an aircraft. The second is the more difficult to teach and learn non-technical skill of managing safety risks.[44]

During flight, a pilot must manage situations that pose threats to that flight, involve errors, or result in undesired aircraft states in order for a flight to be concluded safely.[45] Threat and error management (TEM) is a relatively new approach to managing those risks in the aviation environment that can be thought of as 'defensive driving' for pilots. The application of TEM provides a means to objectively observe and measure a pilot's response to in-flight risks.

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[42] Data available from February 2009 to September 2009 only, encapsulating 892 private pilot licence flight tests.

[43] Flight training and testing - Post Implementation Review Report. CASA. Retrieved 22 July 2009 from http://www.casa.gov.au/wcmswr/_assets/main/aoc/training/ftto/downloads/ftto_pir.pdf

[44] Flin, R., Martin, L., Goeters, K., Hoermann, J., Amalberti, R., Valot, C., & Nijhuis, H. (2003). Development of the NOTECHS (Non-Technical Skills) system for assessing pilots' CRM skills. *Human Factors and Aerospace Safety*, 3, 95-117.

[45] Merrit, A. & Klinect, J., (2006), *Defensive Flying for Pilots: An Introduction to Threat and Error Management.*

Aircraft conspicuity

The contrast provided between an object's colour and its background is one of the major determinants of how easily an object will be detected by the eye. High contrast between objects, such as a light-coloured aircraft against a darker background, would have high conspicuity and allow the aircraft to be more easily detected. Detecting an aircraft against a background cluttered with buildings, vegetation and open paddocks could be difficult, depending upon the colour of the background and the colour of the aircraft. As aircraft are continually moving when flying a circuit, the background against which aircraft are being viewed is continually changing. The areas surrounding Latrobe Valley Aerodrome ranged from built-up areas with housing and factories, to open paddocks, to areas of vegetation. All of those areas provide varying backgrounds against which an aircraft can be viewed.

The investigation was unable to determine if the Avid was fitted with a rotating beacon. There was no evidence of a rotating beacon having been fitted to the aircraft's vertical fin and photographs of the aircraft that were taken before the accident were inconclusive.

Apart from the Avid, which was largely yellow, all of the aircraft that were in the circuit at the time of the collision were predominantly white in colour. This alone would give the Avid some degree of conspicuity, as it was the only yellow aircraft in the circuit.

Visual limitations

There are distinct limitations with the human eye, which is able to accept light rays through an arc of about 190°. While this may seem to be a large area, an area of only 10° to 15° in the central area of vision is used to focus on objects and classify them. In addition, each eye has an area known as the 'blind spot', in which no visual imagery can be detected.

Movement can be detected in the peripheral vision; however, the brain is unable to identify what the object is. Once movement is detected, the eyes can be moved towards the target to allow the central area to focus on the object. If there is little or no relative target motion, such as two aircraft flying in the same direction, there is little for the eyes to detect in the way of motion across the visual field. That can result in an aircraft not being seen. When an aircraft turns and changes direction relative to another, the likelihood of its detection increases, as the aircraft is now moving across the observer's visual field.

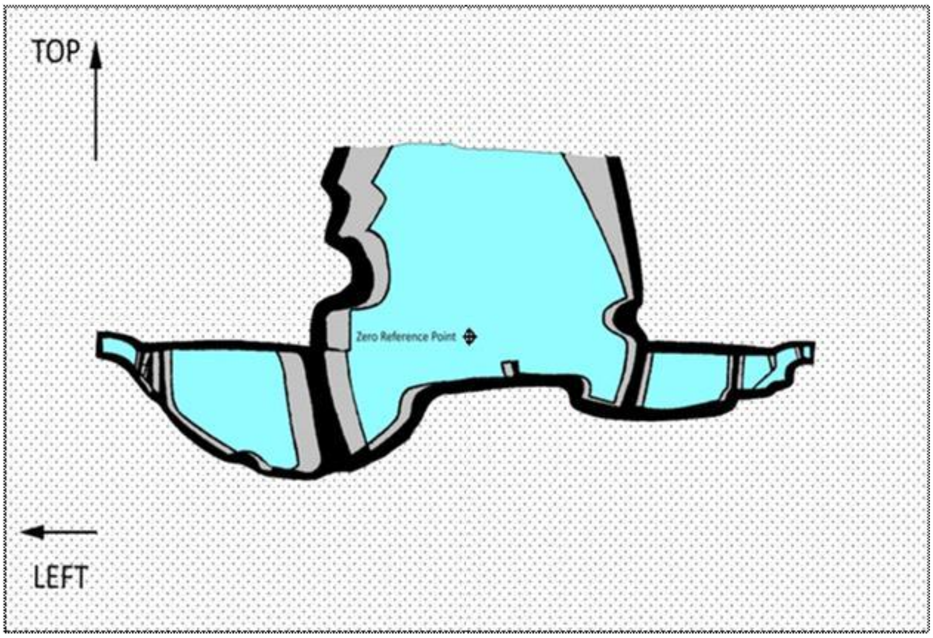
The cleanliness of a windscreen can also impose limitations on vision. Dirt on the windscreen can result in focal traps, in which the eye focuses at the distance of the windscreen, which makes it difficult to see distant objects. When examined following the accident, EUI's windscreen was significantly covered in insect strikes and dirt.

Cockpit vision

The configuration of an aircraft and its cockpit can impose limitations on the vision available to the pilot. The available vision is interrupted by obstructions such as cockpit posts, equipment installations and, in the case of the Cessna 172, external features such as wing struts. All can result in blind spots or limit the vision to one eye only (monocular vision). Cockpit vision is most restricted on the side of the aircraft furthest from the pilot, in this case the right side.

A standard cockpit vision diagram for the Cessna 172 is at Figure 13.[46] The picture is taken from the perspective of a pilot seated in the front left seat and depicts the zero reference point.[47] The areas indicated in light blue are those that provide unobstructed binocular vision to the pilot. The light grey shaded areas indicate those areas of monocular vision, and the black and dotted areas indicate the complete obstruction of the pilot's external vision.

Figure13: Cessna 172 cockpit vision diagram



A pilot's seating position can affect the vision from the cockpit. Following the accident, the student pilot was asked to take his normal seating position in the aircraft and photographs were taken of that position. An examination of those photographs revealed that the student pilot's seating position placed his eyes lower than the zero reference point (Figure 13). That would have decreased the area of vision that was available to the student pilot, particularly ahead of the aircraft.

Obstructions to vision – in context

When viewed, the width of an object can be measured in angular units to describe its size. When an object is further away from the viewer, it will have a smaller angular size, when compared to viewing the same object at a closer distance.

