Australian Government
Australian Transport Safety Bureau

Collision with terrain involving Magni M16C Tandem Trainer gyroplane, G1850, while avoiding Extra EA 300L, VH-IOG

Lake Macquarie Airport, New South Wales on 12 May 2023

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Addendum

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Executive summary

What happened

On 12 May 2023, an instructor and student pilot in a Magni M16C Tandem Trainer gyroplane, registered G1850, were conducting wheel balance exercises on runway 07 at Lake Macquarie Airport, New South Wales. Following the sixth of these exercises, the student made a radio broadcast while the instructor turned the gyroplane around and taxied on the runway toward the runway 07 threshold at the western end to repeat the exercise. Meanwhile, the pilot of an Extra EA 300L, registered VH-IOG, taxied from the apron for a scenic flight with one passenger. The Extra pilot made 2 radio broadcasts before entering the runway near the eastern end and taxied towards the runway 07 threshold. At about this time, the gyroplane commenced another exercise and accelerated down runway 07 towards the Extra. As the gyroplane approached the runway midpoint, the instructor and student observed the Extra about 20 m ahead. The instructor manoeuvred to avoid a collision, banking right before colliding with terrain resulting in substantial damage to the gyroplane. The instructor was seriously injured, with the student sustaining minor injuries. The Extra was not damaged, and its occupants were uninjured.

What the ATSB found

The ATSB found that neither aircraft's pilots heard each other's radio broadcasts and consequently, aircraft separation became reliant solely upon visual acquisition. The investigation found that the Extra pilot did not see the gyroplane before entering the runway, and subsequently taxied towards it. Also, while accelerating on the runway, the instructor and student in the gyroplane did not see the Extra taxiing towards them until a collision was imminent.

There were several factors that likely reduced the ability of the pilots to identify each other, including the small angular size of each aircraft, the complex background features with low relative contrast, and minimal relative movement between the aircraft.

Additionally, the tailwheel configuration of the Extra limited the pilot's forward visibility and sun glare likely also affected the pilot's ability to detect the gyroplane. The gyroplane pilots were likely also influenced by the higher workload associated with the training exercise which probably reduced their available attention for identifying conflicting aircraft.

What has been done as a result

The airport operator released a bulletin to all operators based at Lake Macquarie Airport highlighting the importance of a visual lookout in addition to radio discipline. A runway hold point line was repainted, and radio recording equipment will be purchased to allow radio communications to be periodically reviewed.

The operator of VH-IOG updated operational procedures to require a ground employee to have a hand-held radio switched on and in reach for all operations, and to monitor all departure and arrival radio calls. Pilots are now also required to stop at a hold point line before entering the runway for departure at Lake Macquarie Airport.

The Australian Sport and Rotorcraft Association (ASRA) advised the ATSB of its intent to replace the one-off human factors exam, completed as a requirement of the ASRA pilot certificate, with a recurrent exam, to be completed as part of each biennial flight review.

Safety message

The ATSB SafetyWatch highlights the broad safety concerns that come out of our investigation findings and from the occurrence data reported to us by industry. One of the safety concerns is reducing the collision risk around non-towered airports. This accident highlights the limitations of unalerted see-and-avoid in such an environment. Pilots are reminded of the importance of effective radio communications to increase traffic awareness and to ensure an effective visual scan to identify conflicting traffic.

The investigation

Decisions regarding the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation and the associated resources required. For this occurrence, a limited-scope investigation was conducted in order to produce a short investigation report, and allow for greater industry awareness of findings that affect safety and potential learning opportunities.

The occurrence

On the afternoon of 12 May 2023, an instructor and student pilot in a Magni M16C Tandem Trainer gyroplane, registered G1850 and operated by Airborne Flight Training, were planning to conduct wheel balance training exercises (see the section titled *Operational information*) at Lake Macquarie Airport, New South Wales. The airport was located within class G, non-controlled airspace and had a designated common traffic advisory frequency (CTAF) on which pilots made positional broadcasts to coordinate aircraft separation.

At about 1537, the student and instructor pilots, seated in the front and rear seats respectively, taxied the gyroplane onto the runway near the runway 25[1] threshold and then backtracked[2] towards the runway 07 threshold (Figure 1) to commence the wheel balance training. The training exercise involved the student accelerating the gyroplane on the runway while balancing on the main landing gear until the gyroplane lifted off the ground briefly. The student then handed control to the instructor who would land on the runway, turn the gyroplane around and backtrack towards the 07 threshold before handing control back to the student and repeating the exercise.

At about 1542, the student pilot reported making a ‘rolling' radio call on the CTAF to indicate they were commencing the first wheel balance exercise. About 30 seconds later, after accelerating along the runway and briefly becoming airborne, the gyroplane landed about half-way down runway 07 and turned around. During this turn, the student reported making another radio call to indicate they were backtracking towards the runway 07 threshold.

