Aviation Safety Investigation Report - Final

Cessna Aircraft Company 172P, VH-KTV

Occurrence Details

Occurrence Number:	200200548	Location:	Jandakot, Aero.
Occurrence Date:	22 February 2002	State:	WA
Occurrence Time:	1801 hours WST	Highest Injury Level:	None
Occurrence Category:	Accident	Investigation Type:	
Occurrence Class:		Investigation Status:	
Occurrence Type:		Release Date:	15 October 2003

Aircraft Details

Aircraft Manufacturer:	Cessna Aircraft Company	Aircraft Model:	172P
Aircraft Registration:	VH-KTV	Serial Number:	17275504
Type of Operation:	Non-commercial, Pleasure/Travel		
Damage to Aircraft:	Substantial		
Departure Point:	Jandakot, WA	Departure Time:	1715 hours WST
Destination:	Jandakot, WA		

Crew Details:	Role	Class of Licence	Hours on Type	Hours Total
	Pilot-In-Command	Student/Passenger	10.1	74

2nd Aircraft Details

Aircraft Manufacturer:	TL Ultralight	Aircraft Model:	TL-2000
Aircraft Registration:	OK-GUU39	Serial Number:	
Type of Operation:	Non-commercial, Pleasure/Travel		
Damage to Aircraft:	Substantial		
Departure Point:	Bunbury, WA	Departure Time:	1630 hours WST
Destination:	Jandakot, WA		

Crew Details:	Role	Class of Licence	Hours on Type	Hours Total
	Pilot-In-Command	Foreign	6.0	380

Synopsis

A Cessna 172P (C172) aircraft, VH-KTV and a foreign registered TL Ultralight Sting aircraft, OK-GUU39, converged and collided at low altitude in the vicinity of the threshold of runway 24 right (24R) at Jandakot, WA. The occupants of both aircraft were uninjured. The TL Ultralight Sting (GUU39) was substantially damaged and the C172 sustained only minor damage.

The owner-pilot of GUU39 had imported the aircraft from Czechoslovakia and it was one of two aircraft (GUU38 and GUU39) that had recently been assembled at Jandakot. Both aircraft were being operated in accordance with special flight authorisations issued by the Australian Civil Aviation Safety Authority (CASA). The two aircraft had completed several flights in company during the days prior to the accident and were returning from Bunbury at the time of the collision. The owner-pilot was the sole occupant of GUU39.

The pilot of the C172 had hired the aircraft from a training organisation for the purpose of conducting a local flight to the training area with one passenger. The pilot was seated in the control seat on the left side of the cockpit. The C172 had joined the circuit from the training area at the time of the collision.

Jandakot tower was active until a short time before the collision and both aircraft conducted their arrival to the airport under General Aviation Aerodrome Procedures (GAAP). The GAAP control zone (CTR) was deactivated at the scheduled time of 1800 Western Standard Time (WST) and the aircraft were being operated under Mandatory Broadcast Zone (MBZ) procedures for the final stages of their flights. At the time of the collision a certified air-ground radio operator (CAGRO) was providing operational information to pilots. Although the CAGRO used the facilities of the control tower to provide this service, he was not providing an air traffic control service.

Sequence of events

Recorded information from primary radar returns, voice transmissions and information obtained during investigation interviews were used to compile the following sequence of events. Neither aircraft's transponder was transmitting encoded Mode C altitude information. Additional data was obtained from a global positioning system (GPS) receiver installed in GUU39. This GPS tracking data corresponded closely with the recorded primary radar information.

At about 1750, the pilot of GUU38 reported to the aerodrome controller (ADC) that GUU38 and GUU39 were at Shipyard, approximately 6 NM south-west of Jandakot at 1,500 ft and in receipt of terminal information Kilo, inbound. At about 1753, the pilot of GUU38 reported to the ADC that GUU38 and 39 were overhead Adventure World, approximately 3 NM west of Jandakot. The ADC instructed the crews to join left crosswind for runway 24R. This was to establish single-runway operations at the airport prior to the deactivation of the GAAP CTR at 1800 and accordingly, have aircraft in the zone complying with MBZ procedures when the airspace became non-controlled. A short time later the pilot of the C172 reported to the ADC that he was at

Six South, approximately 6 NM south-southeast of Jandakot at 1,500 ft with Kilo, inbound to the circuit area.