The Cessna 172 cockpit vision diagram allows for the position of obstructions within the cockpit to be measured in terms of angles from the zero reference point. The instrument panel and engine cowling provided the predominant obstructions to

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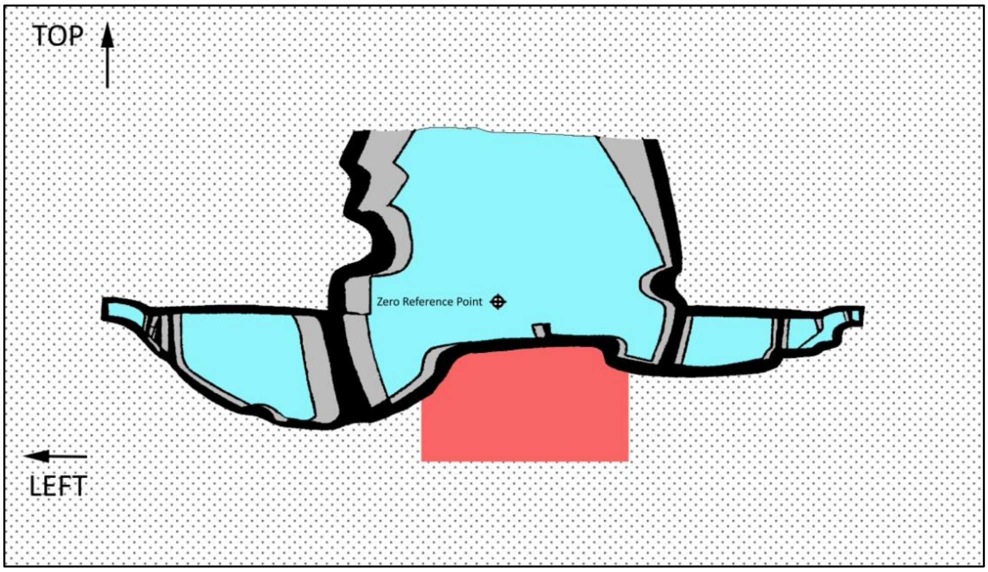
46 Taken from – Barile, A. J. (1981). *A Compendium of Aircraft Cockpit Vision Surveys 1950 through 1980 – Volume 1*, FAA Report CT-81-40.

47 The zero reference point is that point drawn along a level line of sight from the position of the camera and approximates the position of the pilot's eyes in the vision diagram. The zero reference point allows the angular measurement of targets relative to a pilot's eye position.

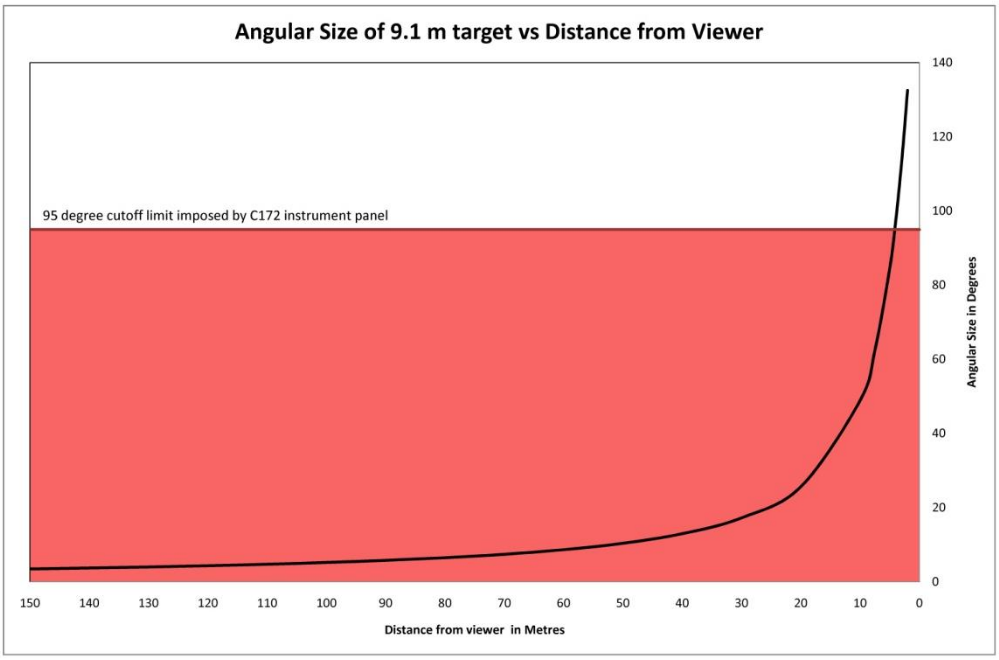
cockpit forward vision. The left and right edges of the instrument panel represented a restriction of about 35° to the left and 60° to the right of the zero reference point. Therefore, a total of about 95° of vision was obstructed or cut off by the instrument panel. Vision below the zero reference point was unaffected for about 16° before being totally obscured by the instrument panel (Figure 14).

Figure 14: Area obscured by the Cessna 172 instrument panel (shaded in red)



The wingspan of the Avid was about 9.1 m. When an object of that size is viewed at a distance of 150 m, it has an angular size of 3.47°. As the object moves closer to the viewpoint, the angular size increases. The angular sizes of a 9.1 m object at varying distances from a specified viewpoint were calculated and are presented at Figure 15 (the area that is obscured by the instrument panel cut-off angle of 95° is marked in red).

Figure 15: Angular size of a 9.1 m object when viewed at various distances



As indicted on the chart by reading left to right on the horizontal distance scale, the angular size of the Avid's 9.1 m wingspan remains relatively small as the distance to the viewpoint decreases. The angular size of the Avid does not become visible outside of the Cessna 172's instrument panel until the Avid is about 5 m from the Cessna.

Based on the assumption that both aircraft were at a circuit height of 1,000 ft, the likely view of the Avid from EUI was estimated as the aircraft flew on the downwind and base legs of the circuit. Those estimations revealed that while on downwind, the Avid should have been visible to the student pilot through the front windscreen. There were no obstructions that would have prevented the student pilot from sighting the Avid.

Once the Avid descended below the altitude of EUI by commencing the base turn, it would have become obscured by EUI's instrument panel while both aircraft were flying in the same direction. The only opportunity for the student pilot in EUI to sight the Avid from then on was when it was flying in a direction away from EUI that positioned it in an area that was not obscured by EUI's instrument panel.

Due to the decreasing vertical distance between the Cessna and Avid on their respective final approaches, the Avid's wingtips would have become visible to the student pilot first, not the entire Avid. At a closing speed of 5 to 10 kts over the ground between the two aircraft, that represented 1 to 2 seconds between the first opportunity for the student pilot to have sighted the Avid before the collision.

See-and-avoid

To see and then avoid another aircraft requires a pilot to perform a number of tasks. The 'see' component involves the following steps:

- **Search:** The pilot looks outside the aircraft, and searches the available visual field. That search may or may not be in response to traffic information, or can be based on previous information about another aircraft's position.
- **Detection:** The pilot may detect possible conflicting aircraft or objects of interest.
- **Identification:** If an object is detected, it is then examined to determine if it is an aircraft or other potential collision threat.

The 'avoid' component involves the following steps:

- **Threat assessment:** If an object is identified as an aircraft, its altitude, heading and speed must be assessed to determine whether or not it is a collision threat.
- **Development of an avoidance plan:** If the aircraft is assessed as a collision threat, a decision must be made as to what type of response is appropriate.
- **Avoidance response:** The pilot must initiate the necessary control movements to take evasive action. There will also be a time period required for the aircraft to respond to the pilot's input and move away from a collision path.

