Australian Government

Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation
AO-2008-081
Final

Midair collision
Cessna 152, VH-FMG and Liberty Aerospace Inc. XL-2, VH-XLY Casula, NSW, 18 December 2008

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CONTENTS

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Figure 4 and Front cover: Reproduced with the permission of Mack Gridley

Abstract

On 18 December 2008, a Liberty XL2 aircraft, registered VH-XLY, collided in midair with a Cessna 152 aircraft, registered VH-FMG, near Casula, New South Wales (NSW). The Liberty was engaged in a pilot licence flight test; the Cessna was engaged in pilot training. The pilots of both aircraft were operating in uncontrolled airspace under the visual flight rules, in good weather. The collision severely damaged the Cessna, which descended in an uncontrolled manner before impacting terrain, fatally injuring the two occupants. The Liberty was able to continue flying and landed at Bankstown Airport, NSW.

The two pilots in the Liberty had previously sighted the Cessna while they were tracking towards an inbound reporting point. They subsequently lost sight of the aircraft prior to the collision. The investigation found that the limitations imposed by the visual size of the Cessna and its lack of relative motion in relation to the Liberty, the focussed workload of the student under test at the time, and obstructions posed by the aircraft's structure were likely factors in them being unable to re-sight the Cessna before the collision.

The investigation did not identify any organisational or systemic issues that might adversely affect the future safety of aviation operations. However, the factors involved are a salient reminder to all pilots that there are limitations with visual flight procedures and that, regardless of pilot's experience, they need to remain vigilant at all times. That is particularly the case when in the vicinity of other aircraft.

As a result of a number of midair collisions in Australia, the Civil Aviation Safety Authority (CASA) conducted two reviews into operations at General Aviation Aerodrome Procedure (GAAP) aerodromes. Although this accident occurred in Class G airspace (uncontrolled airspace), due to its proximity to an inbound GAAP reporting point, CASA referred to it in those reviews. Those reviews made a number of recommendations to enhance the provision of GAAP procedures education and training and on the current implementation of GAAP. On 3 June 2010, CASA introduced full Class D airspace at all aerodromes that previously operated under GAAP in Australia.

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 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 enhance safety. To reduce safety-related risk, ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. However, 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 proactively initiate safety action rather than release formal recommendations. However, depending on the level of risk associated with a safety issue and the extent of corrective action undertaken by the relevant organisation, a recommendation may be issued either during or at the end of an investigation.

When safety recommendations are issued, they will focus on clearly describing the safety issue of concern, rather than providing instructions or opinions on the method of corrective action. As with equivalent overseas organisations, the ATSB has no power to implement 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, the person, organisation or agency must provide a written response within 90 days. That response must indicate whether the person, organisation or agency accepts 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.

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, risk controls and organisational influences.

Contributing safety factor: a safety factor that, if it had not occurred or existed at the relevant time, 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.

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.

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

- Critical safety issue: associated with an intolerable level of risk.
- Significant safety issue: associated with a risk level regarded as acceptable only if it is kept as low as reasonably practicable.
- Minor safety issue: associated with a broadly acceptable level of risk.

FACTUAL INFORMATION

History of the flight

On 18 December 2008, at about 1125 Eastern Daylight-saving Time[1], a Cessna Aircraft Company 152 (Cessna) aircraft, registered VH-FMG, and a Liberty Aerospace Incorporated XL-2 (Liberty) aircraft, registered VH-XLY, collided at an altitude of 1,500 ft above mean sea level (AMSL) over the Sydney suburb of Casula, which was located 10 km south-west of Bankstown Aerodrome, New South Wales. The collision severely damaged the Cessna, which descended in an uncontrolled manner before impacting terrain and fatally injuring the two occupants. The Liberty was able to continue to Bankstown Aerodrome, landing shortly after the collision. One of the occupants of the Liberty reported minor injuries as a result of the collision.

The Liberty had departed from Bankstown Aerodrome at about 0930 that morning to conduct a flight test for the issue of a Private Pilot Licence. On board were a student pilot under test and a Civil Aviation Safety Authority (CASA) approved testing officer (ATO). Following departure, the Liberty tracked north via the 'lane of entry'[2] to the Aeropelican area before diverting to Warnervale to conduct about 10 minutes of airwork.[3] Following the airwork, the Liberty tracked south to the Somersby area for a further 5 minutes of airwork, before tracking to Brooklyn Bridge and then via the lane of entry southbound.

At about 1030, the Cessna departed Bankstown Aerodrome to conduct a local training flight in the training area to the west of Bankstown. On board were a student pilot and an instructor.

At 1103, the Liberty passed Prospect Reservoir and tracked south towards the Bringelly area before entering the Camden Common Traffic Advisory Frequency (CTAF) area.[4]

The recorded radar data showed that, as the Cessna was returning to Bankstown from the training area, the Liberty departed Camden and maintained the runway heading of 060° into the training area, before tracking towards the 2RN radio transmission tower, which was the southern inbound reporting point to Bankstown. The radar data indicated that, about midway between the Camden CTAF area and 2RN, the Liberty conducted a left turn through 180°, followed by a turn to the right through 180°. The Liberty then flew in a northerly direction and flew above and behind the Cessna, which was about 600 ft below and tracking towards the 2RN reporting point. The Liberty continued to track north for a short time, then turned to the right, descended and tracked towards 2RN (Figure 1).

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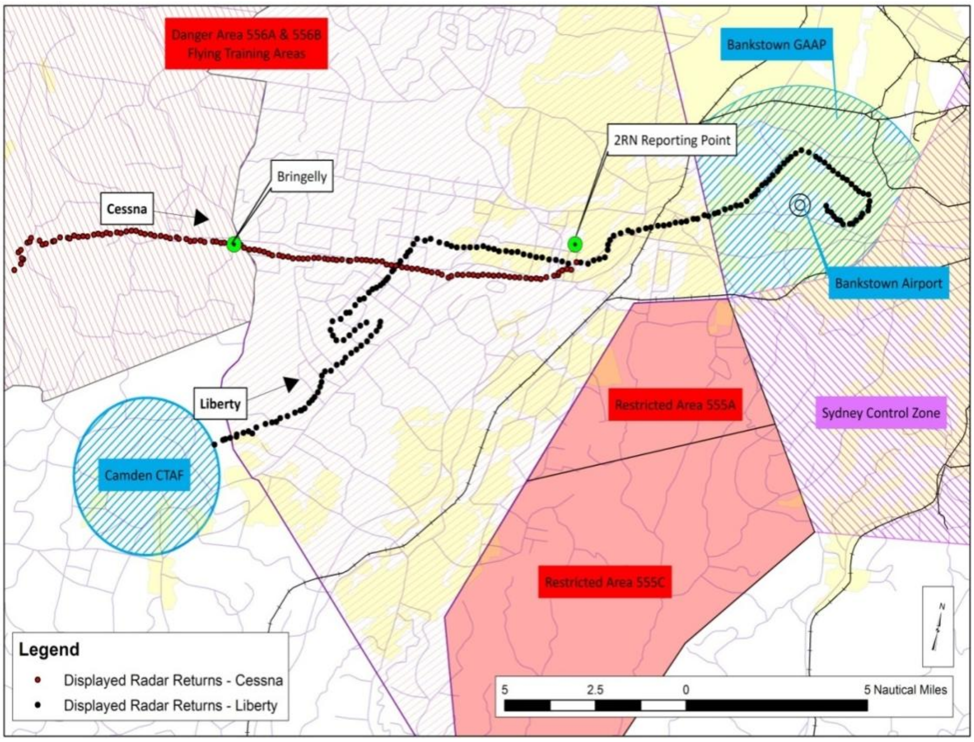
1 The 24-hour clock is used in this report to describe the local time of day, Eastern Daylight-saving Time (EDT), as particular events occurred. Eastern Daylight-saving Time was Coordinated Universal Time (UTC) + 11 hours.

2 Lanes of entry are established to permit passage to and from a general aviation airport procedure (GAAP) control zone without entering an adjacent civil or military control zone.

3 A term used to describe the general manoeuvring of an aircraft over a particular geographic area.

4 Area in the vicinity of Camden Aerodrome in which pilots make positional broadcasts on the designated frequency of 120.1 MHz.

Figure 1: Displayed radar tracks of the Cessna and Liberty



Following the merging of the radar returns in the vicinity of 2RN, one radar return faded and the other return continued to the vicinity of Bankstown Aerodrome. The fading radar return corresponded to the Cessna's initial track towards Bankstown.

Witnesses reported that the Cessna descended almost vertically before impacting the rear of a house in Casula.

Witnesses

At least 12 people witnessed either the collision between the two aircraft, or the events immediately after the collision. All but two of those witnesses were located within 1 km of geographical position of the collision.

One witness reported seeing a white aircraft with red stripes flying towards the city.[5] That witness reported then seeing a second aircraft approaching the first aircraft from behind at an angle of about 45° and that it was travelling faster than the first aircraft. The witness reported observing both aircraft for about 30 seconds before the collision and reported that 'the nose of the second plane just collided in the left side of the tail of the first plane'. Another witness reported that they 'saw the tail of the red and white plane hit the front bottom part of the right hand side of the nose of the other plane'.

All of the witnesses that observed the collision reported that neither aircraft appeared to be manoeuvring or to take evasive action prior to the impact, and that both aircraft appeared to be flying in a straight line with their wings level.

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5 The Cessna was white with red stripes: see *Wreckage and impact information* section of this report.

Following the collision, the witnesses described the Cessna pitching nose-down to a vertical attitude and that the tail of the aircraft broke off, but remained attached by what appeared to be cables. It was reported that the tail appeared to be rotating rapidly behind the Cessna as it descended vertically to the ground.

Recollection of events - Liberty pilots

Student under test

The student under test reported that the flight tracked north from Bankstown airport via the lane of entry and continued north towards Aeropelican. After passing Aeropelican, a diversion was given to him by the ATO to track to Warnervale, where they conducted a practice forced landing and circuits before departing for Somersby. A precautionary search and landing was carried out at Somersby, after which the ATO asked the student to track to Brooklyn Bridge. The student reported that after passing that point, the ATO asked him to don an instrument hood[6] and conduct some instrument flying as he flew down the lane of entry. He reported removing the hood in the Prospect Reservoir area before being asked to identify his position and track to Camden and to enter the CTAF area.

The student recalled entering the Camden CTAF and joining the circuit for runway 06 on the downwind leg. After a touch-and-go landing[7], the student departed on the upwind leg of the circuit, initially maintaining 1,300 ft above mean sea level (AMSL) until clear of the Camden area, and then climbing to 2,500 ft en route to the training area. The student stated that, after two steep turns at 45° angle of bank, first to the left and then to the right, he was asked to recover from an ATO-initiated aerodynamic stall. The ATO then asked him to return to Bankstown Aerodrome via 2RN.

The student reported that as he turned the aircraft to track towards 2RN, the ATO advised him of Cessna traffic on the right of the Liberty at about 45° to the nose. The student stated that he could not see the traffic initially but when he did sight it, it seemed to be higher than the Liberty, and appeared to be turning. He further described the aircraft as a Cessna and that parts of the aircraft were painted red. He also reported that the ATO asked him to reduce speed to a slow cruise configuration of about 80 to 90 kts because of the traffic ahead of the Liberty, and that he complied with that request. In a later interview, the student reported that both he and the ATO lost sight of the Cessna after its initial sighting, and that they discussed losing sight of it.

The student indicated that he was busy preparing for the entry to the Bankstown control zone and could not specifically recall what the ATO was doing during the time the aircraft tracked towards 2RN. He did recall, however, that the ATO had some paperwork on his lap during the flight.

The student also reported that he tuned the aircraft's radio to the Bankstown automatic terminal information service (ATIS) frequency, noted the appropriate information and then made a radio broadcast to the Bankstown Aerodrome

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6 An instrument flying hood is used to simulate instrument flying conditions, whereupon a pilot practises flying by reference to the aircraft's instrument only.

7 Practice landing in which the aeroplane touches the runway briefly, before the pilot applies power and lifts off.

Controller (ADC) at 2RN. He indicated that the air traffic control (ATC) response to the radio broadcast was not what he was expecting and he was about to ask the controller to repeat the response, when he saw the flash of an aircraft's tail fin in the lower right corner of the front windscreen, followed almost immediately by a loud bang.

The student stated that the ATO took control of the aircraft, while he searched for the other aircraft. He reported seeing it descending almost vertically with the tail detached. He recalled a radio broadcast by the ATO, and that the ATO flew the aircraft back to Bankstown and landed.

Approved testing officer

The ATO's recollection corroborated that of the student pilot up to approaching Brooklyn Bridge, at which point he asked the student to divert to Camden. After tracking down the lane of entry and on to Camden via Bringelly, the ATO asked the student to conduct a touch-and-go on runway 06 before departing to the training area for the remainder of the flight test.

The ATO reported that the student departed the Camden CTAF area on the crosswind leg of the circuit for runway 06 and then they tracked to an area between Mayfield and Warragamba Dam (to the north-west of Camden) and climbed to an altitude of 3,000 ft. The ATO recalled asking the student to carry out steep turns and a stall recovery, before having the student conduct instrument flying during the descent and return to Bankstown via 2RN. The ATO reported that on the way back to 2RN, the Liberty tracked via Badgery's Creek.