As GUU38 and GUU39 approached the airport, the ADC provided instructions to the pilot of GUU38 to assist with entry to the nominated circuit and instructions for sequencing with an aircraft operating on a left circuit pattern for runway 24R. At about 1755, the pilot of the C172 reported at Forrestdale Lake (a tracking point, approximately 3 NM south of Jandakot) and the controller instructed the pilot to join the circuit upwind at 1,500 ft for runway 24R.

After sequencing GUU38 and providing the pilot with additional instructions to assist with his entry to the circuit, the ADC instructed the pilot to descend to 1,000 ft due to opposite direction traffic. At about 1757, the pilot of GUU39 reported downwind and the controller advised him that he was number three in the landing sequence and confirmed that he was following GUU38 ahead. The controller also instructed the pilot of GUU39 to descend to 1,000 ft due to an aircraft overflying at 1,500 ft.

As the C172 approached the airport, the ADC amended the circuit entry instructions and instructed the pilot to make a left turn and join left downwind and to follow the aircraft mid-downwind. The controller then clarified the instruction and confirmed that the pilot was required to join the circuit on left downwind for runway 24R. Recorded radar data confirmed that the pilot made a left turn and joined the circuit as instructed.

At about 1758, the ADC issued a landing clearance to the pilot of GUU38. Recorded radar data indicates that the aircraft was about to turn onto final approach at the time this clearance was issued.

At about 1759, the pilot of the C172 reported downwind for a full-stop landing for runway 24R. The ADC advised him that the aircraft he was following was mid-base. The pilot replied with the aircraft's callsign and did not indicate to the ADC that he could not see the aircraft ahead. The recorded radar data confirmed the position of GUU39 on mid-base at this time, with GUU38 established on mid-final. The pilot of the C172 recalled seeing an aircraft that he assessed was turning onto final and identified it as the aircraft that he was assigned to follow. He recalled last seeing this aircraft about the time he made his base turn and noted that this aircraft was now on short final approach.

The last primary radar return from GUU38 was received at 1759:41, when the aircraft was approximately 150 m from the threshold of 24R and at a radar derived ground speed of about 45 kts. Twelve seconds later, the ADC commenced an all-stations broadcast, advising that the tower was closing and that MBZ procedures applied. During this transmission the ADC described the traffic disposition as `the aircraft on final GUU39, KTV is a Cessna just turning base, NMS is an Eagle on downwind and SRR to join upwind'. The controller also stated that the CAGRO was in attendance. Recorded radar data confirmed the position of GUU39 on long final approach (approximately 1.4 NM from the runway threshold and having just completed the turn from base), and the C172 on late downwind and about to turn base. During a post-accident interview the pilot of the C172 could not recall the specific aspects of this closing broadcast.

The pilot of the Eagle broadcast his position on downwind a short time after the tower closed and advised his intention to conduct a touch and go. The CAGRO responded to this broadcast and indicated that there was one aircraft ahead, although there were actually two aircraft ahead of the Eagle when this transmission was made. The pilot of the C172 could not recall the specific aspects of this transmission during a post-accident interview and could not recall such a transmission altering his perception of the traffic ahead of him in the landing sequence.

At about 1800:39, the CAGRO made a broadcast on the MBZ frequency (that was the same as the aerodrome control frequency) advising that the CAGRO service was operating, that he had copied all reported traffic and requested details from taxying aircraft. The pilot of an aircraft taxying for departure provided the CAGRO details of his intentions and the pilot of GUU38 reported that he had landed and was taxying for the southern hangars. The pilot of GUU38 subsequently recalled that he was well clear of the runway when he made that transmission, probably in the vicinity of the run-up bay on taxiway B5, about 250 m from the runway turn-off.

At about 1801:16, approximately 30 seconds before the collision, the pilot of GUU39 broadcast his position as, `All stations Jandakot, GUU39 late finals runway 24, full stop'. (The terms late final and short final are interchangeable.) This broadcast was additional to the mandatory radio calls required when operating in an MBZ. The CAGRO acknowledged this transmission and read back the aircraft callsign. The recorded radar data indicated that GUU39 was approximately 550 m from the threshold of runway 24R at this time and the track log from the aircraft's GPS indicated that the aircraft was approximately 100 ft above the elevation of the runway threshold. The pilot of the C172 recalled hearing the transmission and something about `late final', but found the call hard to understand due to static breaking through on his radio. He realised that he was also on late final approach and looked to see if there was another aircraft ahead. As he could not see another aircraft ahead he considered that it was safe to continue his approach to land. The pilot of the C172 did not broadcast his position on short final and such a broadcast was not mandatory. Radar data indicates that at this stage of the approach, GUU39 was 200 m ahead of and about 20 degrees to the right of the C172, relative to that aircraft's track. Both aircraft faded from radar coverage a short time later.