For each of these six steps, there are many factors that can limit the timeliness and effectiveness of pilot performance. In some instances it may take up to 12.5 seconds to complete all of the above steps. Detailed information on these limitations is provided in a number of sources, including the Bureau of Air Safety Investigation 1991 research report Limitations of the See-and-Avoid Principle.[48]

The factors that can affect the likelihood of a pilot seeing another conflicting aircraft in sufficient time to make the necessary control movements and allow the aircraft to respond and avoid that aircraft include:

- a foreknowledge of the existence and relative location of the other aircraft
- the size, conspicuity and speed of the other aircraft
- the different types and operational characteristics of aircraft operating within a defined airspace, and the number of aircraft in that airspace
- cockpit visibility, blind spots and background contrast
- fatigue and stress.

Midair collision research

Midair collisions are relatively rare events in aviation. Research has indicated that when a midair collision occurs, the most likely place for it to occur will be in the circuit area of an aerodrome.[49] Within the circuit, the most likely place for a collision to occur is either on final approach or during the base-to-final approach turn.

In-flight visibility was found not to be a contributing factor in most, if not all of the collisions reviewed by the ATSB, with the visibility at the time of the collisions reported as being 10 km or greater. The majority of the midair collisions involved one aircraft colliding with another from behind or converging from similar directions at an angle of less than 30°.

In the majority of midair collisions, there was evidence to suggest that the pilots involved made appropriate radio broadcasts prior to the collision. Consistent with the research, the pilots of all of the aircraft in the Latrobe Valley circuit were reported to have made the correct radio broadcasts at the appropriate points in the circuit.

In this occurrence, the collision occurred in the early part of the final approach leg, one of the areas where research has indicated that a collision is most likely to occur. Also consistent with the research was that cockpit visibility restrictions severely impacted on at least one of the pilots who were involved in the collision, reducing the time for that pilot to avoid the collision.

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48 Bureau of Air Safety Investigation. (1991). *Limitations of the See-and-Avoid Principle.* Retrieved 8 June 2009 from http://www.atsb.gov.au/publications/1991/limit_see_avoid.aspx.

49 Australian Transport Safety Bureau. (2004). *Review of Midair Collisions involving General Aviation Aircraft in Australia between 1961 and 2003*. Retrieved 17 June 2009 from http://www.atsb.gov.au/publications/2004/review_of_midair_collisions.aspx.

ANALYSIS

Introduction

During normal circuit operations at the Latrobe Valley Aerodrome, a Cessna 172 aircraft, registered VH-EUI (EUI), and an Avid Flyer ultralight aircraft (Avid), registered 28-0929 collided, resulting in the Avid pilot being fatally injured.

The benign ambient conditions and position of the sun at the time were not a factor.

The collision sequence was largely established from the on-site physical evidence. However, the lack of any recorded information, the student pilot's limited recollection of events, and the at times inconsistent witness recollections, required the consideration by the Australian Transport Safety Bureau (ATSB) of a number of scenarios in an attempt to explain the factors leading up to the collision.

The collision damaged the flight controls on the Avid's left wing, rendering them unusable and the aircraft uncontrollable. The as-found location of the safety pin in the Avid's ballistic parachute recovery system meant that its in-flight deployment was not an option for the pilot. The ATSB was unable to determine if the deployment of the ballistic parachute system, if available to the pilot, would have altered the outcome of the collision.

The experienced Avid pilot's reported compliance and familiarity with the procedures at Latrobe Valley Aerodrome, and his position ahead of EUI minimised the likelihood of his contributing to the development of the accident. Despite the finding at post-mortem of ethanol in samples taken from the pilot following the accident, the investigation was unable to determine the extent of any post-alcohol impairment or hangover effect, and its potential to have affected the operation of his aircraft.

Although of low experience, the student pilot of EUI had operated previously at Latrobe Valley Aerodrome and completed a pre-solo assessment flight in EUI in light circuit traffic immediately prior to the accident flight. Despite that recency in the aircraft and local environment, the elevated traffic density encountered during the solo as compared to the assessment flight would have increased the student pilot's workload and tested his situational awareness.

Despite some minor documentation issues in the Avid's prior maintenance history, there was no evidence of any mechanical, aircraft performance or maintenance-related issues with either aircraft. Similarly, the nature of the post-impact fire was consistent with there being a reasonable quantity of fuel quantity on board the Avid at that time.

This analysis will examine the circumstances of the collision in respect to: the cockpit visibility in EUI and how other aircraft can be obscured from vision, even at relatively close distances; the importance of situational awareness to flight operations; a number of risks during the flight to the student pilot's situational awareness; the benefits to flying schools of competency-based training; the objective assessment of individual pilot competence and other risk mitigation strategies prior to authorising solo flight operations.

Occurrence events

Visibility from EUI in the circuit

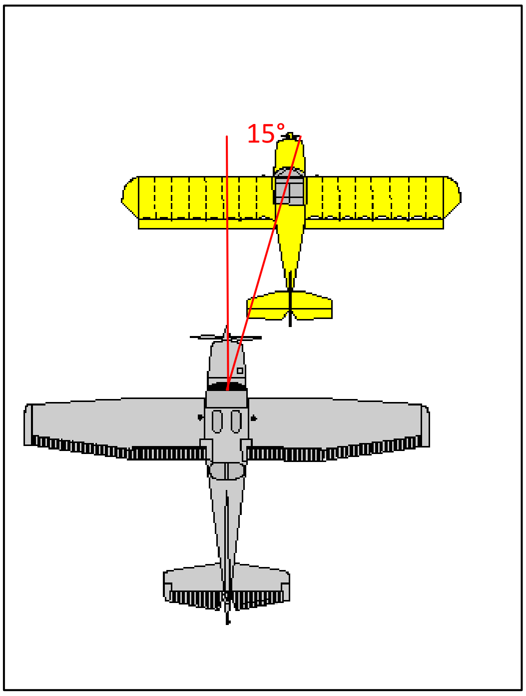
The unavailability of radar data prevented the accurate reconstruction of the position of each aircraft throughout their respective circuits. Despite the relative closing speed of EUI on downwind in comparison to the Avid, the lack of any obstructions to the front of the pilot of EUI meant that collision avoidance ought not to have been a problem on that leg.

However, once the Avid was on the early part of the base leg of the circuit, EUI's relative closing speed became problematic for the student pilot, with the Avid likely being intermittently obscured by EUI's left cockpit post and wing strut. When the student pilot turned onto base, the Avid would have been obscured below EUI's instrument panel and engine cowl. At the closing speed between the two aircraft, had the student pilot sighted the Avid immediately it became visible, there would have been insufficient time for the student to avoid the collision.