The ATO stated that during the flight back through the training area, he only sighted one aircraft, a Cessna. When queried about the Cessna, the ATO indicated that it was sighted after the student pilot had completed the steep turns and stall recovery, and that the Cessna was higher than their aircraft. He reported indicating the location of the Cessna to the student pilot.

The ATO indicated that as the aircraft tracked towards 2RN, he briefly completed the sections of the test report form that dealt with steep turns and stall and recovery before closing his notebook on his lap. He then monitored the student's preparation to report inbound. Sometime later, having himself lost sight of the Cessna, the ATO asked the student if he still had the Cessna sighted, to which the student had replied 'no'. There was no evidence that either the ATO or the student pilot actively sought to reacquire the Cessna at that time.

The ATO indicated that the Liberty normally cruises at about 110 to 115 kts, and that he had asked the student to slow the aircraft to about 90 kts after they had initially sighted the Cessna.

The ATO reported that the student correctly obtained the ATIS for Bankstown before making a radio broadcast at 2RN. He stated that the broadcast was responded to by Bankstown Tower, and that the Liberty was cleared to enter the control zone on the crosswind leg of the circuit for runway 29 right. He reported hearing no other inbound radio broadcasts on the Bankstown Tower radio frequency.

The ATO indicated that almost immediately after the student's inbound radio transmission, the Liberty collided with a Cessna aircraft. The ATO recalled the Cessna appearing in his 2 o'clock high position, at an angle of 45° to the right of the nose of the Liberty, descending at an angle of about 15° down to the horizon and in a left turn. He further reported that the impact ‘was nearly a head-on collision’, and that he estimated the Cessna’s heading was about 290°.

The ATO stated that he took control of the aircraft from the student and conducted a controllability check of the aircraft and its controls before making a MAYDAY[8] radio transmission to the Bankstown ADC. He then flew the aircraft to Bankstown and landed.

Injuries to persons

The student and the instructor of the Cessna were fatally injured.

The student of the Liberty did not report any injuries as a result of the accident. The ATO reported that he had a cut to the thumb on his right hand and some bruising to his left knee.

There were no reported injuries to any person on the ground.

Damage to property

One house was seriously damaged as a result of the impact from the Cessna. A pergola attached to the rear of the house was destroyed, along with its contents. A number of other houses surrounding the impact site also sustained damage to roofing tiles, internal roofing structures and guttering.

Personnel information

Cessna pilots

The student pilot held a Student Pilot (Aeroplane) Licence (SPL(A)) and a current Class 2[9] Medical Certificate, with a restriction that distance vision correction was required while exercising the privileges of the licence. It was reported that the student wore contact lenses to meet this requirement. The student pilot had 24.2 hours of aeronautical experience.

The instructor held a Commercial Pilot (Aeroplane) Licence (CPL(A)) with a current Grade 3 instructor rating and Class 1[10] Medical Certificate with no restrictions. She had 423.9 hours of aeronautical experience, with 127.2 hours instructor experience.

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[8] International radio call for urgent assistance.

[9] A Class 2 medical certificate allows the holder to exercise the privileges of a private pilot licence.

[10] A Class 1 medical certificate allows the holder to exercise the privileges of a commercial or higher pilot licence.

Liberty pilots

Student under test

The student under test held an SPL(A) and a current Class 1 Medical Certificate with no restrictions. He had 88.2 hours aeronautical experience.

ATO

Experience and qualifications

The ATO held a CPL(A), a current Grade 1 multi-engine instructor rating and a number of testing delegations from CASA. The ATO had in excess of 27,000 hours of aeronautical experience.

The ATO reported that, to exercise the privileges of his delegation as a CASA ATO, he was required to undergo 6-monthly competency assessments with a nominated experienced ATO and to renew his instructor rating every 2 years with a CASA flying operations inspector (FOI).

The ATO reported that he last underwent a competency assessment with an experienced ATO on 3 December 2008.

Medical certificate and tests

Because of his age, the ATO was required to undergo more stringent, individualised medical examinations on a yearly basis to renew his medical certificate. Those examinations included consultations with and examination and testing by a specialist cardiologist, a specialist aviation ophthalmologist and a specialist aviation medical examiner.

The specialist aviation medical examiner that carried out the ATO's last examination reported that no abnormality was found in the ATO's visual fields.[11] The aviation ophthalmologist who examined the ATO confirmed the need for vision correction while the ATO exercised the privileges of his licence; however, no comment was made regarding the ATO's visual fields.

CASA had endorsed the ATO's medical certificate as 'Renew by CASA only', which meant that all of the results of the ATO's medical examinations had to be forwarded to CASA. CASA then determined the medical fitness of the ATO to exercise the privileges of his licence. CASA issued the ATO's Class 1 Medical Certificate on 8 September 2008 with a restriction that the ATO was to wear distance and reading correction while exercising the privileges of the licence. The ATO reported that he was complying with that restriction during the flight.

Previous medical history

In December 1999, CASA temporarily suspended the ATO's medical certificates after receiving information that indicated that a reassessment of his medical fitness to hold valid Class 1 and Class 2 medical certificates was necessary. The ATO complied with the request from CASA and underwent the necessary neurological assessments. He subsequently underwent a second assessment by another doctor

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11 The area within which stimuli will produce the sensation of sight with the eye in a straight-ahead position – Miller, B.F. and Keane, C.B., *Encyclopaedia and Dictionary of Medicine, Nursing and Allied Health*, 3rd Ed., W.B. Saunders, Philadelphia

who examined him at length and also conducted a number of cognitive function tests. The second doctor found that there was no impediment to the ATO continuing to fly; however, the doctor indicated that it would be desirable to review the ATO in 12 months time.

CASA lifted the suspension on the ATO's Class 1 and Class 2 medical certificates on 28 April 2000. In its letter that lifted the suspension, CASA indicated that the renewal of his next medical certificate would again require a neurological review to determine the ATO's fitness to fly. As the ATO's current medical was due for renewal in July 2000 (3 months after the suspension was lifted), CASA indicated that this review was to take place prior to the renewal of his subsequent medical certificate in July 2001.

In December 2000, the ATO suffered from a major medical condition that required hospitalisation. As a result of that hospitalisation, the ATO developed secondary medical complications. He subsequently recovered from those complications and, when he applied to renew his medical certificate in June 2001, CASA required him to undergo supplementary medical examinations to assess if he met the standard required for the issue of the medical certificate.

The ATO underwent those examinations and CASA subsequently assessed him as meeting the required standard and issued a Class 1 Medical Certificate for a 6-month period on 18 August 2001. Despite being stipulated by CASA when they renewed his medical certificate in April 2000, there was no evidence that the ATO underwent a neurological review during that renewal.

CASA medical officers indicated that this was an oversight, possibly due to the amount of other medical information that the ATO had to provide at that time and resulting from his hospitalisation.

Subsequent to this accident, the ATO has been required by CASA to undergo more cognitive testing in addition to the necessary medical examinations for the reissue of his medical certificate. The ATO has continued to meet all of the required standards and, as at the date of this report, continues to hold a Class 1 Medical Certificate.

Pilot histories – all pilots

Examination of the 72 hours leading up to the accident for all four pilots involved did not reveal any problems related to sleeping, eating or pre-existing personal issues.

Aircraft information

Cessna 152 – VH-FMG

Manufacturer	Cessna Aircraft Company
Model	152
Serial Number	15283511
Registration	VH-FMG
Year of manufacture	1979
Certificate of airworthiness	Issue date: 28 January 1992
Certificate of registration	Issue date: 11 July 1979
Maintenance Release	Valid to hours/date: 8,395 hours total time in service (TTIS)/23 December 2009
Total airframe hours	8,376.1 hours TTIS as at 17 December 2008

Liberty XL2 – VH-XLY

Manufacturer	Liberty Aerospace Incorporated
Model	XL-2
Serial Number	0112
Registration	VH-XLY
Year of manufacture	2008
Certificate of airworthiness	Issue date: 30 July 2008
Certificate of registration	Issue date: 25 July 2008
Maintenance Release	Valid to hours/date: 308.3 hours TTIS/5 December 2009
Total airframe hours	237.2 hours TTIS as at 17 December 2008

Both aircraft were maintained in accordance with CASA-approved systems of maintenance. The maintenance releases for both aircraft were reviewed and no outstanding defects were evident. A review of both aircraft's logbooks did not reveal any outstanding defects or maintenance anomalies.

Meteorological information

The student pilot under test and the ATO both reported that the weather conditions were adequate for flight under the visual flight rules (VFR), with a visibility in excess of 10 km and a cloud base of about 3,500 ft. The Bureau of Meteorology forecast for the area was consistent with the Liberty pilots' observations.

The position of the sun at the time of the collision was calculated via the Geoscience Australia website at www.ga.gov.au That calculation revealed that the sun was at an elevation[12] of 67° and an azimuth[13] of 67° at that time.

Communications

General

There were no reported abnormalities or unserviceabilities with the radio equipment at Bankstown Tower. Transmissions on the ADC and surface movement control (SMC) frequencies were recorded and made available to the investigation.

Cessna

Examination of the recorded ATC transmissions on the ADC frequency of 132.80 MHz during the time leading up to and after the collision revealed that the only transmission from the Cessna was associated with its departure to the training area about 1 hour before the collision. There were no inbound transmissions recorded from the Cessna prior to the collision.

The single radio in the Cessna only allowed the crew to listen to the active frequency. The standby frequency, although tuned in the radio, was not able to be listened to until it was selected as the active frequency.

An examination of the damaged radio from the Cessna revealed that the active frequency was selected to 132.80 MHz (Bankstown ADC) and that the standby frequency was selected to 120.90 MHz (Bankstown ATIS). Impact damage precluded functional testing of the radio.

There was evidence that both pilots in the Cessna were wearing headsets at the time of the collision.

Liberty

The student under test reported making a radio broadcast approaching 2RN, but that the response was not as expected. A second broadcast seeking clarification was about to be made by the student when the collision occurred.

The ATO reported that a correct inbound broadcast was made by the student under test, that it was acknowledged by Bankstown ATC and that the Liberty was cleared to enter the circuit on the crosswind leg.

Examination of the ADC frequency revealed that there was no inbound radio transmission from the Liberty before the collision. An examination of the recorded information on the SMC frequency of 119.90 MHz revealed that the inbound broadcast from the Liberty was made on this frequency at 1123:28 and lasted 8.5 seconds. The recording indicated that the SMC controller advised the student

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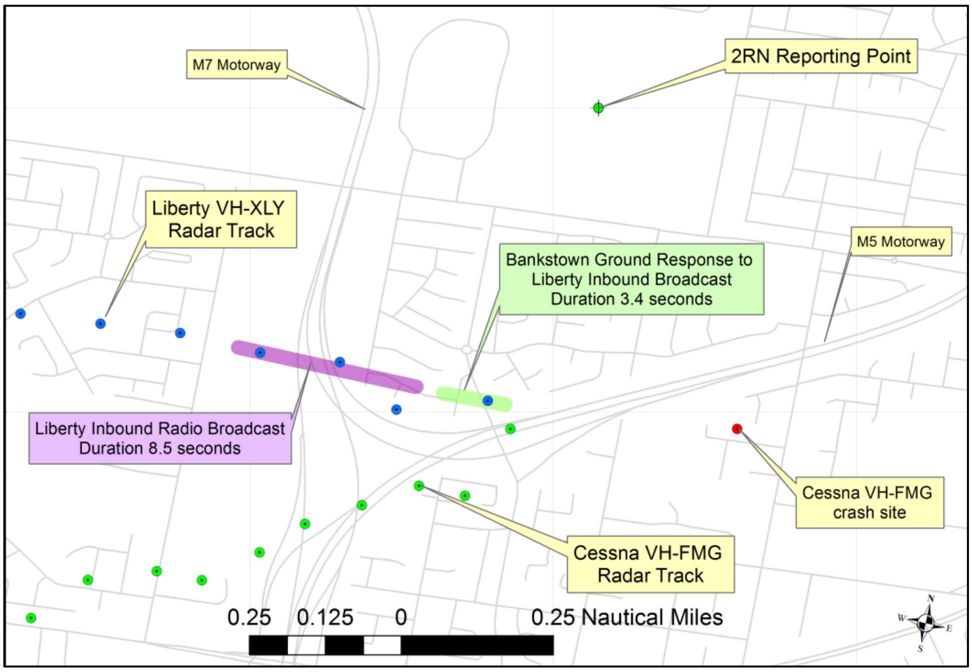
12 The vertical angle to the sun from an ideal horizon, measured in degrees.

13 The clockwise horizontal angle from the sun to true north, measured in degrees.

that the broadcast was on the Bankstown ground[14] frequency and to contact the tower[15] on frequency 132.80 MHz. That radio broadcast from the SMC lasted 3.4 seconds. The location of the radio broadcasts by the student pilot under test and SMC in relation to the collision is displayed in Figure 2. The location of the Liberty during those transmissions was to the south-west of 2RN and not in accordance with the instructions contained in documentation published for operations at Bankstown.[16]

Figure 2: Location of the Liberty during the student pilot under test and SMC radio transmissions



The first recorded inbound transmission on the ADC frequency of 132.80 MHz from the Liberty was the MAYDAY broadcast from the ATO following the collision. The ATO reported that he did not have to change the radio frequency or transmitter selector before making the MAYDAY broadcast. There was no inbound radio broadcast from the Liberty identified on the frequency prior to the MAYDAY.