The pilot of GUU39 reported that he had just started the landing flare and estimated that he was about 10 – 15 ft above the runway, when the nose of his aircraft pitched violently upwards. The canopy above his head shattered and the aircraft's nose pitched down before striking the runway and skidding to a stop. It was not until he vacated the aircraft that he realised that he had been involved in a collision with another aircraft.

The pilot of the C172 recalled that the approach to land was normal and he had checked that the runway was clear. He was just about to commence his flare for landing when he heard a loud bang. He realised that he had collided with another aircraft and the two aircraft slid a short distance together along the runway before coming to a halt. He had not seen the other aircraft prior to the collision.

The collision occurred at about 1801:47 and corresponded with a significant reduction in groundspeed recorded on the GPS track log from GUU39. The propeller of the

C172 had struck the rear fuselage of GUU39 several times and had probably also shattered the cockpit canopy. There was no post impact fire.

Separation between aircraft during base and final approach

The recorded radar data indicated that as the pilot of the C172 turned base there was a lateral displacement of about 1 NM (1,850 m) between the two aircraft, with GUU39 established on long final approach in a relative position of about a 12 o'clock. Information recorded in the GPS track log from GUU39 indicated that at this time, it was at an altitude of about 650 ft, approximately 2,150 m from the threshold of runway 24R.

As the C172 turned onto final approach, the lateral displacement between the two aircraft was about 800 m. At the time the pilot of GUU39 broadcast his position on late final, the lateral displacement between the two aircraft had further reduced to about 200 m. The recorded radar data indicated that the two aircraft continued to converge, with the ground track of the C172 appearing to converge with GUU39 from the rear left quadrant.

The average groundspeed (radar derived, to the nearest 5 kts) of the C172 on the base leg of the circuit was calculated to be about 85 kts, 80 kts during early final and 60 kts on short final. The average groundspeed (radar derived, to the nearest 5 kts) of GUU39 on the base leg of the circuit was calculated to be about 75 kts. It was 50 kts during early final and 40 kts on short final.

Performance of aircraft on base and final approach

The pilot of GUU39 reported that the airspeed of his aircraft was about 90 kts as he turned base and that the speed was progressively reduced during the base leg. The final approach was flown at an airspeed of 60 kts with the aircraft configured with full flap.

The pilot of the C172 reported that the base leg of the circuit was flown at an airspeed of 70 kts and 65 kts on the final approach.

Meteorological and environmental information

The Jandakot Automatic Weather Station recorded a south-westerly surface wind of about 10 kts in the period leading up to the collision and visibility conditions were reported as being good. Last light at Jandakot was 1925 WST. At the time of the collision the sun was approximately 10 degrees above the western horizon and about 30 degrees to the right of the extended centreline for runway 24R.

Aircraft on final approach to runway 24R overflew a sand quarry and other areas of light-coloured terrain.

Colour scheme GUU39

The aircraft was predominantly white, with colour decals and stripes on the fuselage. The wingspan was about 8.5 m.

GUU39 pilot information

The pilot of GUU39 held a valid licence issued by the Czech Republic Light Aircraft Association. He also held an unrestricted cross-country certificate issued by the Australian Ultralight Federation and a restricted private pilot licence issued by CASA. He was entitled to operate the foreign registered GUU39 on the basis of his licence issued by the Czech Republic Light Aircraft Association.

C172 pilot information

The pilot of the C172 held a student pilot licence and had passed the general flying progress test. This permitted the student pilot to carry passengers during certain local flights. All flights conducted by a student pilot required the authorisation of a flying instructor. He held a CASA-issued Class 2 medical certificate, indicating that correction for distance vision was required. At the time of the accident, the pilot was wearing prescription contact lenses, together with polarised sunglasses.