Cockpit vision from EUI immediately prior to the collision

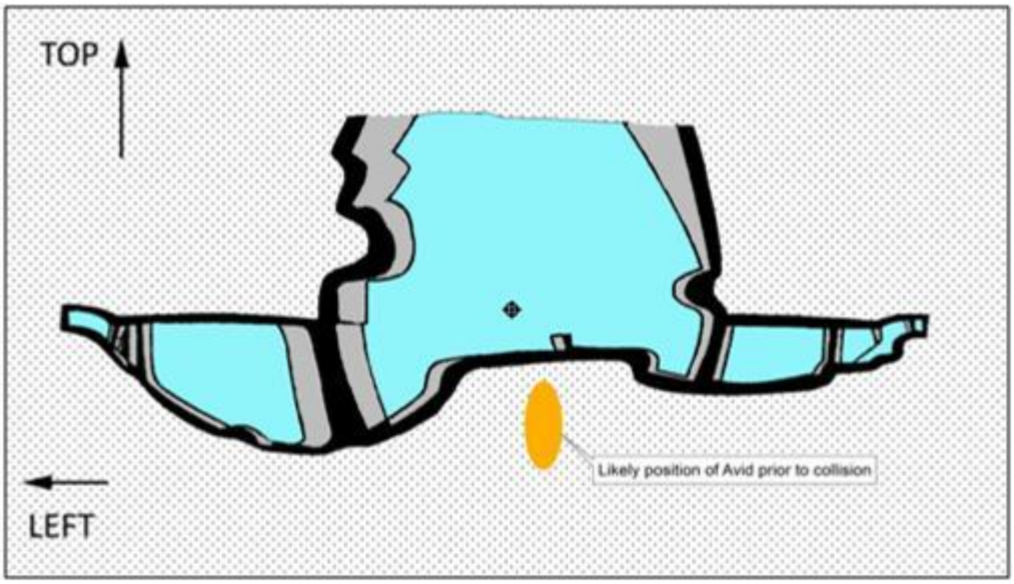
A plan view of the estimated relative locations of the Avid and EUI immediately prior to the collision, as reported by witnesses and confirmed by the on-site physical evidence is at Figure 16. The Avid is located to the right of EUI at an angle of about 15° from the zero reference point. EUI is above the Avid and the vertical and horizontal distances between the two aircraft is decreasing.

Figure 16: Aircraft positions immediately prior to the collision



The transfer of the Avid's position to the Cessna 172 cockpit vision diagram (Figure 17) shows the Avid in a position that is lower and to the right of EUI's zero reference point, in an area that is obscured by the instrument panel, engine and aircraft structure in front of the student pilot. An aircraft in that area would not have been visible to the student pilot from the front left seat.

Figure 17: Representation of the relative position of the Avid on the Cessna 172 cockpit vision diagram

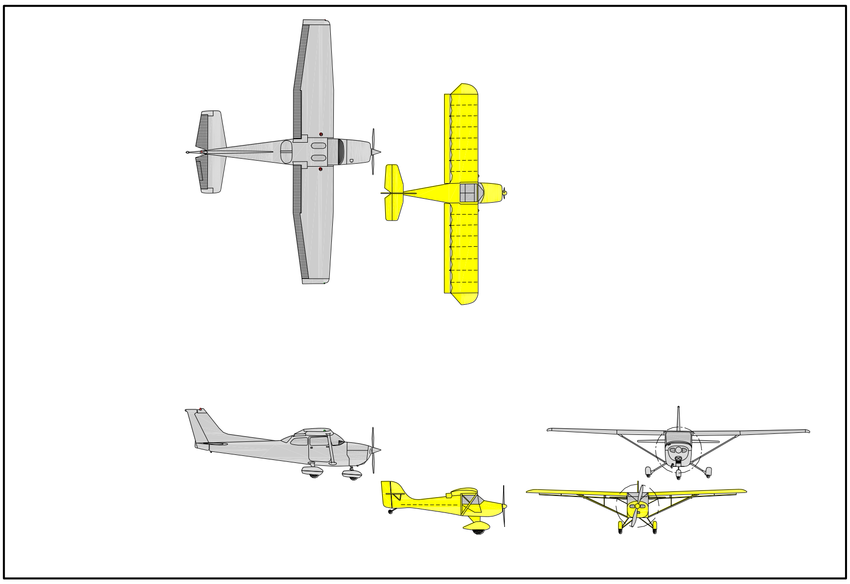


Collision sequence

The witness marks observed on EUI and the Avid, combined with witness statements allowed the construction of a collision sequence (Figures 18 to 23). In those figures, each aircraft is depicted to scale from top, side and front views.

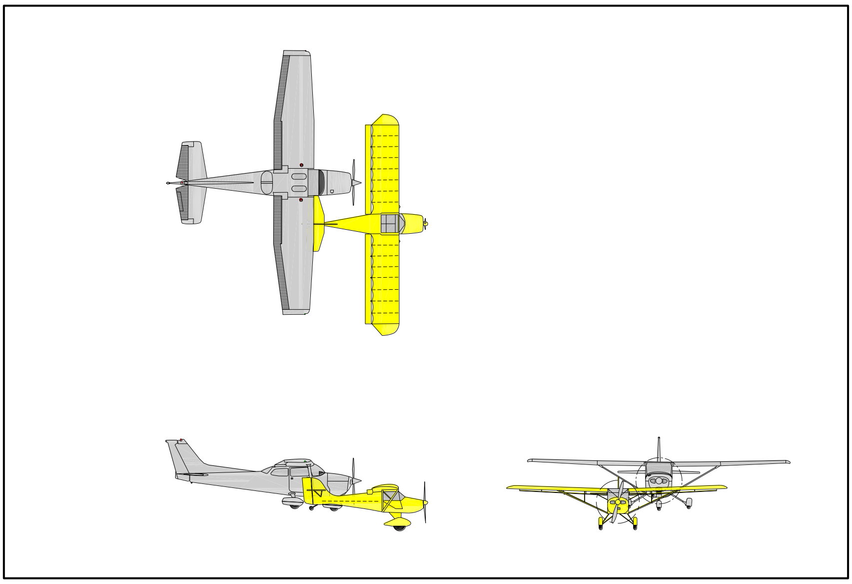
The collision sequence commenced with EUI approaching from above and behind the Avid (Figure 18), and with EUI's rate of descent and speed over the ground greater than that of the Avid. Due to the relative differences in the aircraft's speeds and rates of descent, the propeller of EUI missed the tail surfaces of the Avid.

Figure 18: Collision sequence 1



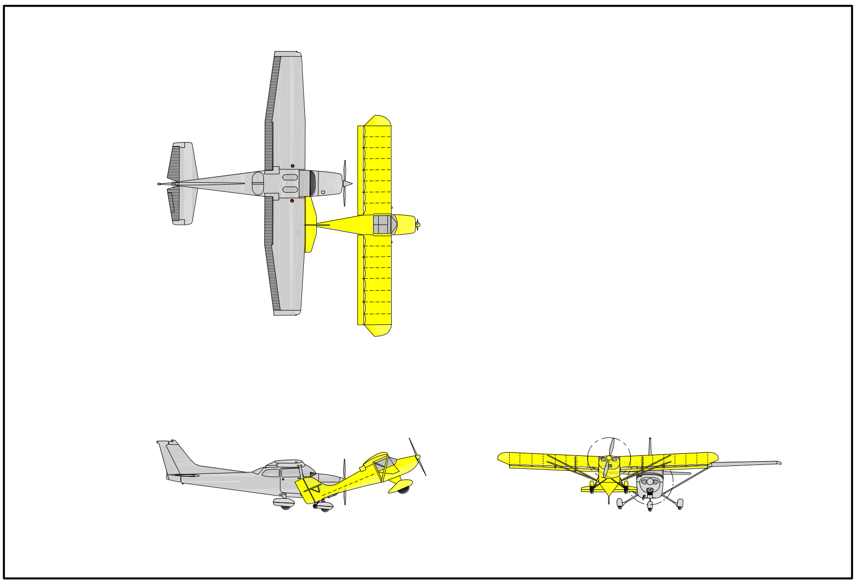
Shortly after, EUI's right wing strut contacted the top of the Avid's fin and rudder (Figure 19). The force of that impact bent the rudder and fin over, probably breaking the Avid's fin from the aircraft.