A number of inbound radio broadcasts were recorded from other aircraft on the ADC frequency, and were correlated to the recorded radar data for each relevant aircraft.

The audio recording for the ADC also revealed that about 14 seconds prior to the MAYDAY transmission from the Liberty, there was a short, 1.8 second recording of an open microphone[17] followed shortly after by an overtransmission[18] from

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[14] Control tower position or other authority assigned to control all vehicles, including taxiing aircraft, on an airport's movement area.

[15] Radio callsign for the ADC position in a control tower.

[16] Enroute Supplement Australia – Sydney/Bankstown entry – arrival procedures. This information is amplified in the *Sydney Basin Visual Pilot Guide – Fixed Wing*, Civil Aviation Safety Authority, Australia, 2003, 2007 & 2010 editions.

[17] An 'open-microphone' is where the transmit button of a radio transmitter is activated; however, no voice transmission takes place.

another aircraft. When correlated with the radar data, that overtransmission was found to have occurred about 9 seconds after the estimated time of the collision. The source of the overtransmission was not able to be confirmed.

The Liberty was equipped with two communications radios as part of its avionics fitment that allowed the crew to listen to the active frequencies from both radios, depending upon how they were selected on the audio panel. The pilot could select the audio output from each radio individually or could listen to both radios simultaneously. The standby frequency, although tuned on each radio, was not able to be listened to until it was selected as the active frequency.

Examination of the upper communications radio revealed that the active frequency was 132.80 MHz (Bankstown ADC) and that the standby frequency was 124.55 MHz (Sydney Radar - South). The lower communications radio had 119.90 MHz (Bankstown SMC) selected as the active frequency and 120.90 MHz (Bankstown ATIS) as the standby frequency.

Both pilots in the Liberty reported that they were wearing headsets at the time of the collision.

Recorded radar data

The original radar recordings[19] were processed via a computer program that replicated the Australian Advanced Air Traffic System (TAAATS) radar system. Replay of the TAAATS radar data displayed each aircraft's flight path. There were no reported radar unserviceabilities at the time of the collision.

The data indicated that the Cessna and Liberty each had functioning transponders leading up to the collision and displayed secondary surveillance radar returns[20] that indicated the selection in each case of transponder code 1200.[21]

The radar data also displayed a number of other aircraft in the Sydney area. Those aircraft were operating at a number of different altitudes, ranging from less than 500 ft to above 10,000 ft. The data also indicated a number of primary radar returns[22] only.

A depiction of the air situation display (ASD)[23] at the time that the Liberty pilots reported first sighting a Cessna in the training area is at Figure 3.

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18 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.

19 Both aircraft were operating in Class G airspace (non-controlled) at the time of the occurrence and were not subject to a control service by air traffic control. As both aircraft had turned on their onboard transponders, and were within radar coverage, their tracks were recorded by TAAATS.

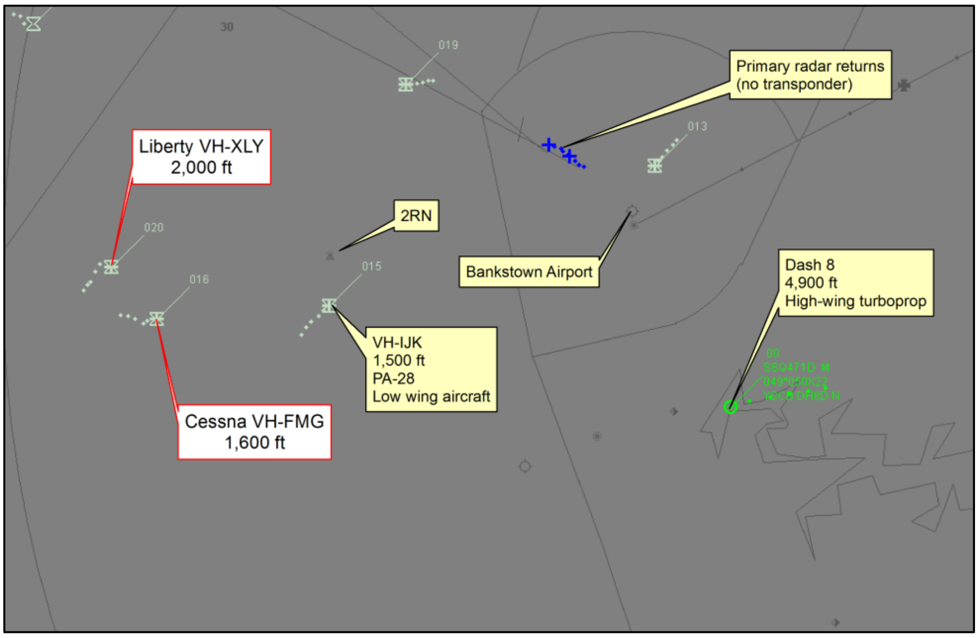
20 A secondary radar return is one which displays additional information in the form of altitude and any applicable transponder code from the aircraft's on board transponder unit.

21 Civil VFR aircraft operating in Class G airspace are required to operate their onboard transponder on code 1200.

22 A primary radar return is one which does not contain additional information from an aircraft transponder and indicates that the aircraft is either not equipped with a transponder or that it is switched OFF or unserviceable.

23 An air situation display is the radar picture as displayed on an air traffic control display.

Figure 3: Air situation display at the reported time of the Liberty sighting the Cessna



The ASD also displayed other aircraft at that time, including primary and secondary radar returns. The radar return immediately ahead of the Liberty was identified as Cessna VH-FMG (FMG) and another radar return to the east was identified as a Piper PA-28 low-wing aircraft, registered VH-IJK. The only other radar return in the area ahead of the Liberty's flight path was an instrument flight rules Bombardier DHC-8 (DHC8) high-wing turboprop aircraft, which was 2,900 ft above the Liberty and about 13 NM (24 km) distant. The DHC8 was likely to have been obscured by cloud at the time given the reported meteorological conditions.

The radar data indicated that the Cessna maintained a relatively straight track towards 2RN from the training area and that, as it approached 2RN, it made a slight turn to the left to possibly align with the start of the M5 motorway. That tracking via the M5 motorway was consistent with other aircraft observed on radar that were tracking towards Bankstown that day.

The radar data indicated that both aircraft tracks crossed at about 1123:43 with a closing angle between 20^{o} to 30^{o}.

Derivation of aircraft performance

Cessna

The radar data for the time that the Cessna was in the training area was intermittent but indicated that the aircraft conducted a number of climbing and descending manoeuvres. There were limited opportunities to observe the Cessna on radar in cruise flight.

The predominant recording of cruise flight by the Cessna was when it returned from the training area and was tracking towards 2RN. During that time, the Cessna's average ground speed was 84 kts.

Liberty

Radar data was available for the majority of the flight by the Liberty. Examination of that data showed a cruising ground speed of between 110 and 115 kts.

Comparative aircraft performance

After the pilots of the Liberty reported sighting the Cessna, the Liberty averaged a groundspeed of 111 kts and the Cessna 86 kts. There was no indication of a reduction in the Liberty's groundspeed during the track towards 2RN.

Flight and other recorders

Neither aircraft was equipped with a flight recorder, nor were they required to be so equipped by aviation regulation.

The Liberty was equipped with an engine management system that included a data recording capability. The system's data card was recovered and examined but no data relating to the accident flight was recorded.

Wreckage and impact information

Overview of wreckage

A search of the area surrounding the Cessna's point of ground impact recovered small fibreglass and metal fragments that were later identified as coming from the Cessna. The rear white navigation light and housing from the tail of the Cessna was recovered from a field about 140 m west of the main ground impact position. All other Cessna components were accounted for at the wreckage location.

Cessna

The Cessna was a high-wing aircraft and was painted white with large red stripes on its fuselage that extended to the lower section of the tail area. The vertical fin was painted white with a red and black accent on each side, which extended around the leading edge of the fin (Figure 4).

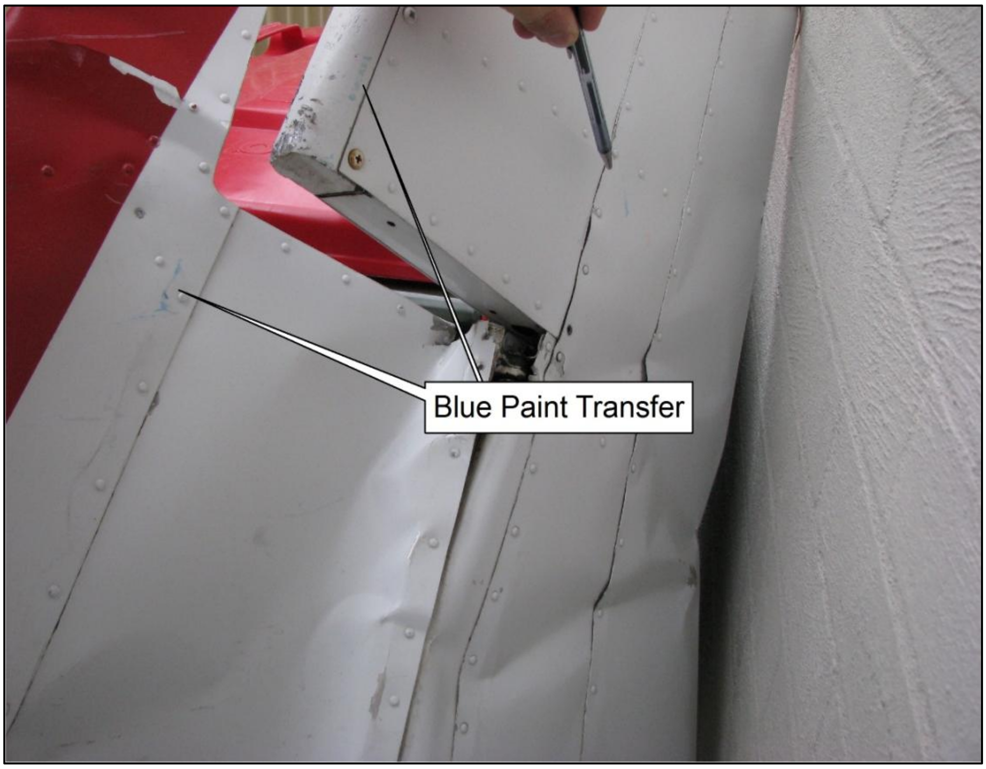
Figure 4: Cessna prior to the occurrence

The Cessna impacted a house and the ground in a vertical, nose-down attitude. The damaged tail section remained attached to the remainder of the aircraft by the flight control cables and was located on the bottom of the fuselage after the aircraft came to rest. There was significant compression damage to the leading edges of both wings, consistent with impact with the structure of the house and the ground (Figure 5).

Figure 5: Cessna wreckage and crash site

A detached section of the Cessna's vertical fin came to rest between two houses in an upright position after impacting the roof of a house to the west of the main wreckage. Examination of that piece of wreckage revealed blue paint transfer on the left side of the mass balance weight and upper section of the vertical fin (Figure 6).

Figure 6: Paint transfer on the detached portion of the Cessna's vertical fin



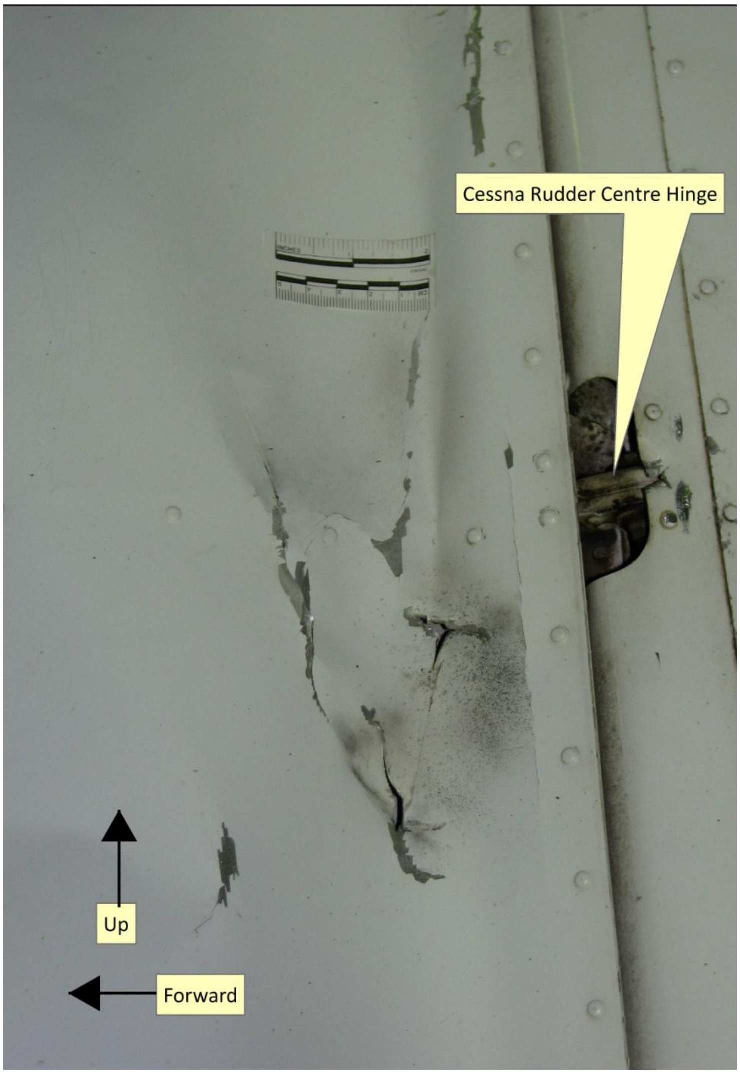
The Cessna's left wing sustained damage consistent with impact damage to a house to the east of the main wreckage.