Polarised sunglasses

Polarised sunglasses contain lenses that polarise the incoming light waves to the eye and reduce reflected glare from flat surfaces. Aviation literature identifies several limitations associated with the use of polarised lenses in aviation, including the potential for polaroid sunglasses to `mask the sparkle of light that reflects off shiny surfaces, such as another aircraft's wings or windscreen' (V. B. Nakagawara, R. W. Montgomery, K. J. Wood, Aviation Accidents and Incidents Associated With the Use of Ophthalmic Devices by Civilian Pilots, Civil Aviation Medicine Institute, Federal Aviation Authority DOT/FAA/AM-01/14 July 2001). The CASA Designated Aviation Medical Examiner's Handbook also states `Polarising sunglasses should not be used when flying. The polarising filter interacts with the cockpit transparency to produce a distorted and degraded visual field that poses a threat to air safety'.

Certified Air-Ground Radio Operator

The CAGRO operated each night, Monday to Friday, between 1800 and 2100 and provided pilots with basic operational information that may be relevant for aircraft operating at the airport. Although part of this service was to provide traffic information to pilots of aircraft operating inside the MBZ, it was not the responsibility of the CAGRO to continually monitor the relative position of aircraft or to use techniques to ensure that adequate separation was maintained between aircraft. The service did not provide any function associated with the provision of an air traffic control service and pilots remained responsible for all operations within the MBZ.

The CAGRO used the control tower facilities to provide the service. The operator on duty for the night of the accident had previously been employed as an air traffic controller by Airservices Australia (Airservices) and had extensive experience in control tower operations. He held a CASA-issued Air/Ground Radio Operator Certificate.

The CAGRO had commenced duty concurrently with deactivation of the GAAP CTR. He did not observe the two aircraft converging on final. A large concrete support

pillar could restrict the view of the airspace associated with the approach to runway 24R and may have obstructed the CAGRO's view of the two converging aircraft on short final approach.

Tower operating hours

Since May 1997 Airservices had reviewed staffing levels and tower operating hours at Jandakot. Similar reviews were also performed at other GAAP airports. The Jandakot reviews had resulted in the reduction of both tower operating hours and staffing levels.

In an attempt to make tower operations more cost effective, staffing levels were further reduced during December 1998 and resulted in a reduction of controller numbers from ten to seven. This reduction in staff numbers was facilitated by a reduction in tower operating hours and various procedural changes to the conduct of flight operations at Jandakot. Prior to implementing this change, Airservices conducted a review of airport traffic levels and prepared a safety case to assess the impact of the proposed changes. This safety case was submitted to CASA and no objection was raised to the proposal to reduce staffing levels and to reduce tower operating hours.

Following the reduction in tower operating hours there was a perception among local operators that operations had become less safe. These assessments were based on their perception that the traffic density sometimes reached levels that were unsuitable for MBZ operations and also that a significant number of aircraft were failing to comply with the published MBZ procedures.

In response to concerns from the local operators and to address an issue of some pilots failing to transmit the required information on the MBZ frequency, the airport operator trialed and then implemented a permanent CAGRO service during evening week days. Data collected during the operation of this service indicated that traffic density occasionally exceeded the upper limits used to define the risk for the purpose of the safety case prepared by Airservices to assess the acceptable levels of safety during MBZ operations.

Events post-collision

Following the collision the airport operator reviewed the ongoing provision of the CAGRO function and decided to discontinue the service.

Traffic complexity at time of collision

In the period leading up to the collision there was one aircraft conducting circuit operations. The two Ultralight Sting aircraft had joined the traffic pattern for a landing and were followed by the C172, also for a landing. At the time of the collision there were three aircraft in the circuit and another inbound aircraft joining the traffic pattern upwind. Several aircraft were taxying for departure. Of the three aircraft operating in the circuit, all were on the final leg when the collision occurred.

Analysis

The circumstances of the collision were consistent with the C172 converging on GUU39 from behind, principally as a consequence of the relative speed difference between the two aircraft during the final approach to land. Adequate lateral displacement of about 1 NM existed between the two aircraft when the C172 turned onto the base leg. Although the displacement between the two aircraft had further reduced to about 800 m at the time the C172 turned onto final approach, it was adequate for that stage of the approach.

The pilot of the C172 had not seen GUU39 prior to the collision and was unaware that another aircraft was ahead in the landing sequence. Prior to the closure of the tower, the ADC had correctly described the circuit traffic when issuing sequencing details to the pilot of the C172 and instructing him to follow the aircraft on mid-base. Although it was possible that the pilot of the C172 had sighted GUU38 and identified it as the traffic to follow, that aircraft was on mid-final approach and not mid-base as described by the controller.