Figure 19: Collision sequence 2



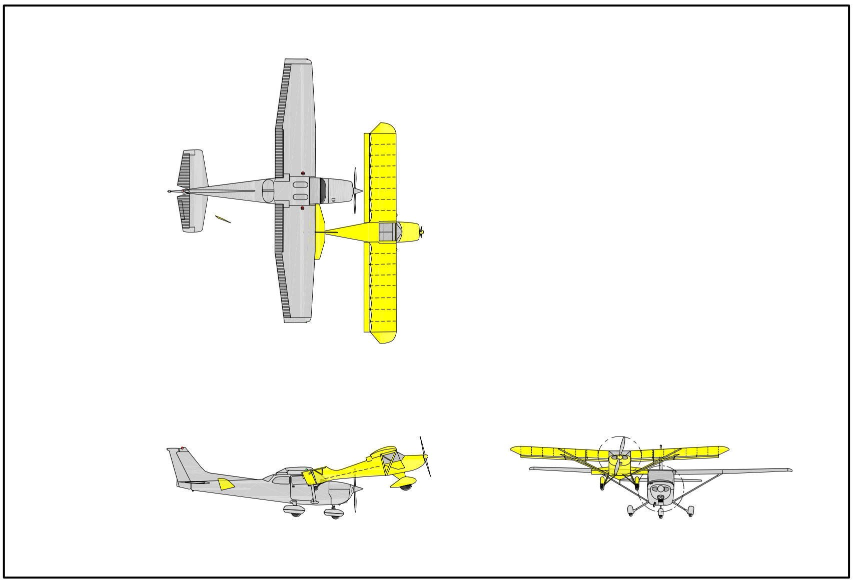
The downward force of EUI on the Avid pitched the nose of the Avid up, and increased the angle of attack on the Avid's horizontal stabiliser, creating a large aerodynamic upward force (Figure 20).

Figure 20: Collision sequence 3



The upward aerodynamic force on the Avid's tailplane became so large that the aircraft's damaged tail section slipped forward and off EUI's wing strut (Figure 21).

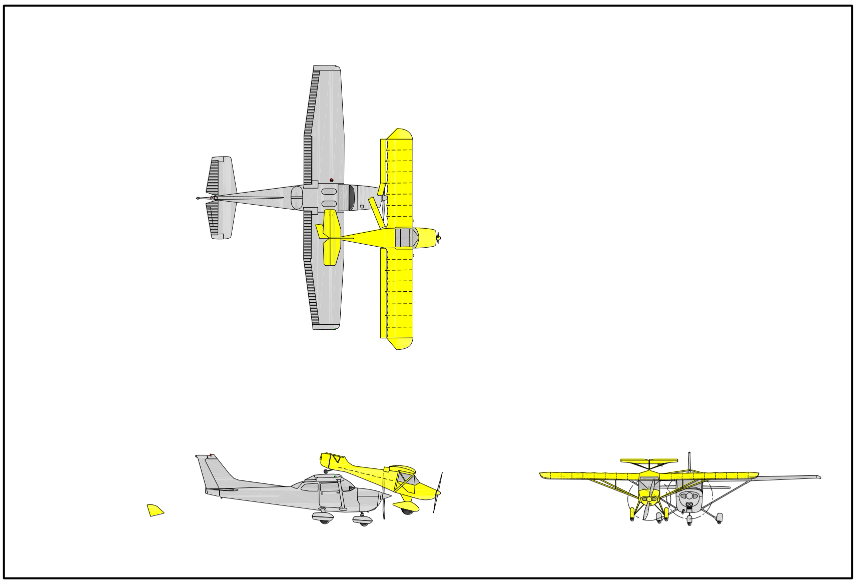
Figure 21: Collision sequence 4



The release of the Avid's tailplane resulted in a rapid nose-down pitching of the Avid, resulting in the remainder of the aircraft's empennage rising and impacting the leading edge of EUI's right wing. The Avid's severed fin moved rearward in the airflow and struck the right tailplane of EUI.

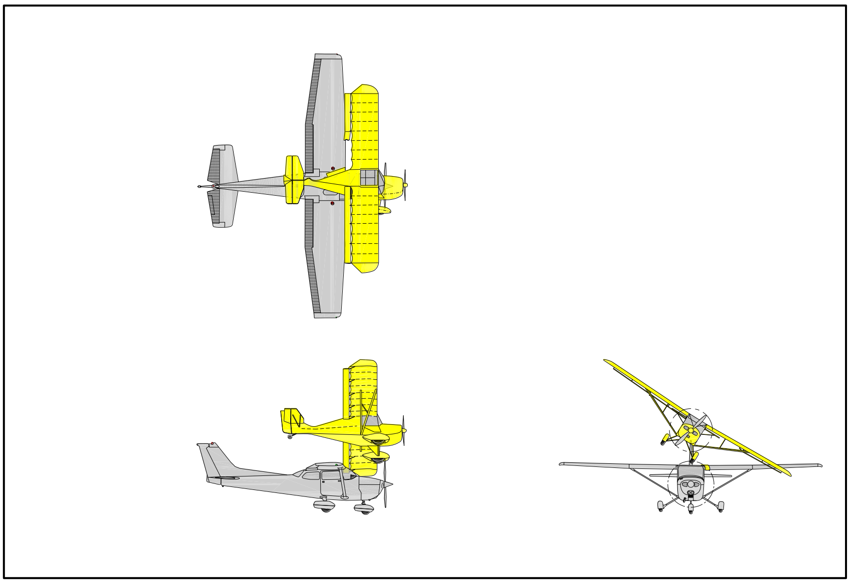
As EUI continued to overtake the Avid, its propeller contacted the left flaperon and trailing edge of the Avid's left wing (Figure 22). The damage to the flaperon resulted in the mass balance weight detaching and moving rearward to strike the flap of EUI. The inboard section of the flaperon was flung upwards by the propeller, directing it towards EUI's left wing root. The flaperon bent around the leading edge of the wing root, where it remained until EUI landed and taxied in.

Figure 22: Collision sequence 5



The damage to the Avid's left flaperon and wing resulted in the aircraft rolling to the left (Figure 23). The left wing of the Avid struck the leading edge of the left wing of EUI, before the Avid spiralled to the ground. EUI remained under control and was safely landed.