The tail of the Cessna had separated about midway between the cabin and tail. The rudder, elevator and trim control cables remained intact, resulting in the separated section remaining connected to the main wreckage following the collision. The horizontal tail surfaces were relatively undamaged and remained attached to the tail of the aircraft.

Control continuity to all flight controls was confirmed and there were no abnormalities with the engine of the Cessna. The wing flaps were in the retracted position. The cockpit controls were severely impact damaged and, as far as could be ascertained from the wreckage, all of those controls were in their normal operating positions.

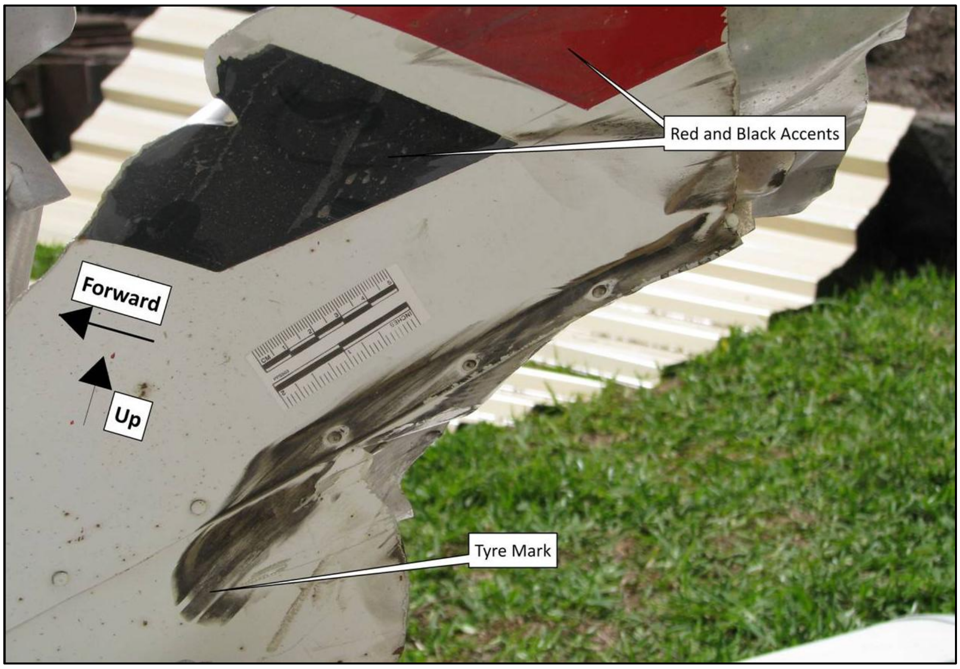
Examination of the portion of the vertical fin that remained attached to the Cessna revealed impact damage on the left side of the fin that was inconsistent with an impact with the ground or house. Later examination revealed that this damage was consistent with an impact with the Liberty's exhaust pipe (see the following wreckage description titled *Liberty*) (Figure 6).

Figure 6: Witness mark on the Cessna's vertical fin



A single tyre mark was located on the left side of part of the Cessna's vertical fin (Figure 7). In addition, debris that was consistent with contact with a tyre was located at the base of the vertical fin.

Figure 7: Tyre mark on the left side of the Cessna's vertical fin



Liberty

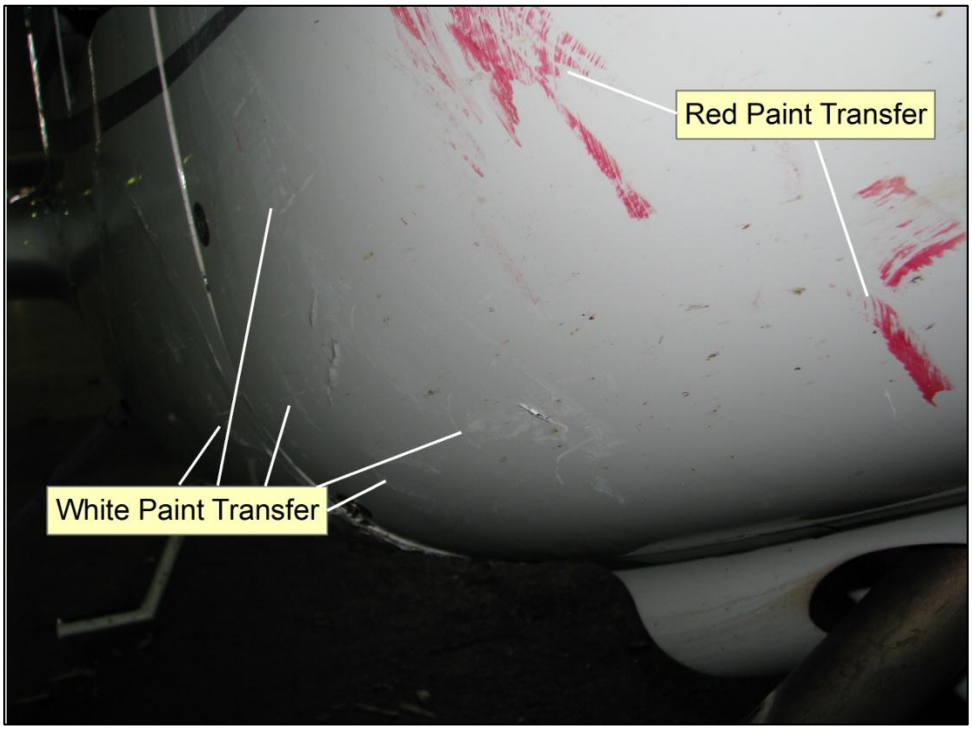
The Liberty was a low-wing aircraft and was painted white with blue, grey and aqua accents located along the fuselage. The propeller was painted white with red tips and black trailing surfaces.

After the collision, the Liberty remained in a controllable condition and landed at Bankstown Aerodrome where it was secured by the NSW Police Force until examined by the Australian Transport Safety Bureau (ATSB). Damage to the Liberty consisted of impact damage to the right side of the aircraft's nose cowling, with associated paint transfer and crush damage to the single exhaust pipe that was located on the lower-right side of the engine cowling. There was also damage to the right side of the nosewheel, paint transfer on the leading and trailing surfaces of the impact-damaged propeller and a break on the lower-right side of the cockpit windscreen (Figure 8).

Figure 8: Broken right lower windscreen

Examination of the damage to the right side of the nose cowling revealed red paint transfer at the front of the cowling, with additional crush damage and white paint transfer towards the rear of the cowling (Figure 9).

Figure 9: Impact damage to the right engine cowling



Inspection of the single exhaust pipe on the right front of the Liberty revealed crush damage to the forward section and white paint transfer (Figure 10).

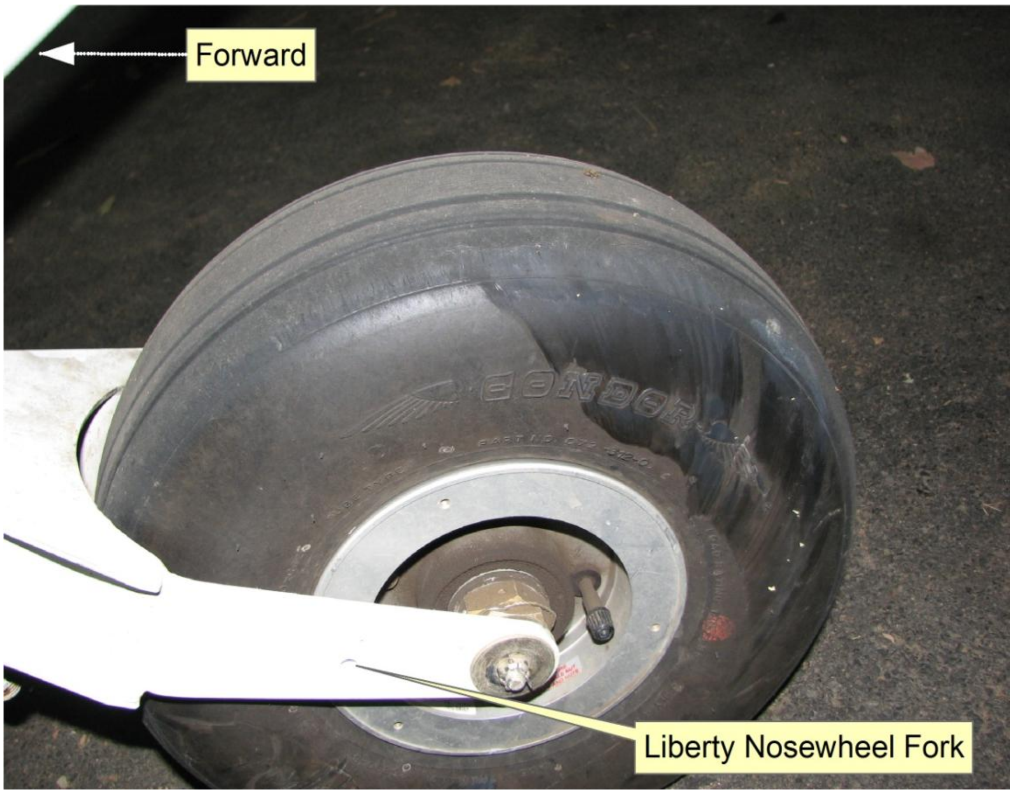
Figure 10: Exhaust pipe crush damage

The nosewheel had been displaced to the left of its normal position on the aircraft’s centreline. There was red paint transfer on the right side of the nosewheel leg (Figure 11).

Figure 11: Red paint transfer on the right side of the nosewheel leg

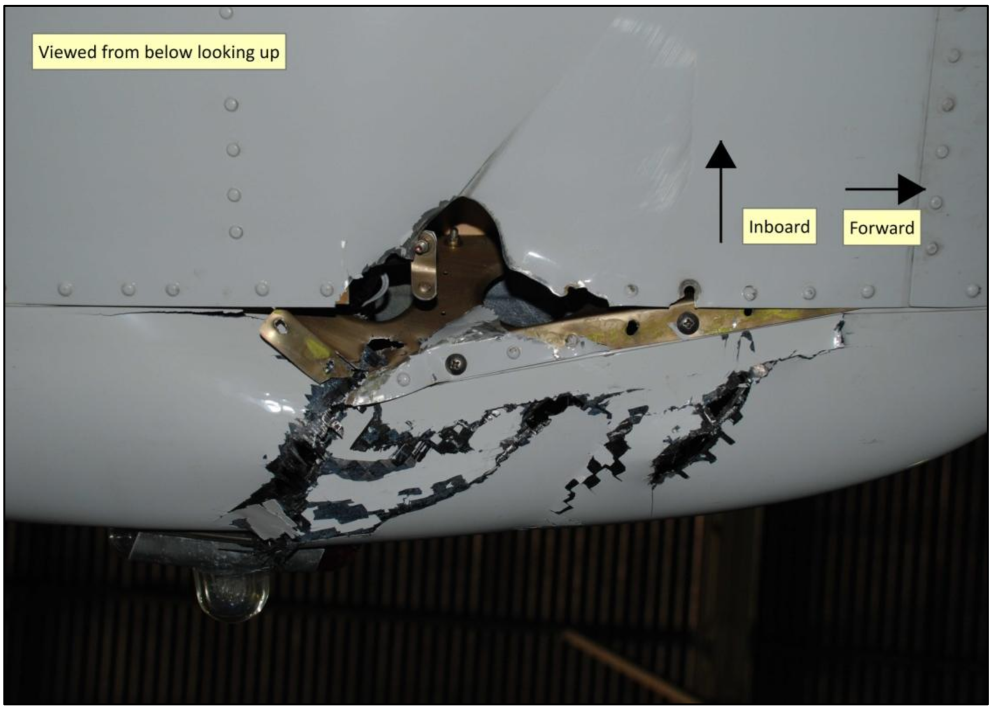
Examination of the nosewheel tyre revealed rubbing damage to the left side, consistent with it coming into contact with the nosewheel fork structure (Figure 12).

Figure 12: Liberty nosewheel tyre left side damage



There was additional damage to the underneath surface of the left wingtip (Figure 13).

Figure 13: Damage to the underneath surface of the left wing



The damage to the lower surface of the left wing was consistent with a contact with a second structure with sufficient force that it pierced the Liberty's wing surface and wingtip fairing. That damage was later found to be consistent with striking the Cessna’s tail navigation light, which was recovered from a field to the west of the main wreckage.

A reading magazine was found adjacent to the right pilot seat when the Liberty was inspected by the ATSB (Figure 14). The ATO reported reading the magazine earlier in the flight as a means to ‘put the student pilot at ease’ during the flight and that he put it away after he had finished with it.