At about 1543, the pilot of an Extra EA 300L, registered VH-IOG and operated by Inverted Downunder, walked towards the aircraft, which was located on the airport apron near the eastern end of the runway, to prepare for a scenic flight with one passenger. This was to be the pilot’s fifth flight of the day in the Extra.

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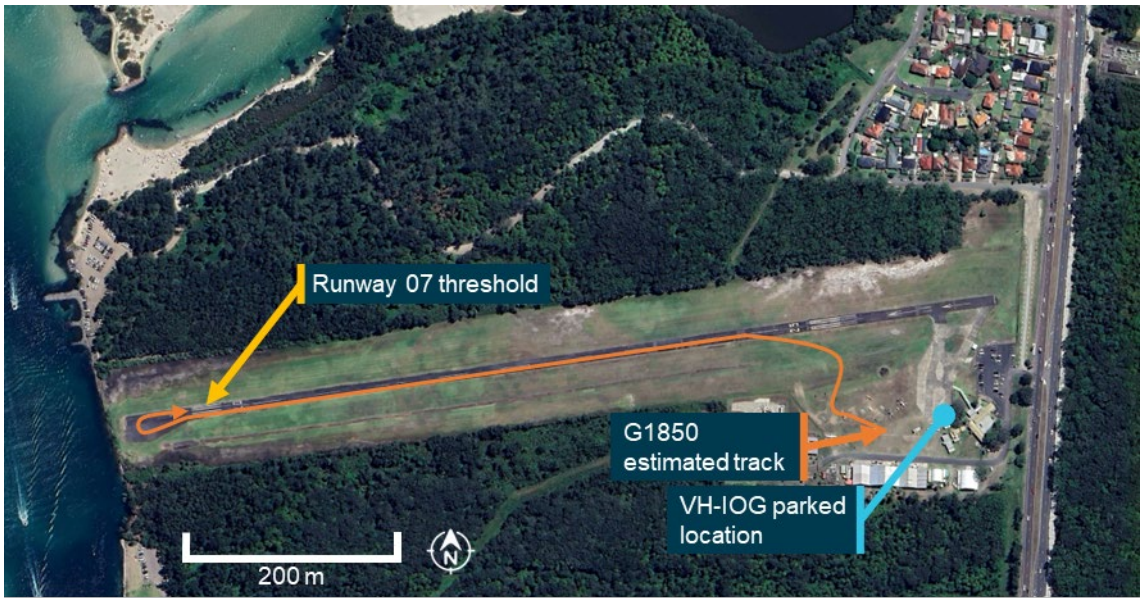
1 Runway numbers represent the magnetic heading closest to the runway orientation (for example, runway 25 is oriented 250° magnetic while the reciprocal runway 07 is oriented 070º magnetic).

2 An airport ground procedure which involves the use of any portion of a runway as a taxiway for an aircraft to taxi in the opposite direction from which it will take off or has landed.

Figure 1: Lake Macquarie Airport showing G1850 estimated ground track and VH-IOG location

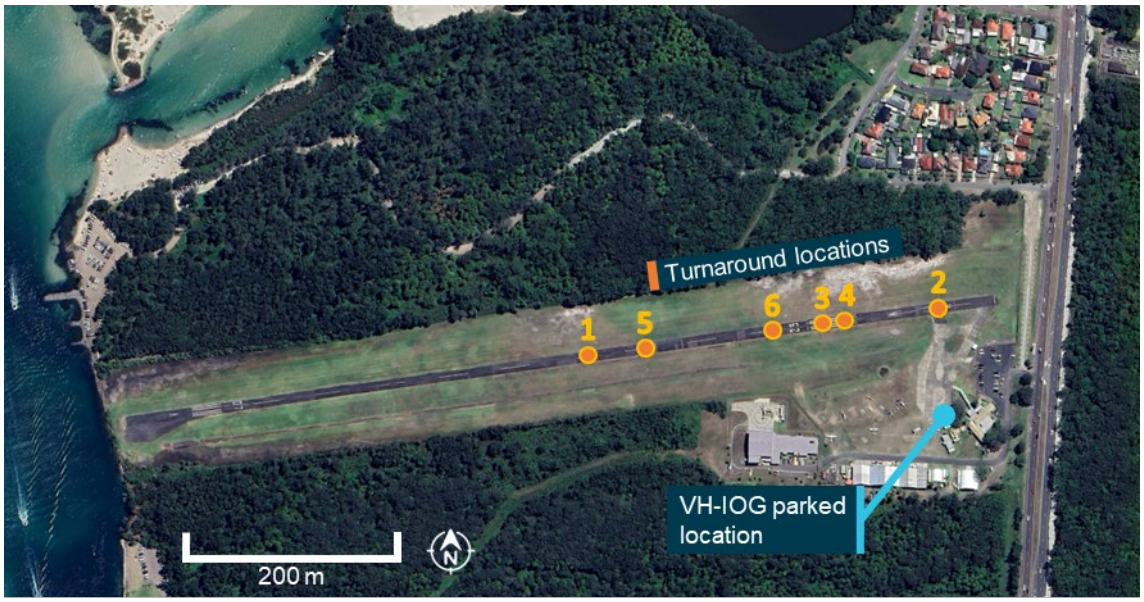


G1850 track estimated using CCTV footage and pilot statements. VH-IOG location based on CCTV footage.
Source: Google Earth, annotated by ATSB