Figure 23: Collision sequence 6



As the motions are relative to the aircraft, a similar collision sequence could be applied where the Avid was climbing relative to EUI. In that scenario, the fin would have also made the initial contact with the strut of EUI, and the same collision sequence would have followed. There was no physical evidence to favour either scenario, although the phase of flight and witness statements suggest that the first scenario is more likely. Notwithstanding, the investigation could not conclusively discount that the Avid may have climbed into EUI.

Student pilot awareness of the presence of the Avid

The circuit speeds of the two aircraft meant that the student pilot needed to manage the overtake speed with the Avid, most critically on the downwind leg, where the overtake speed was greatest, and on base, where there was the greatest risk of the Avid being obscured from the student pilot's view. The responsibility for a pilot of an overtaking aircraft to avoid another slower aircraft was clearly articulated in a number of documents. The student pilot's questionable understanding of those requirements as evidenced by the results of his pre-solo exam, suggested that the more complex the circuit traffic situation, the greater the risk that the student would experience difficulty maintaining situational awareness in respect of the other circuit traffic.

Situational awareness is an important precursor to collision avoidance and a pilot's lack of, or decreased situational awareness can lead to situations where the safety of one or more aircraft is compromised. The student pilot's reported lack of awareness of the Avid ahead on finals, and indication that he had not heard any relevant radio calls indicated incomplete situational awareness. In that context, the ability of the student pilot to avoid the pending collision reverted to unalerted see-and-avoid. The estimated 1 to 2 seconds available to the student pilot from the appearance from below of the Avid was insufficient time for the student to see and then avoid that aircraft.

Individual actions

Application by the student pilot of EUI of a normal circuit pattern

The student pilot of EUI had previously flown solo circuits on weekends when the traffic levels at Latrobe Valley were reported to be high. However, on the day of the accident, the student's initial flight with the instructor was carried out with only two other aircraft in the circuit; a Jabiru and the Avid. The location of those aircraft in the circuit behind EUI meant that, despite EUI being the faster aircraft, the student pilot did not have to modify his normal circuit during that flight.

When the now solo student pilot re-entered the circuit and re-established a 'normal' circuit pattern, he was behind the Avid and Jabiru and eventually confronted with a total of five aircraft in the circuit. Together with the many variables that can affect the size of a circuit, it was highly unlikely that the student pilot, by flying a 'normal' circuit dimension would have ensured sufficient separation between his aircraft and the Avid. The greater the number of aircraft in the circuit, the more likely that pilots of following aircraft would have to modify their circuit, or conduct a go-around to maintain adequate separation with aircraft in front of them. As there were five aircraft in the circuit in the time leading up to the collision, the probability that any one of the aircraft would have had to modify their circuit to maintain separation from other aircraft ahead was high.

Together with EUI's higher circuit and therefore overtake speed when compared to the Avid, the elevated traffic density increased the criticality of the student's situational awareness and preparedness to amend his circuit as required for collision avoidance. The student's reliance on a normal circuit with no modification as a result of traffic or of differences in aircraft performance was consistent with the student's low experience. That could explain the restriction placed by other instructors on the number of aircraft in the circuit when they sent their students solo.

There was the opportunity for the student pilot to assess his position relative to the Avid at a number of positions in the circuit, most notably when turning from downwind onto the base leg of the circuit. If the separation from the Avid was insufficient at that time, the student pilot could have either extended his downwind leg, or have conducted a go-around from the base leg.

As the student pilot approached the downwind-to-base turn position, the visibility from the cockpit meant that he should have been able to sight the Avid to determine the required spacing. Whereas the investigation was unable to determine the reason why, the lack of any alternative courses of action by the student to ensure separation with the Avid was consistent with his not sighting the Avid at that time.

Local conditions

Student pilot lack of situational awareness

Although also possibly a consequence of the trauma associated with the collision, the student pilot's inability to recall the details of the aircraft that he was following, of the other aircraft in the circuit at the time, and of any radio broadcasts prior to the collision would also indicate low situational awareness. His report of flying a normal circuit and of not knowing what had happened after the collision was also consistent with a low level of awareness and suggested that he did not comprehend the implications of the increased traffic density and differing aircraft performances.

The flying school's student competency assessments should have been robust enough to ensure that the student's situational awareness would have allowed him to complete the solo flight safely. Certification by the school of the student pilot's competence at that level implied that the student pilot was able to recognise the need for an alternative course of action to ensure safe flight, and then to take that action. That is, maintain situational awareness. The difficulty associated with the maintenance of situational awareness increases with increasing traffic density and differing aircraft performance; as in this occurrence.

The lack of any objective criteria for application to the assessment of situational awareness at the flying school prevented instructors from reliably certifying student competence in that respect.

English language competence

The student pilot's proficiency in the English language was certified by the flying school before his initial solo, and confirmed by his earlier solo flights that were carried out without incident. English was reported as the student's first language and he had satisfied the language requirements for the issue of the student pilot license. Moreover, the student would have satisfied the English language standards that were introduced for student pilots in 2009.

The investigation concluded that it was unlikely that the student pilot's language proficiency was a factor in the accident.

Student pilot's experience

Given the traffic complexity, the student pilot's low experience would have increased the student's workload in terms of the control of the aircraft and management of the flight. It could be expected that the student's decision making and situational awareness might be adversely affected as a result. The minimal guidance in the operator's operations manual to assist instructors to address that risk required instructors to subjectively assess students' competence in that environment. The development and application of additional guidance in the operations manual would assist instructors to reliably assess student competence for solo operations in differing operational environments.

The delayed introduction, or controlled use of the radio during training can be a workload management tool that is used by instructors to facilitate the assimilation by students of early flight lessons. However, as stated in the *Flight Instructor Manual*, student use of the radio should be maximised, which could be expected to assist in the development of a student's situational awareness.

The report by the instructor in Jabiru J4497 that the supervising instructor appeared to be making the majority of the radio broadcasts during the pre-solo assessment flight indicated that the student pilot may have been experiencing difficulty coping with the workload of flying the aircraft and attending to the required radio broadcasts. That would have impacted on the time for the supervising instructor to have assessed the student's competence for the following solo flight. It could also have been an indicator that, had the student's workload increased during the solo, his situational awareness may have suffered.

Overtransmission of radio broadcast

An overtransmission between two or more pilots is not uncommon, whether operating inside controlled airspace or at common traffic advisory frequency (CTAF) procedure aerodromes. Whereas there was no indication that the CTAF procedures were a factor in the midair collision, increasing traffic density or complexity can increase the likelihood of an overtransmission.

The chief flying instructor (CFI) in UGO reported that the overtransmission occurred between two aircraft as they were making their base-to-final turns. The CFI indicated that those two aircraft were likely Jabiru J4497 and the Avid. The CFI stated that the Avid was following J4497 in the circuit, and that the Avid pilot indicated via radio that he would extend the crosswind and downwind legs of the circuit in response to the arrival of J3587. That would have required that the pilot of the Avid to fly a larger circuit dimension than 'normal', and possibly larger than that of J4497.