Figure 14: Location of the magazine at the right pilot seat

Medical and pathological information

Post-mortem examination of the student pilot and the instructor in the Cessna did not reveal any medical condition in either pilot that would have contributed to the accident. Toxicological testing of both pilots was negative for the presence of drugs and alcohol.

Fire

There was no evidence of an in-flight or post-impact fire involving either aircraft.

The fire brigade attended the Cessna accident site and reported that a significant amount of fuel had spilt from the aircraft’s fuel tanks. Fire suppression foam was deployed as a precaution to prevent a fire.

Survival aspects

The collision between the Cessna and the Liberty resulted in damage that rendered the Cessna uncontrollable. The Cessna’s impact with the ground was not survivable.

Organisational and management information

Collision avoidance

Both aircraft were returning to Bankstown Aerodrome and were operating in Class G airspace at the time of the accident. The pilots were based at Bankstown Aerodrome and all four had experience, albeit to varying degrees, with the normal procedures for entry to the Bankstown control zone (CTR) via the nominated inbound reporting points, including via the 2RN transmission mast. The instructor in the Cessna and the ATO in the Liberty were the nominated pilots in command (PIC), and both were the most experienced pilots in each aircraft and had the most experience in operating into the Bankstown CTR.

Responsibility for collision avoidance in Class G airspace rests with the PIC. The rules affecting the right of way and for the prevention of a collision are found in Civil Aviation Regulations (CAR) 161 and 162 respectively.

In respect of the right of way, CAR 161 (2) sets the overall requirement that:

> The pilot in command of an aircraft that has the right of way must maintain its heading and speed, but 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.

In regard to aircraft on converging headings, CAR 162 (1) states that:

> When 2 aircraft are on converging headings at approximately the same height, the aircraft that has the other on its right shall give way, except that:
>
> (a) power-driven heavier-than-air aircraft shall give way to airships, gliders and balloons;
>
> (b) airships shall give way to gliders and balloons;
>
> (c) gliders shall give way to balloons; and
>
> (d) power-driven aircraft shall give way to aircraft that are seen to be towing other aircraft or objects.

In the case of overtaking, CAR 162 (3) further states:

> An aircraft that is being overtaken has the right-of-way and the overtaking aircraft[24], 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.

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24 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.'

The Cessna 152 has a normal cruise speed of about 95 kts at 65% power[25] and the Liberty XL-2 about 113 kts at 65% power.[26] The Liberty was the faster aircraft.

The responsibility of a pilot 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.

Age-related proficiency checks

The ATO reported that it was a requirement for him to undergo 6-monthly proficiency checks in accordance with the applicable regulations. CAR 5.110 titled *Commercial (aeroplane) pilot: requirements if over 60 years old* stipulated the regulatory requirements affecting commercial pilots over 60 years old. More specifically, subregulation (2)(c) stated that a CPL holder who is greater than 65 years of age shall only exercise the privileges of their licence, if the pilot has:

> within the period of 6 months immediately before the day of the proposed flight the pilot has satisfactorily completed an aeroplane proficiency check or an aeroplane flight review.

The ATO reported that he last underwent a proficiency check with an experienced ATO on 3 December 2008 (15 days prior to the accident). That other experienced ATO reported that the ATO demonstrated all briefings, manoeuvres and procedures to a competent standard. Therefore, at the time of the accident, the ATO met the criteria to exercise the privileges of his CPL and therefore his delegation.

The ATO indicated that the proficiency check immediately prior to that in December 2008 was with a CASA FOI when he underwent the renewal of his flight instructor rating on 6 May 2008. Therefore, to comply with the requirements of CAR 5.110 (2), the ATO should have undergone another proficiency check no later than 6 November 2008.

Between 6 November and 3 December 2008, the ATO conducted a number of flight tests using his CASA delegation. As he was unable to legally act as PIC during that period, the validity of any flight tests conducted under his instrument of delegation during the period from 6 November to 3 December 2008 is uncertain.

Licence and delegation holders are responsible for ensuring that all requirements for exercising the privileges of their licences and delegations are complied with at all times.

CASA subsequently reported during the report review period that the ATO was not required to undergo 6-monthly proficiency checks, as the conduct of a flight test is classified as a private operation and is not covered by the requirements of CAR 5.110.

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[25] C152 Pilot Operating Handbook – Section 5 *Cruise Performance.*

[26] Liberty Aerospace Website - http://www.libertyaircraft.com/airplane-liberty-xl2/5-performance.php

Ageing pilot issues

The medical certification of ageing pilots is a very contentious issue, not only in Australia but also around the world. It was first raised in the United States in 1959, when the Federal Aviation Administration (FAA) issued a ruling that professional pilots engaged in international and domestic high capacity passenger carrying operations were unable to do so as PIC after the age of 60. This age limit has subsequently been raised to 65 years.

The imposition of an age limit in many countries has been challenged and found to be discriminatory by the courts and contrary to human rights. Very few countries have formal age restrictions enshrined in legislation. Even so, those age limitations only apply to pilots engaged in commercial air transport operations, not to those pilots engaged in other forms of flying, such as private or instructional flights.

Australia has placed additional requirements on Air Transport Pilot (Aeroplane) Licence (ATPL(A)) and CPL(A) holders aged 60 years and older while operating in commercial operations. Those requirements include that they can only fly as PIC in aircraft with fully-functioning dual controls and with another appropriately-qualified flight crew member. An alternative to those requirements is for the licence holder to undertake an aeroplane proficiency check flight[27] or aeroplane flight review[28] in the 12 months immediately prior to the flight. Once the holder reaches the age of 65, the requirement for a proficiency check is reduced to 6 months. There are currently no similar requirements for pilots aged 65 or older who engage in non-commercial operations.

In Australia, discrimination on the basis of a person's age is prohibited under the *Age Discrimination Act 2004.* Section 39(1) of that Act allows for a form of age discrimination to be made where there is to be direct compliance with other legislation, such as Acts, Regulations and other legal instruments. The Civil Aviation Regulations 1988 (CAR) and the Civil Aviation Safety Regulations 1998 (CASR) are specifically exempted under that section of the *Age Discrimination Act 2004*. This form of discrimination is known as positive age discrimination.

Positive age discrimination is the application of additional requirements based solely on a person's age to determine compliance with specific legislative requirements. In the case of aviation medical certification in accordance with the applicable CASR, CASA chooses to apply positive discrimination to pilots aged 80 and above, and has specified that each pilot's medical re-certification is to be based upon individualised medical examinations and, where necessary, additional testing.

The ATO's medical certification was subjected to positive age discrimination. Where those additional examinations and in some cases, testing, reveal that the applicant meets the required standard for the required medical certificate, CASA must issue a valid medical certificate. When CASA does issue a certificate to an

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27 Civil Aviation Regulation (1988) (2) defines *aeroplane proficiency check* as a check that tests the aeronautical skills and aeronautical knowledge relevant to aeroplane flight of the person undertaking the check.

28 Civil Aviation Regulation (1988) (2) defines *aeroplane flight review* as a test of the aeronautical skills and aeronautical knowledge relevant to aeroplane flight of the person undertaking the review.

aged pilot, they often issue the certificate with conditions, such as a reduced validity period and a 'renew by CASA only' clause. Those conditions allow CASA to monitor the aged pilot on a more frequent basis, in recognition of possible risks related to the age of the pilot. There are a number of pilots in Australia aged over 80 that are currently managed under this regime.

While the medical examinations placed on these pilots are targeted towards determining the likelihood of in-flight incapacitation, there is very little information contained in the Designated Aviation Medical Examiner's handbook that relates to the cognitive evaluation of aged pilots. Evaluating aged pilots for cognitive fitness to fly is likely to be difficult due to the lack of an accurate and valid measurement tool.

There are a number of cognitive assessment tools for assessing a person's cognitive functioning; however, very few are tailored to measure the required cognitive functioning in the aviation environment. Regardless of which tool is used to cognitively assess ageing pilots the results, to be consistent and valid, and measure what is supposed to be measured, must be compared against a known population of aged pilots. The number of aged pilots is very small, impacting on the validity of the population against which to compare results.

The issue of medical certification of ageing pilots is likely to become more prominent in the future as the population ages and many more pilots are likely to seek medical certification to continue to fly. It is not a problem that is unique to Australia; it is a challenge for aviation regulation agencies around the globe.

Additional information

Visual limitations - general

There are distinct limitations with the human eye, which is able to accept light rays through an arc of about 190°. As a person ages, this field of vision gradually contracts, with males suffering a marked reduction in the field of vision after 55 years of age. 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, or two aircraft remaining on constant relative bearings from each other, 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, it increases the likelihood of its detection, 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 viewed following the accident, the windscreen of the Liberty was relatively clean with very few dirt marks or insect impact marks visible.

Alerted search versus unalerted search

Searching for traffic in the absence of a radio broadcast indicating the likely position of that traffic, is generally more difficult than when a broadcast has been received. In this case, the pilots of the Liberty had already sighted the Cessna, in the absence of a radio broadcast; however, they subsequently lost sight of it.

There was no radio broadcast from the Cessna.

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 can be difficult, depending upon the colour of the background and of the aircraft. As aircraft are continually moving in-flight, their background is continually changing.

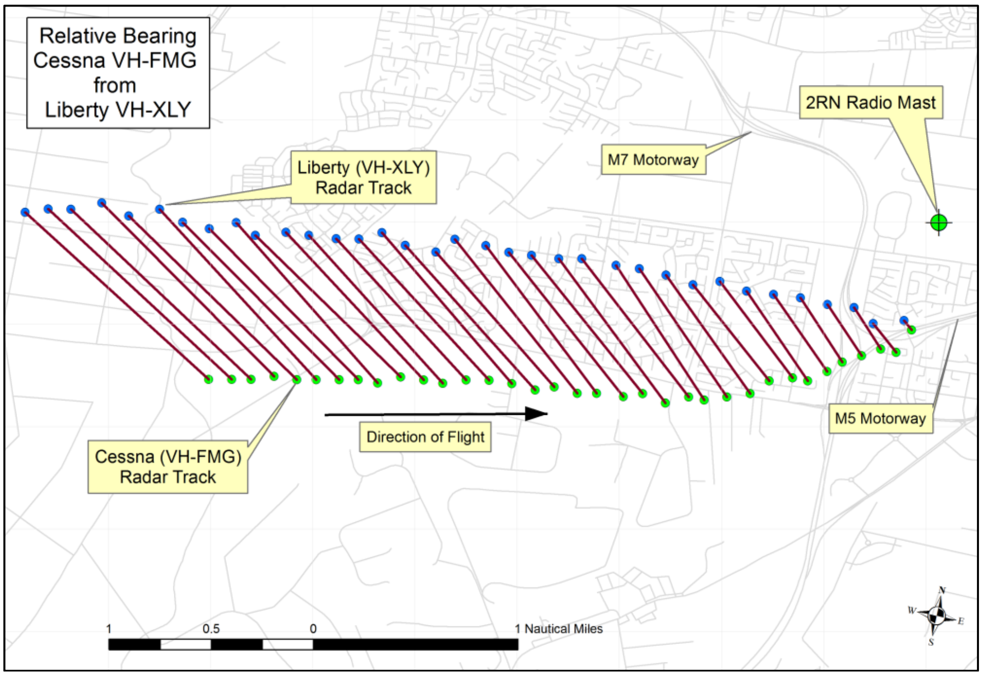
The background against which the Cessna was viewed from the Liberty ranged from open areas of vegetation to built-up areas with industrial and residential buildings. Both the student pilot and the ATO reported initially sighting the Cessna.

Relative motion of targets

The human visual system is particularly good at detecting targets that are moving across the visual field but is less effective at detecting stationary targets. An aircraft that is on a collision course with another aircraft will usually remain as a stationary object in the pilot's visual field. The result is that the target remains in the same position, only growing in size as the distance between the two aircraft decreases.

The radar data for the period from when the pilots in the Liberty reported sighting the Cessna until the collision is displayed in Figure 15. The corresponding radar returns for each time group are paired with a line and show that the when the Liberty assumed a track towards 2RN, the Cessna maintained an almost constant relative bearing to the right of the nose of the Liberty. There would have been some movement of the Cessna in the Liberty's windscreen as the Liberty descended to the same altitude as the Cessna; however, once at the same altitude, there would have been little apparent movement of the Cessna in the windscreen of the Liberty.