The closing broadcast made by the ADC deactivated the control zone at the published time. The depiction of the location of aircraft provided by the controller appeared to be accurate and correctly described the relative positions of aircraft in the circuit. Although the investigation could not positively determine the position of GUU38 at the time the closing broadcast was made, based on its ground speed and last-recorded radar position, it was probable that the aircraft had reached the runway threshold at the time of the closing broadcast. The relative position and lateral displacement between GUU39 and the C172 at the time of the closing broadcast did not indicate at this stage that there was a conflict between the two aircraft.

It was probable that the pilot of the C172 had misidentified the traffic he was instructed to follow by the ADC during the initial sequencing to land. He recalled that he last sighted this aircraft as it was on short final approach to runway 24R. Because this aircraft was well ahead of him in the traffic pattern it would have been unlikely for him to consider this aircraft as traffic for his arrival. He was unaware of the second aircraft and its position relative to his aircraft. Had the pilot of the C172 correctly identified the aircraft he was instructed to follow, it would have been more likely that he would have assessed this as a possible conflict for his approach and landing and may have more closely monitored its position relative to his aircraft.

Although the CAGRO incorrectly reported the number of aircraft ahead in the landing sequence when responding to the downwind broadcast made by the pilot of the Eagle, the pilot of the C172 could not recall specific aspects of this transmission. It was not possible for the investigation to determine if this transmission had influenced his understanding of his position in the landing sequence.

It was not a requirement for the pilot of either aircraft to broadcast their position on final approach. The pilot of the C172 did hear the broadcast from the pilot of GUU39 while on short final approach, but found the transmission hard to understand and did not recognise that this transmission was from the pilot of another aircraft, also on short final approach. The pilot of the C172 did not broadcast his position on short

final approach and accordingly, the pilot of GUU39 ahead would have been unaware of the proximity of the C172. Although the pilot of the C172 did look to see if there was another aircraft ahead, he did not see the aircraft. The task of successfully detecting the other aircraft at that stage of the approach was made more difficult by the relative position between the two aircraft and his expectation that the aircraft ahead had already landed.

The investigation was unable to determine what role the use of polarised sunglasses may have played in the inability of the pilot of the C172 to see the aircraft ahead and while they were laterally displaced during final approach. The polarised lenses could have eliminated some of the reflected glare from the upper surfaces of GUU39's wings and reduced the probability of seeing the aircraft ahead.

As the lateral displacement reduced between the two aircraft, GUU39 could have become progressively harder to see due to the combination of the pilot's seating position in the left control seat of the C172 and the relative position of GUU39 on the right side of the C172's nose.

The lack of contrast between the light colour of GUU39 and the light coloured sandy terrain over which it flew also probably increased the difficulty for the pilot of the C172 to see the aircraft ahead.

The position of the sun on the western horizon may also have reduced the ability of the pilot of the C172 to see the aircraft ahead.

After the pilot of the C172 turned his aircraft onto the base leg of the circuit, a number of factors existed that could have increased the difficulty for him to successfully detect another aircraft that was ahead of him in the traffic pattern, but which had not previously been sighted. Therefore, the investigation concluded that the best opportunity for the pilot of the C172 to see and identify this aircraft was on the downwind leg, when the ADC provided the sequencing instructions. The successful completion of this task was probably prejudiced when the pilot of the C172 inadvertently sighted GUU38 on final approach.

The investigation did not consider that the density of traffic or complexity of operations within the Jandakot MBZ at the time of the accident were factors in the collision.

Significant Factor

1. The pilot of the C172 incorrectly identified the aircraft that he was instructed to follow and did not realise that there was another aircraft in the landing sequence ahead.
2. The pilot of the C172 did not sight GUU39 during his base and final approach. This task was made more difficult by a number of factors including the lack of contrast between GUU39 and the background terrain, the relative position between the two aircraft during the final stages of the approach and possibly the effects of sun glare. This was compounded by the pilot's perception that the aircraft ahead had already landed.

3. GUU39 and the C172 converged during final approach due to the relative difference in aircraft approach speeds.
4. The pilot of the C172 did not realise that the `late finals' broadcast was made by the pilot of GUU39, also on short final approach.

Safety Action

Following the withdrawal of the CAGRO service at Jandakot, Airservices Australia reviewed the safety case that had been prepared prior to reducing the hours of tower operation. This review accounted for the reported traffic levels at times when the CAGRO service was operating and resulted in a reassessment of risk. The review resulted in an increase of air traffic control staffing levels at Jandakot and a corresponding increase to the evening hours of weeknight tower operations. This change became effective in May 2002.