The instructor in J4497 reported that he did not adjust his circuit to follow J3587 as it arrived in the circuit, and so flew a normal circuit dimension. For the Avid to have simultaneously arrived at a wider base-to-final turn position than J4497's arrival at the normal base-to-final turn position, it would have had to travel faster than J4497. As the Avid has a cruise speed some 25 kts slower than the Jabiru, it is highly unlikely that the Avid, if it did extend its crosswind and downwind circuit legs as recalled by the CFI, was in the base-to-final turn position when the overtransmission was made. Even if the Avid did not extend its crosswind leg, and extended the downwind leg only, it still would have had to fly a greater distance at a slower speed than J4497, yet still arrive at the base-to-final turn position at the same time as J4497. A more likely scenario is that the Avid pilot made a downwind-to-base radio broadcast, which was overtransmitted by the base-to-final radio broadcast from J4497.

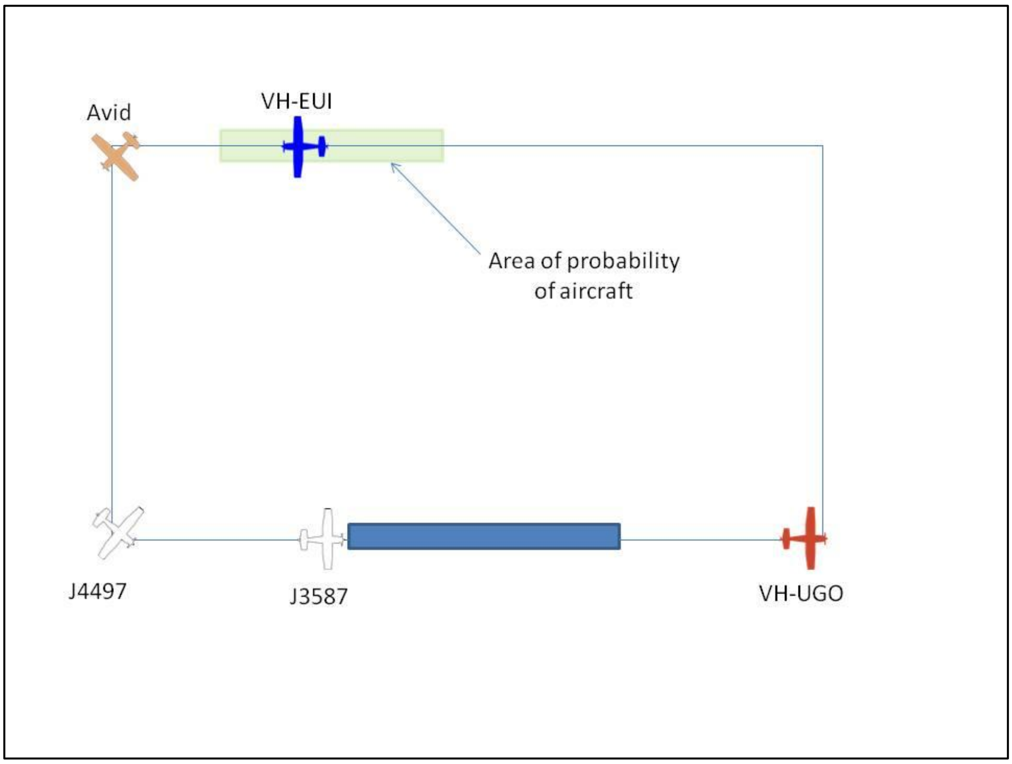
The overtransmission by the pilots of the Avid and the Jabiru negated the Avid pilot's advice that he was at the base turn position. In consequence, the remaining pilots in the circuit momentarily reverted from the 'alerted see-and-avoid' traffic management context, to 'see-and–avoid' for detecting possible traffic conflictions with the Avid. Although increasing the student pilot's workload in terms of locating the Avid, it was highly likely that there remained at least two opportunities for the student to have seen the Avid prior to the student commencing the base turn.

The first was when the Avid commenced its turn from the downwind to the base leg of the circuit, providing the student pilot with a larger visual target during the turn. The second would have been as the Avid flew down the base leg, its relative movement being across the student pilot's field of view, as compared to the apparent lack of relative movement when following the Avid on downwind.

Even if the Avid pilot's radio broadcast was not heard or able to be comprehended by the student pilot, the reported standard of his clearing turns should have allowed him to locate the Avid on the base leg, and to adjust his turning point accordingly. However, the student pilot's low experience meant that his attention at that time was probably on flying the aircraft. Any confusion as a result of the overtransmission would have further increased the student's workload entering the base turn. That would have diminished the student's capacity to assimilate what was going on around him, including any attempt to decipher the overtransmission and to determine implications for his circuit planning.

The CFI's broadcast that there were two aircraft on the final approach leg of the circuit was an attempt to ensure that if that was the case, the affected pilots were aware of each other in spite of the overtransmission. However, that overtransmission was most likely not between the two aircraft that were on the final approach leg, it was between Jabiru J4497 and the Avid. J4497 was turning from base to final and the Avid was turning from downwind to base (Figure 24).

Figure 24: Likely positions of the aircraft at the time of the overtransmission *(not to scale)*



An additional effect of the CFI's broadcast was that pilots would naturally look to the final leg of the circuit to identify the two aircraft; Jabiru J3587, who had joined the circuit on downwind, and Jabiru J4497 who was ahead of the Avid. Seeing the two Jabiru aircraft on final would have confirmed the student pilot's expectation in response to the alert from the CFI. In consequence, the subsequent broadcast from the pilot of the Avid that he had the other aircraft sighted could have been interpreted by the student pilot that it came from the second aircraft on finals, Jabiru 4497. That could have served to further confirm the student pilot's (incorrect) understanding that there was no aircraft on the base leg, and that he could commence a normal base turn.

The investigation was unable to determine why, given the benign weather conditions of the day and good visibility, the student pilot was unable to differentiate the predominantly white Jabirus from the largely yellow Avid. The student pilot had, and should have continued to follow the yellow Avid onto base.

In summary, it is likely that the overtransmitted radio broadcast, coupled with the CFI's broadcast in response to that overtransmission, resulted in the student pilot forming the incorrect impression that there were no aircraft ahead of him in the circuit, other than the two aircraft on finals. In that case, he would have deduced that it was safe to commence the turn onto the base leg of the circuit in the normal position.

Cockpit vision

The vision from the cockpit of a Cessna 172 is well documented, is well known by instructors in practice and has known areas where vision is obscured by structures. As a high-wing aircraft, the vision in the direction of a turn is also obscured by the down-going wing; however, this is a known phenomenon and the student pilot was trained to clear the area into which the aircraft was turning. The supervising instructor reported that the student applied that technique during the pre-solo assessment flight.

The investigation concluded that the obstructions to cockpit vision would not have affected the student's ability to sight the Avid for significant periods of time while it was on the crosswind, downwind and early base legs of the circuit. However, once EUI was established on the base leg, the opportunities for the student pilot to sight the Avid reduced, as the Avid was in front of and lower than EUI. That would have placed the Avid in a position where it would have been obscured by the instrument panel and engine of EUI, increasing the risk of collision.