Figure 15: Relative bearing of the Cessna from the Liberty in the 2 minutes prior to the collision

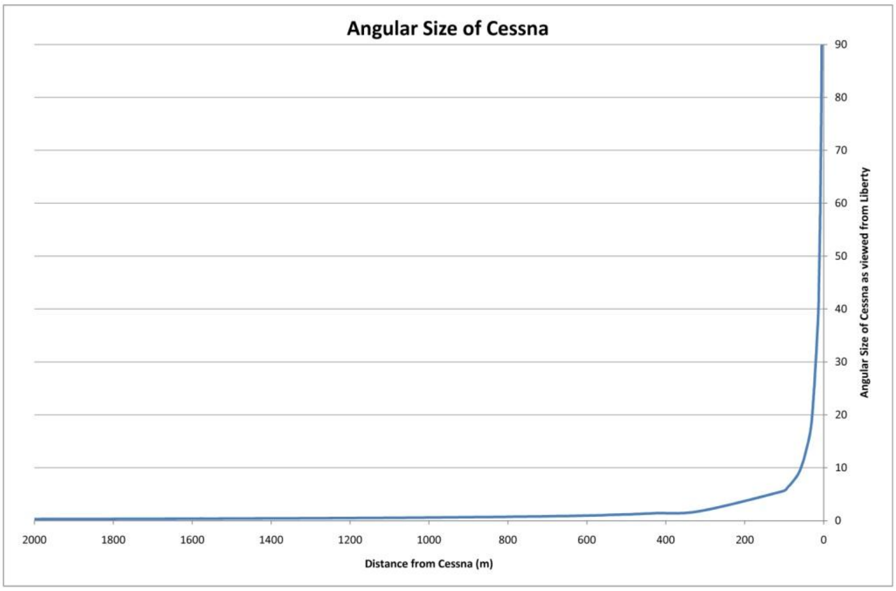


Small visual angles of approaching targets

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 rate of closure between the two objects will determine the speed at which the smaller object grows in size as it approaches the viewer. A slow rate of closure will result in a slow growth in the size of the target, whereas a high rate of closure will result in a rapid growth in its visual size.

The Cessna’s wingspan was about 10 m. When an object of that size is viewed at the estimated 2,000 m distance that it was first reported as seen by the pilots of Liberty, it has an angular size of 0.28°. The angular sizes of a 10 m object at varying distances from a specified viewpoint were calculated and are presented at Figure 16.

Figure 16: Angular size chart for the approximate Cessna wingspan of 10 m



As indicted on the chart by reading left to right on the horizontal distance scale, the angular size of the Cessna's 10 m wingspan remains relatively small as the distance to the viewer decreases until the distance between the aircraft is about 200 m or less. At that point, the increase in the size of the Cessna is essentially exponential, rapidly increasing in visual size.

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, instrument panels and, in the case of the Liberty the low-wing configuration. The reverse is the case with the Cessna 152, in that the high-wing configuration and the wing struts can obstruct vision. All these obstructions 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; however, in this case both seats in each aircraft were occupied.

In 1980 the FAA conducted a series of photographic research tests that were aimed at documenting the binocular vision from a number of aircraft cockpits.[29] The Cessna 152 was not photographed at that time and, as the Liberty XL-2 has only recently been certified, cockpit vision diagrams for both aircraft were not available as part of the FAA research.

As part of this investigation, monocular cockpit vision diagrams were developed for the Liberty from the left and right pilot seats. Those diagrams were used in conjunction with radar data to display the likely position, and therefore visibility, of the Cessna when viewed from the Liberty.

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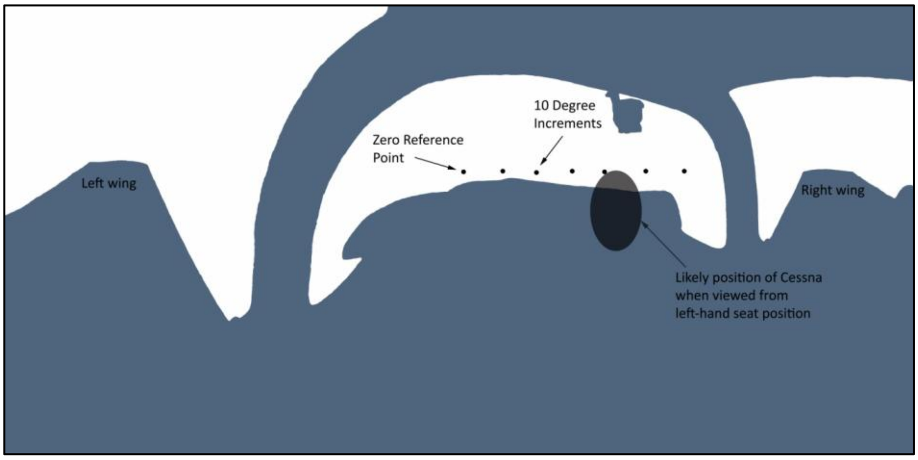
[29] Barile, A. J. (1981). *A Compendium of Aircraft Cockpit Vision Surveys 1950 through 1980 – Volume 1*, FAA Report CT-81-40.

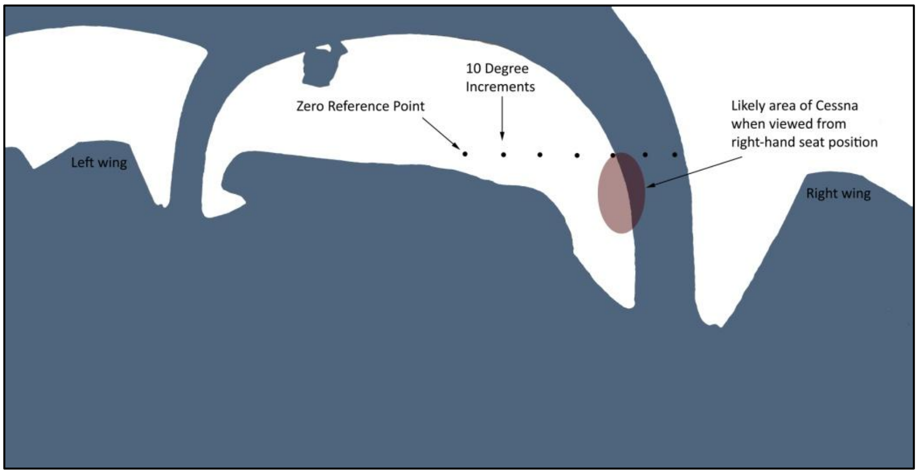
The left seat cockpit vision diagram for the Liberty that was developed by the investigation is at Figure 17. The zero reference point[30] is located directly ahead of the pilot on the horizon. The light grey shaded areas indicate those areas of obstruction to monocular vision. The likely position of the Cessna when viewed from the left seat is indicated. As the Liberty was above the altitude of the Cessna for some period prior to the collision, the area extends below the horizontal reference level.

Figure 17: Liberty left pilot's seat monocular cockpit vision diagram[31]



The right seat cockpit vision diagram for the Liberty that was developed by the investigation is at Figure 18. As previously, the light grey areas represent areas of obstructed monocular vision.

Figure 18: Liberty right pilot's seat monocular cockpit vision diagram



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30 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.

31 Diagrams are for a mean eye position and do not include allowances for binocular vision or head movement away from the position of the camera used to construct the diagram.

Obstructions to vision – in context

The Liberty cockpit vision diagram allows for the position of obstructions to vision 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 cockpit forward vision. The right edge of the instrument panel represented a restriction of about 58° from the zero reference point for the left seat occupant and about 25° for the right seat occupant.

A further obstruction to vision is created by the forward right cockpit pillar, which produces an obstruction that commences at about 70° to the right of the zero reference point for the left seat occupant and about 40° for the right seat occupant. The right seat occupant has an obstructed area of vision that is about 20° in width, and the left seat occupant an obstruction that is about 10°. The reduced obstructed view from the left seat is a result of being seated further away from the obstruction.

If the Cessna was either partially or totally obscured by one of the Liberty's cockpit pillars, then its small angular size was less than the pillar's 20° obstruction to vision and could have been obscured from the vision of the right seat occupant. The left seat occupant's vision would have been further obstructed by the instrument panel and engine cowling; however, once the two aircraft were flying at the same level, the effect of that obstruction would have been negligible.

See-and-avoid

The operations in Class G airspace at the time of the collision meant that collision avoidance relied on the 'see-and-avoid' principle. That principle is constrained by a number of limitations, as detailed in the Bureau of Air Safety Investigation 1991 research report *Limitations of the See-and-Avoid Principle.*[32]

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.

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32 Bureau of Air Safety Investigation. (1991). *Limitations of the See-and-Avoid Principle.* Retrieved 8 June 2010 from http://www.atsb.gov.au/publications/1991/limit_see_avoid.aspx.

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.

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.[33] Very few midair collisions occur outside of this area, with research indicating that for a period of 42 years, only four midair collisions occurred in Australia in the en route phase of flight.

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. In this occurrence, the Liberty made its inbound radio broadcast to Bankstown, albeit on an incorrect frequency. There was no radio call from the Cessna.

Also consistent with the research was that cockpit vision restrictions severely impacted on at least one of the pilots who was involved in the collision, reducing the time for that pilot to avoid the collision.

Analysis of the ATSB occurrence database from the period of 1980 onwards, after General Aviation Airport Procedures (GAAP) were introduced at Bankstown Aerodrome, revealed that this was the only midair collision that occurred in the vicinity of an inbound reporting point. All other midair collisions that occurred in or near GAAP airspace have taken place within the circuit area.

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33 Australian Transport Safety Bureau. (2004). *Review of Midair Collisions involving General Aviation Aircraft in Australia between 1961 and 2003*. Retrieved 17 June 2010 from http://www.atsb.gov.au/publications/2004/review_of_midair_collisions.aspx.

The data also revealed that of the 55 reported airprox[34] incidents associated with Bankstown Aerodrome, only two occurred in the location of inbound reporting points.

Other issues

The recollection of the student pilot under test, when combined with the radar data, revealed that when he conducted the aerodynamic stall entry and recovery exercises as required by the general flying progress test (GFPT) form, he did so without conducting clearing turns prior to the exercise. The radar data also showed that there was only one stall exercise conducted.

During training, student pilots are taught the proper procedure in preparation for stalling exercises. Those procedures include ensuring sufficient height above ground to recover and a comprehensive lookout for other aircraft. The importance of those procedures is reinforced in the CASA *Flight Instructors Manual* (FIM), which states:

> Before carrying out any advanced [aerodynamic] stalling exercise it is important that sufficient height is gained to ensure recovery by 3,000 feet above ground level...

and that:

> A turn through 360 degrees to ensure that all is clear around and below should be carried out immediately prior to commencing the first stall and a 90 degree turn should be carried out before subsequent stalls.

An analysis of the radar data indicated that, when the Liberty conducted the stall sequence after conducting the steep turns, the Cessna was 0.6 NM (966 m) ahead and slightly to the left of the track of the Liberty and 500 ft below.

The student pilot under test recalled that he did not enter an aerodynamic stall himself but only recovered from a stall, after the ATO had stalled the aircraft. This part of the flight test was to comply with the requirements of the GFPT, which was being conducted concurrently with the private pilot flight test. The GFPT test report form required two demonstrations of the stalling sequence. That included an entry and recovery from a stall in the approach configuration, and an entry and recovery from a stall with a wing drop.

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[34] An occurrence in which two or more aircraft come into such close proximity that a threat to the safety of the aircraft exists or may exist, in airspace where the aircraft are not subject to an air traffic separation standard or where separation is a pilot responsibility.

ANALYSIS

Introduction

The collision sequence was established from examination of damage to both aircraft and the recorded radar data. There were some inconsistencies in witness recall, specifically that of the approved testing officer (ATO), whose recollection of the immediate aspects of the collision, and of some of the events leading up to it, was at variance to that of the student, and inconsistent with the recorded radar data and the physical evidence. Although unable to be explained fully by the investigation, it was possible that the trauma associated with the event may have affected the ATO's recollection of events.

Both aircraft were correctly maintained and no mechanical problem was identified with either that might have contributed to the accident. The in-flight conditions were adequate for visual flight and the position of the sun at the time of the collision was not a factor. All of the pilots were correctly licensed at the time, adequately rested and there were no reported personal issues that would have contributed to the accident.

As a result, the investigation was left to consider two major issues – were the pilots of the Cessna aware of the Liberty's position and the potential collision risk, and were the pilots of the Liberty able to sight and maintain sight with the Cessna to avoid a collision. This analysis will examine those factors in respect of the cockpit visibility from both the Liberty and the Cessna, and how other aircraft can be obscured from vision, even at relatively close distances. Aspects of the medical certification of ageing pilots will also be discussed.

Collision analysis

The on-the-ground witness recollections of the collision were consistent with the physical evidence at the accident site. The following discussion links those recollections with the physical evidence to describe the impact sequence between the two aircraft.[35]

The collision occurred when the Liberty, which was travelling faster than the Cessna, impacted the left of the Cessna's tailplane. The position of the damaged single exhaust pipe on the right of the Liberty's engine cowling and corresponding impact mark on the left side of the tail of the Cessna, served as a point of reference on which to orientate both aircraft at the time of the collision. When coupled with the tyre mark on the left side of the Cessna's tail, the vertical and horizontal orientation of the Liberty at that time was able to be determined with a high degree of certainty. The location of the Cessna's vertical fin at that time was confirmed by the paint transfer between both aircraft. That location is depicted at Figure 19.

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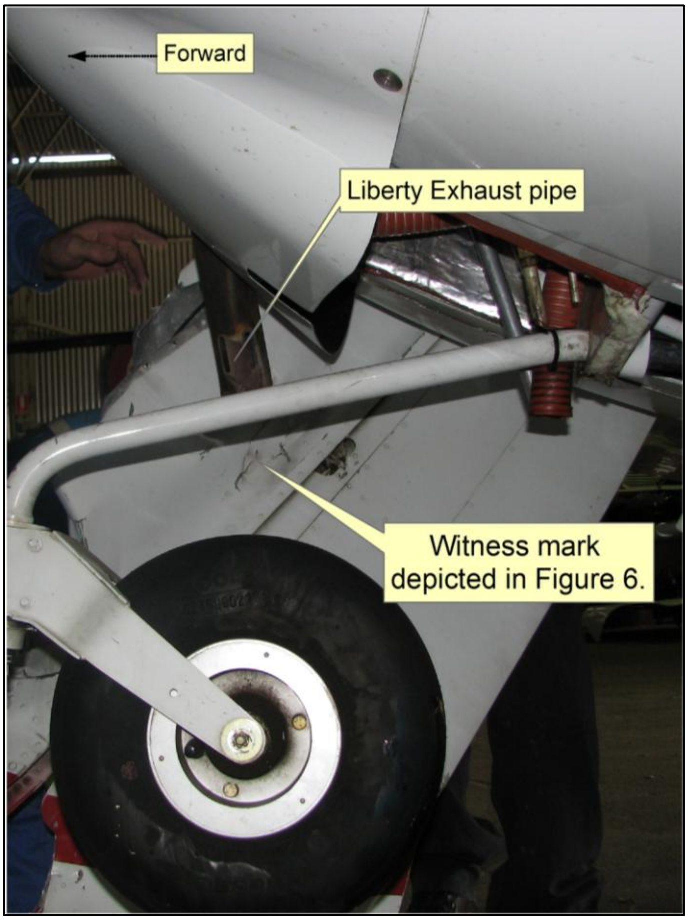
35 All references to location are made as viewed from the cockpit, looking forward.

Figure 19: Alignment of witness marks – Cessna vertical fin and Liberty exhaust pipe and nosewheel



Figures 20 and 21 show the orientation of both aircraft at the point of impact from the side and plan views respectively.

Figure 20: Impact orientation of both aircraft – side view

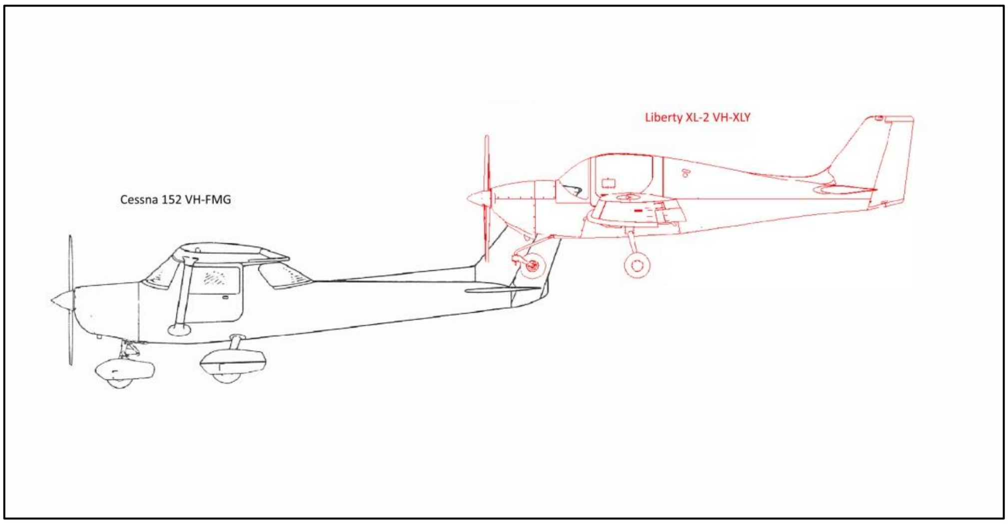
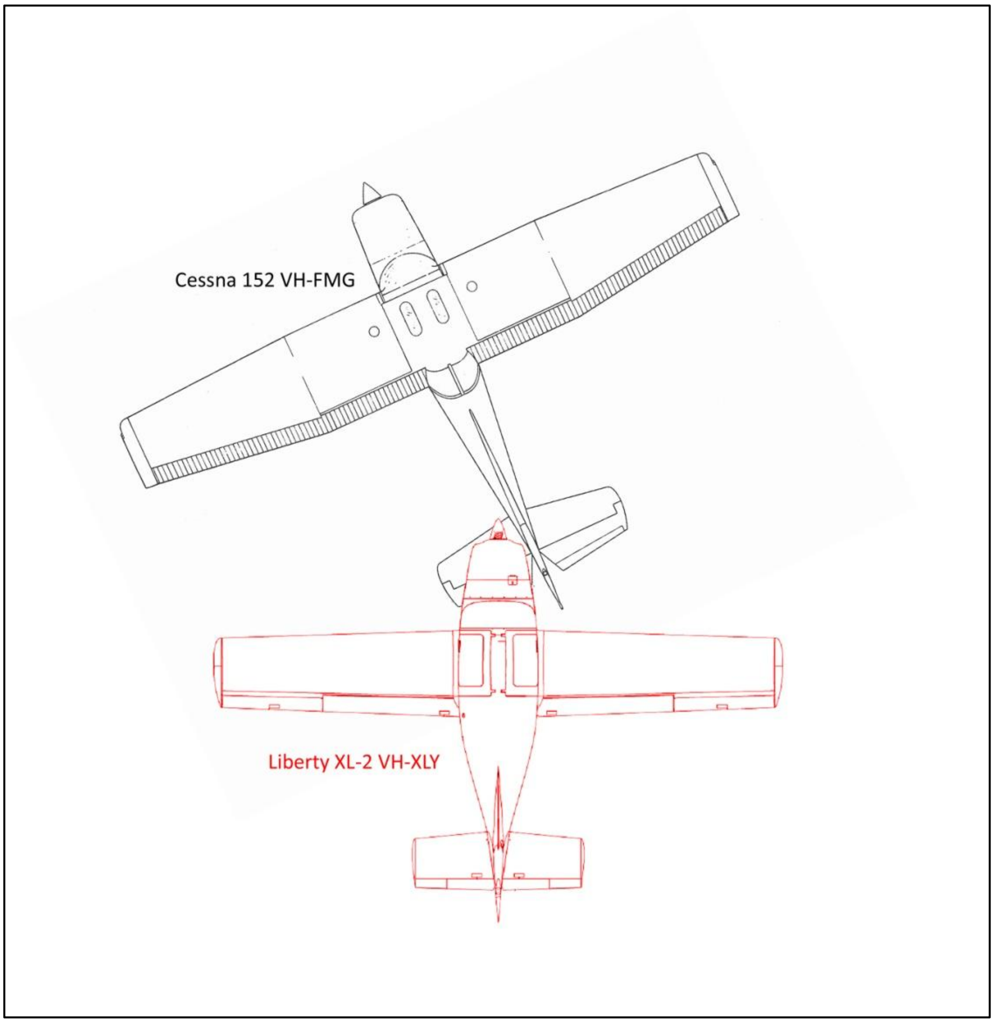


Figure 21: Impact orientation of both aircraft – plan view



The impact from the Liberty deflected the Cessna's vertical fin to the right and resulted in a twisting failure of the empennage of the Cessna towards the right, before its separation about midway between the cabin and tail. Once that structure failed and separated from the remainder of the aircraft, the flight control cables were the only connection between the tail and the remainder of the aircraft. The witness reports of the uncontrolled rotation of the separated tail section were explained by the vertical airflow over that aerofoil during the vertical descent.

The separation of the Cessna's tail to the right resulted in the tail commencing to rotate in that direction and possibly completing one revolution before the Cessna's tail-mounted white navigation light came into contact with the left underwing surface of the Liberty. That impact liberated the navigation light, which was the first item found along the wreckage trail. It is also possible that the student under test in the Liberty, as the handling pilot at the time of the collision, could have rolled the aircraft to the left as an instinctive reaction to the rapid bloom of the Cessna in the Liberty's right windscreen, placing the Liberty's left wing lower and closer to the Cessna's tail.

The breakage of the lower-right corner of the Liberty's windscreen was most likely the result of its impact with the top of the Cessna's rudder. The energy imparted to the liberated fragments of perspex would, had any fragments struck the ATO in the Liberty's right front seat, explain the injuries to the ATO's right hand. The paint transfer on the nearby engine cowl of the Liberty matched the orientation of the paint scheme on the vertical tail of the Cessna. Similarly, the paint transfer on the Liberty's nose landing gear was consistent with the orientation of the paint on the tail of the Cessna. Finally, the blue paint transfer to the left side of the Cessna's tail was consistent with an impact with the right side of the Liberty's nose cowling.

The paint transfer on the Liberty's propeller was most likely the result of it coming into brief contact with the leading edge of the Cessna's vertical fin, before the fin was pushed aside by the forward movement of the Liberty relative to the Cessna. The subsequent separation of the tail from the rest of the Cessna removed the aerodynamic balancing force provided by the tail and as a result, the centre of gravity of the Cessna would have moved rapidly forward. An uncommanded and irretrievable nose-down pitching moment resulted, causing an uncontrolled vertical descent and impact with the ground that was not survivable.

The ATO's account of the collision as being '...nearly a head-on collision' was unable to be reconciled with the physical evidence of the contact between the two aircraft.

Radar data analysis

The pilots in the Liberty both indicated that they identified a high-wing Cessna aircraft when they turned towards 2RN. Of the other aircraft that were displayed on the radar ahead of the Liberty as it tracked towards 2RN, the DHC8 was the only other high-wing aircraft in the area. However, the DHC8 was considerably higher and further away from the Liberty (about 13 NM (24 km)) than the high-wing aircraft that was reported by the pilots in the Liberty, and was unlikely to have been visible due to the reported cloud cover. Equally, if the DHC8 had been visible, it could be expected that the highly-experienced ATO, with extensive operations in the Sydney area, would have discerned the profile of the larger, twin-engine aircraft from that of a Cessna. It is therefore virtually certain that the pilots sighted FMG.

Cessna pilots' awareness of the Liberty

The Cessna's initially relatively straight track, constant altitude and essentially straight and level flight was consistent with a return from the flying training area to Bankstown via the inbound reporting point at the 2RN radio transmission mast. Normal procedures during the return included obtaining the airport terminal information and changing radio frequencies to the Bankstown Aerodrome Control (ADC) frequency in preparation for their inbound radio call at 2RN. The as-found selection of the Cessna's damaged radio to the ADC frequency supports the conclusion that the Cessna pilots were applying normal procedures to their return to Bankstown Aerodrome.

At 2RN, pilots were required to make a radio broadcast to the ADC and, upon receipt of control zone entry instructions, track in accordance with those instructions. For the runway configuration at Bankstown at the time of the collision, that essentially meant that aircraft flew along the initial part of the M5 motorway. The radar data indicated that the pilots of the Cessna made a slight turn to the left of about 10° to align their aircraft with the M5 motorway. That was similar to the radar recordings of other aircraft tracking from the 2RN reporting point to

Bankstown Aerodrome that day. The slight left turn by the Cessna brought both aircraft's tracks into closer proximity.

The position of the Liberty in the rear left quarter of the Cessna would have meant that to sight that aircraft, the Cessna pilots would have to look behind and over their respective left shoulders. As the Liberty pilots gave their inbound call on the incorrect frequency, the pilots of the Cessna were not alerted to its close proximity and therefore had no reason to look towards the rear of their aircraft. Their prime focus would have been on searching for other aircraft in front of or to either side of their aircraft. The radar data revealed that the only potential traffic conflict in that area was the PA-28, about 1 minute ahead.

A faster aircraft in an overtaking position was required by the Rules of the Air to manoeuvre clear of a slower aircraft to avoid a collision. Those rules also required that an aircraft that has another aircraft on its right is to give way to that aircraft. Therefore, once the pilots of the faster Liberty sighted the Cessna to their right front, they were responsible for giving way and remaining clear of the Cessna.

Given the relative positions of the aircraft leading up to the collision, it is very likely that the pilots of the Cessna were unaware of the Liberty and therefore had no opportunity to take avoiding action to prevent a collision.

Liberty pilots' sighting of the Cessna

The recollections of the student under test and the ATO were, at times, inconsistent. However, some aspects of their recall were consistent with each other, the recorded radar data and the physical and witnesses evidence on the ground.

The indication by the ATO to the student under test of a Cessna to the right of the Liberty after the steep turns and stalling exercises was consistent with the relative positions of both aircraft on the recorded radar data. The student's recollection that the Cessna was higher than the Liberty and appeared to be turning contrasted with the recorded data, which showed that the Liberty was higher than the Cessna at that time. The identification by the student under test of red areas on the Cessna, and its identification by the ATO as a Cessna confirmed its conspicuity against the background over which it was flying, despite its small angular size at the time. Consistent with the earlier analysis of the radar data, the investigation concluded that the Liberty pilots sighted the Cessna before the collision.

Having sighted the Cessna, the pilots in the Liberty then had to consider if it presented a potential collision threat to their aircraft. The recollection by the ATO of asking the student under test to slow the aircraft, and student's reported compliance with that request, was an indication that they possibly perceived the Cessna as a traffic risk as they approached 2RN. However, despite the recall of both pilots, the recorded radar data showed no reduction in the Liberty's groundspeed. It is possible that the student pilot overlooked the request to slow down as he was preoccupied with preparing for the entry to the Bankstown control zone.

The ATO, as the pilot in command of the Liberty, retained ultimate responsibility for ensuring separation from the Cessna. If the ATO considered that a speed reduction was necessary, for whatever reason, he could have repeated the request or have intervened to take control of the aircraft to slow down or otherwise manoeuvre. Neither took place, and the investigation was unable to reconcile the difference between the pilots' recall and the recorded radar data in respect of a reduction in the speed of the Liberty. Had the Liberty reduced speed as it tracked towards 2RN, it would have in all probability not collided with the Cessna.