Regardless of any limitations to cockpit vision, the student pilot retained responsibility for collision avoidance. In context, this effectively meant that any aircraft ahead of EUI on the base leg of the circuit had to remain visible to the student pilot. Once the Avid was totally obscured to the pilot EUI, and the aircraft were on a collision course, there was no opportunity for the student pilot to detect and avoid the Avid.

The dirt and insect impacts on EUI's windscreen may have occurred during the flight with the instructor or during the solo flight. The investigation could not quantify the extent to which those marks resulted in focal traps that would have increased the student pilot's difficulty in seeing the Avid.

Risk controls

Situational awareness training

The application of alerted see-and-avoid in the circuit environment required the student pilot to maintain a constant scan and listen out for other aircraft and to appropriately direct his attention to areas of potential conflict. On the basis of that information, he needed to develop and maintain an accurate mental model of the circuit activity, and to react accordingly. For example, if the spacing between his aircraft and another aircraft in the circuit was too close, he would need to adjust his circuit, or take some other appropriate action.

The student pilot's lack of flying experience would have made it harder for him to allocate sufficient attention to maintaining a lookout for possibly conflicting aircraft, as compared to a more experienced pilot. Hence, it was essential that his early training provide him with the skills necessary to maintain situational awareness in the circuit area.

The flying training school had not fully implemented the competency-based training (CBT) regime that underpinned the Day visual flight rules (VFR) Syllabus. As a result, the student pilot's training did not include formal instruction and objective assessment based on the situational awareness performance criteria of that training package. In particular, he did not receive formal training and assessment in his ability to continuously monitor flight progress, his ability to recognise the need for corrective action, or his ability to identify any breakdown in situational awareness and to recover the situation safely.

The investigation could not discount that, had the student pilot received formal training and undergone an objective assessment of his situational awareness competence, he may have been better equipped to safely handle the situation in the period leading up to the accident.

Solo flight assessment

The action by the Civil Aviation Safety Authority (CASA) to provide assistance to the flying training industry in support of the introduction in 1999 of CBT significantly reduced the associated workload for flying training organisations. Nevertheless, the flying school that trained the student pilot of EUI had not implemented a CBT system at the time of the accident. The lack of evidence in the student pilot's training records of his competence in a number of areas precluded an objective assessment of those competencies, particularly in the area of situational awareness.

The assessment of an individual's competency is based on the collection of evidence in support of demonstrated competence in a range of situations. To be valid, that evidence needs to be measured in an objective manner against industry-accepted standards, and be sufficient to allow the accurate assessment of a person's competency under all expected in-flight conditions. That contrasted with the situation at the flying school, where the lack of guidance in the operations manual on; what the school's performance standards meant, what the grading scale in the training records indicated in terms of performance, and how students should be assessed for solo flight compelled the instructors to subjectively assess a student pilot's competency.

It could be expected that the introduction of Civil Aviation Safety Regulation Part 61 – *Flight crew licensing*, and the associated requirement for instructors to hold formal qualifications in training and assessment, will address the subjective assessment by instructors of student pilot competence.

Organisational influence

Flying school operations manual

The out-of-date material, incorrect references to other sections of the manual, inclusion of a training syllabus that did not conform to the published CBT requirements, and lack of guidance on performance standards in the operator's operations manual provided little support for the school's instructors. Although guidance as to relevant considerations when assessing and authorising students for solo operations was available in a number of instructional publications, the paucity of guidance in the operations manual meant that the operator had to rely on an individual instructor's previous knowledge and/or motivation to locate and apply those considerations to the operation at Latrobe Valley.

The action by the instructor in Jabiru J4497 to not send students solo with more than two other aircraft in the circuit represented a risk management approach to flight authorisation for solo students. The operator's operations manual would benefit from the inclusion of relevant risk management strategies for application by instructors when assessing and authorising students for solo operations.

FINDINGS

From the evidence available, the following findings are made with respect to the midair collision between Cessna Aircraft Co. 172 aircraft, registered VH-EUI and Avid Flyer aircraft, registered 28-0929 that occurred at Latrobe Valley Aerodrome, Victoria on 1 December 2007 and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The student pilot of EUI was not aware of the presence of the Avid Flyer when he turned his aircraft onto the final leg of the circuit.
- The student pilot of EUI had a low level of experience on which to base operational decisions.
- The student pilot of EUI reportedly flew a normal-sized circuit pattern that, when combined with EUI's relative overtake speed, did not take into account the position of the other circuit traffic.
- The radio alert of two aircraft being on the final leg of the circuit could have resulted in the student pilot of EUI forming an incorrect impression that there was no other aircraft in the circuit ahead of EUI, including the Avid.

Other safety factors

- The ballistic parachute recovery system in the Avid Flyer was not armed for use in flight.
- Once the student pilot in EUI turned onto the base leg of the circuit, the obscuration of the Avid by his aircraft's instrument panel increased the risk of a collision.
- The lack of any objective criteria to assess students' situational awareness prevented instructors from reliably certifying student competence in that respect.
- The flying school's operations manual did not provide the necessary guidance and support to assist its instructors to adequately assess student pilot performance and to provide an environment where risks could be managed for solo student flights.*[Minor safety issue]*
- The Avid pilot's post-mortem examination detected the presence of ethanol in samples taken from the pilot.

Other key findings

- There was no evidence that the common traffic advisory frequency procedures at Latrobe Valley Aerodrome at the time were a factor in the midair collision.

SAFETY ACTION

The safety issues identified during this investigation are listed in the Findings and Safety 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.

All of the responsible organisations for the safety issues identified during this investigation were given a draft report and invited to provide submissions. As part of that process, each organisation was asked to communicate what safety actions, if any, they had carried out or were planning to carry out in relation to each safety issue relevant to their organisation.

Flying school

Operations manual

Minor safety issue

The flying school's operations manual did not provide the necessary guidance and support to the instructors at the school to adequately assess the performance of the student pilot and to provide an environment where risks could be managed for solo student flights.

Action taken by/response from the flying school

The chief flying instructor of the flying school reported that the following actions have been taken as a result of this accident:

> The flying school has submitted a revised operations manual to the Civil Aviation Safety Authority for their approval. The revised operations manual contains updated information on:
>
> - competency-based training
> - risk management strategies for application to solo student flight operations.
>
> The flying school has implemented an electronic competency-based training system and provided training on its use to both instructors and students.

ATSB assessment of safety action

The ATSB considers that the action taken by the flying school will, once implemented, address the safety issue.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of Information

The sources of information during the investigation included the:

- Civil Aviation Safety Authority (CASA)
- student pilot of VH-EUI (EUI)
- chief flying instructor of the flying school
- supervising instructor of the student pilot of EUI
- Bureau of Meteorology
- next of kin of the Avid pilot.

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 chief flying instructor of the flying school, the supervising instructor of the student pilot of EUI, the student pilot of EUI and CASA.

Submissions were received from the chief flying instructor of the flying school, the supervising instructor of the student pilot of EUI, the student pilot of EUI, the next of kin of the Avid pilot and CASA. Those submissions were reviewed and, where necessary, the text of the report was amended accordingly.

Midair collision
Latrobe Valley Aerodrome, Victoria
1 December 2007
Cessna 172 VH-EUI & Avid Flyer 28-0929