As the Liberty tracked towards 2RN, the student under test would have become focussed inside the cockpit in preparation for the entry to the control zone. The ATO's focus was also inside the cockpit, as he completed the test report form after the stalling and steep turns. Although the time taken would have been short, it was possible that, for some time, neither pilot was looking outside for the Cessna. The location of the magazine in the Liberty suggested that it came loose from its stowage, or that the ATO was accessing it or had it on his lap at the time of the collision. However, the ATO reported that he had finished with the magazine earlier in the flight and had put it away. The investigation was unable to explain how that magazine came to be located on the right of the Liberty's cockpit.

In order for the ATO to re-sight the Cessna, it would have had to present a target in terms of its size, conspicuity and relative movement across his visual field, and be in an unobstructed position. In addition, the ATO's expectation of the Cessna's position in terms of where it was previously sighted would have influenced his ability to reacquire the aircraft.

The angular size of the Cessna remained relatively small and was possibly obscured by the Liberty's forward-right cockpit pillar when viewed from the ATO's position in the right seat. The lack of relative movement across his visual field, which may have reduced with age, would have compounded any difficulty experienced in reacquiring the Cessna. Overall, it is reasonable to conclude that, once the ATO lost sight of the Cessna, a number of factors would have made its reacquisition difficult for the ATO.

The report by the ATO of losing sight of the Cessna and asking the student under test if he still had it in sight was an indication that the Cessna was possibly obscured from the ATO by the cockpit pillar. The student under test was managing the return to Bankstown at the time, requiring his attention inside the cockpit and impacting on his ability to sight the Cessna. The student's inability to reacquire the Cessna would have been of concern to the ATO, as neither pilot had sight of the Cessna. The result was an unresolved collision threat as both aircraft continued tracking towards 2RN.

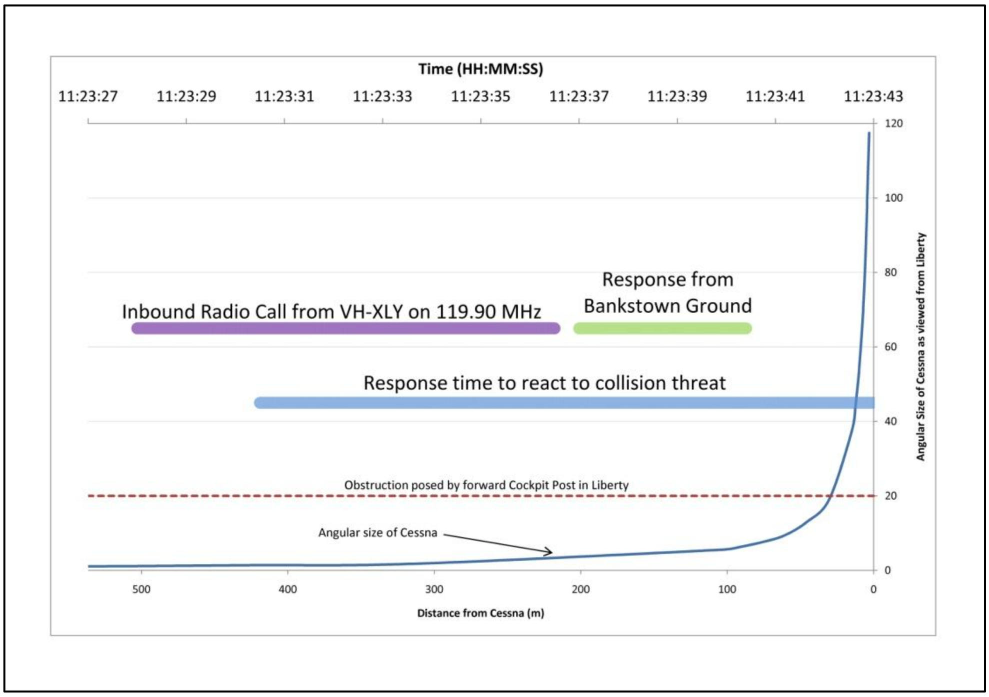
Given that the pilots in the Liberty both sighted the Cessna as they turned towards 2RN, the discussion between the Liberty pilots about the location of the now unseen Cessna most likely took place prior to the student's inbound radio broadcast. The combined duration of the inbound call by the student under test, and response by Bankstown Ground, meant that it was possible that there was sufficient time for the Liberty pilots to have resolved the collision threat before arriving at 2RN. However, there was no evidence of positive action by the crew of the Liberty to attempt to re-sight the Cessna and resolve the developing threat of collision.

Radio broadcast on the incorrect frequency

It may take up to 12.5 seconds to process the information presented and act upon it in order to avoid a collision. If there is no alert to the location of traffic, the probability of detecting it is low, until a short time before the collision when the target increases in visual size. When the Cessna was 12.5 seconds away from the collision, it still presented a very small angular target to the pilots of the Liberty and, as previously stated, possibly could have been obstructed from the ATO's view by the cockpit pillar. The student under test also most likely had his attention diverted to inside the cockpit making the inbound radio broadcast and responding to the unexpected response from the surface movement controller (SMC). Once the time to impact reduced below 12.5 seconds, the likelihood of avoiding a collision was reduced for both aircraft.

The times and durations of the inbound radio broadcast made by the student pilot on the incorrect frequency in relation to the angular size of the Cessna are represented in Figure 22. Also indicated are the limitations imposed by cockpit vision obstructions from the right seat in the Liberty. The 12.5 second time to act and avoid a collision is also presented for reference.

Figure 22: Radio broadcast, visual size of Cessna, obstruction to vision and time to react to the collision threat



The combination of the student pilot's inbound radio broadcast and response from the SMC would have impacted on his attention to other tasks during the more than 12 seconds taken by those calls. The little more than 2 seconds between the end of the SMC's transmission and the estimated time of the collision minimised any hope that the student might have avoided the collision. The student under test was most likely processing the unexpected response from the SMC and, having realised his error, was possibly in the process of switching the radio to the aerodrome control (ADC) frequency at that time. That would explain why the ATO did not have to change radios to broadcast the MAYDAY call, and the record of that call on the ADC frequency.

The investigation was unable to explain the ATO's recall of the student making a correct inbound radio broadcast on the correct frequency, and receiving a clearance from Bankstown Tower to enter the control zone. Given the radio broadcast's proximity to the collision it is possible that trauma may have affected the recall of the ATO.

Given the time taken for the inbound broadcast by the student pilot under test and that, had that call been made on the correct frequency, the ADC would probably have responded in some form, the time for the pilots in the Cessna to alert the Liberty of their position on the ADC frequency would have been minimal. It was unlikely that, if alerted by the pilots of the Cessna that they were in the same location, the pilots of the Liberty would have had sufficient time to avoid a collision after that call.

An inbound broadcast by the student under test on the correct frequency would have alerted the pilots of the Cessna of the presence of the Liberty virtually coincident with the commencement of the nominal 12.5-second collision avoidance response time, leaving the Cessna pilots the minimum time to acquire the Liberty and avoid the collision. Any delay in that acquisition decreased the opportunity to avoid the collision. As the Liberty was in an unexpected position behind the Cessna, and therefore more difficult to sight, it was unlikely that a broadcast by the student under test on the correct frequency would have allowed the Cessna pilots to react in time and avoid the collision.

The Cessna pilots may have been about to transmit their inbound report on the ADC frequency. However, even if that call had been made, it would not have alerted the pilots in the Liberty of the Cessna's position, as the Liberty was on the (incorrect) SMC frequency. Being alert to the existence and relative location of a conflicting aircraft has been shown to affect the likelihood of a pilot seeing that aircraft in sufficient time to avoid a collision.

Liberty cockpit vision obstructions

The angular size of the Cessna increased as the distance between the two aircraft reduced. As the Cessna became visible beyond the obstruction posed by the Liberty's cockpit pillar, it would have effectively 'grown' rapidly in size from the right of the Liberty, despite the relatively slow closing speed between the two aircraft. As the headings between the two aircraft were about 20^{o} to 30^{o} different, with the Cessna passing from the right to left of the Liberty, this could have given the impression that the Cessna was turning in front of the Liberty. Although possibly explaining the Cessna's apparent left turn as recalled by the ATO, it does not explain the ATO's recollection of the Cessna being above the Liberty and almost tracking for a head-on collision.

It is therefore possible that the obstruction posed by the forward right cockpit pillar obstructed the ATO from sighting the Cessna, until its angular size exceeded the width of the pillar. At that time the collision was almost certain. In addition, the engine cowling, instrument panel and pillar would have significantly obstructed the view of the student under test. In those conditions, the requirement to make the inbound radio broadcast, and unexpected response to that broadcast from SMC, would have compounded the difficulty for the student to detect any targets. The investigation concluded that the visual obstructions in the Liberty cockpit impacted on the likelihood that the Liberty crew might sight the Cessna.

Ageing pilot certification

The application of positive age discrimination to the ATO by the Civil Aviation Safety Authority (CASA) was in accordance with the existing aviation regulations and required him to undergo additional medical examinations. The results of those additional examinations assured CASA that the ATO was medically fit to exercise the privileges of his licence and therefore his delegation.

The at present minimal information in the Designated Aviation Medical Examiner's handbook on the cognitive testing of ageing pilots suggests that the probable increasing number of ageing pilots in the future will require work in that area. It appears that an aviation-compatible cognitive assessment tool will need to be identified in order for that to occur.

Other Issues

It could be expected that during a flight test, a student would demonstrate flight manoeuvres consistent with their training, including the conduct of a comprehensive lookout. Although testing officers are allowed a certain degree of discretion in how they conduct a flight test, the conduct of two steep turns as a clearing exercise and immediate conduct of the stall sequence was difficult to reconcile with the immediate airspace being 'clear around and below' in accordance with CASA's Flight Instructor Manual. Not least, the proximity of the Cessna 966 m ahead and 500 ft below the Liberty would suggest that in this case, any lookout possible during the steep turns had been ineffective.

FINDINGS

Context

From the evidence available, the following findings are made with respect to the midair collision between Cessna Aircraft Company 152 aircraft, registered, VH-FMG, and Liberty Aerospace Incorporated XL-2 aircraft, registered VH-XLY, and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- The approved testing officer and the student under test in the Liberty initially sighted the Cessna, but subsequently lost sight of it.
- A number of the limitations of the see-and-avoid principle likely combined to limit the ability of the approved testing officer and student under test in the Liberty to re-sight the Cessna once they had lost sight of it.
- The instructor and student pilot in the Cessna were probably not aware of the proximity of the Liberty.

Other safety factors

- The student under test in the Liberty made the inbound broadcast to Bankstown Aerodrome Control on the incorrect frequency.

Other key findings

- The medical certification of the approved testing officer was carried out in accordance with the existing regulatory requirements.

SAFETY ACTION

Any safety issues identified during an 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 an 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.

The investigation did not identify any organisational or systemic issues that might adversely affect the future safety of aviation operations. However, in respect of operations in or near General Aviation Airport Procedure (GAAP) aerodromes, the ATSB has been advised of the following proactive safety action following the accident.

Action taken by the Civil Aviation Safety Authority

Aerodrome procedures

As a result of a number of midair collisions in Australia, the Civil Aviation Safety Authority (CASA) conducted two reviews into operations at GAAP aerodromes. Although this accident occurred in Class G airspace (uncontrolled airspace), due to its proximity to an inbound GAAP reporting point, CASA referred to it in those reviews.

The first was a review into the efficacy of training related to GAAP procedures provided by flying training schools at GAAP aerodromes. This review found that there was room for improvement in the training provided by flying training schools at GAAP aerodromes. The report made a number of recommendations surrounding the provision of education and training to pilots on GAAP procedures. The report can be located at
http://www.casa.gov.au/scripts/nc.dll?WCMS:STANDARD::pc=PC_93315

The second review was undertaken into the utility of GAAP procedures across Australia. This review found that the current Class D GAAP model contained the most appropriate classification for the six GAAP aerodromes reviewed. The report contained a number of recommendations relating to the current implementation of GAAP. The report can be located at
http://www.casa.gov.au/wcmswr/_assets/main/oar/papers/gaapfull_june09.pdf

CASA acted on 3 June 2010 to introduce full Class D airspace at all aerodromes that previously operated under GAAP in Australia.

Medical certificates

CASA has also indicated that they propose to modify the system for issuing medical certificates to prevent the issue of a medical certificate unless all required pre-requisites, including individualised assessments and requirements, have been completed.

APPENDIX A: SOURCES AND SUBMISSIONS

Sources of information

The main sources of information during the investigation included:

- the pilots of VH-XLY (XLY)
- Airservices Australia (Airservices)
- the Bureau of Meteorology.

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 Civil Aviation Safety Authority (CASA), Airservices, the pilots and operator of XLY and the operator of VH-FMG (FMG).

Submissions were received from CASA, Airservices and the operator of FMG. The submissions were reviewed and, where considered appropriate, the text of the report was amended accordingly.

Midair collision - Cessna 152, VH-FMG and Liberty Aerospace Inc. XL-2, VH-XLY, Casula, NSW, 18 December 2008