At about 1544, the gyroplane's student pilot commenced a second wheel balance exercise from the runway 07 threshold. While the gyroplane was undertaking this exercise, airport video footage showed that the pilot of the Extra stepped onto the parked aircraft's wing to prepare the front seat for the passenger. By about 1545, the gyroplane had travelled towards the end of runway 07, adjacent to the apron area and was slowing down to turn around (Figure 2). The student recalled that during the turn, a backtracking radio call was made. At about the same time, the video footage showed the Extra's pilot, who was still on the wing, appear to look up for about a second toward the gyroplane. Shortly after, the passenger climbed into the front seat of the Extra, while the gyroplane backtracked towards the runway 07 threshold.

Over the next 8 minutes, the Extra's pilot secured the passenger in their seat, provided a pre-flight briefing, and then climbed into the rear seat, putting their seatbelt and helmet on. During this time, the instructor and student pilot performed a further 4 wheel balance exercises, with the gyroplane turning around at different locations along the runway (Figure 2), but none as far as during the second wheel balance exercise (near the airport apron). The student pilot and instructor recalled radio calls being made prior to the commencement of, and during the turnaround at the end of, each wheel balance exercise.

Figure 2: G1850 turnaround locations



Source: Google Earth, annotated by ATSB

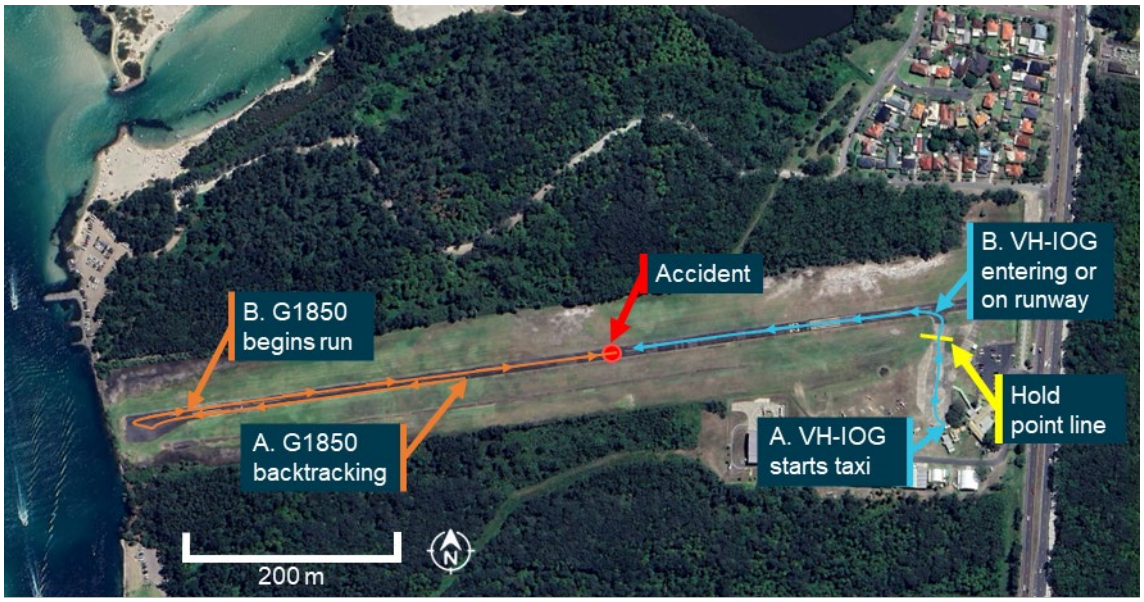
At 1554:05, a few seconds after turning around following the sixth wheel balance exercise, the Extra's pilot started the aircraft's engine and conducted pre-flight checks which included switching on the aircraft's radios.

At 1554:39, the Extra's pilot began to taxi towards the runway while the gyroplane was backtracking along runway 07. At about 1554:53, the Extra's pilot reported making a radio call on the CTAF that the aircraft was taxiing for runway 07.

At about 1555:09, and for about the next 10 seconds while taxiing, the Extra pilot reported visually looking for aircraft on final approach for runways 25 and 07, and for aircraft on the runway. The pilot recalled that most of their attention during this visual lookout was towards the 'bad lighting' at the runway 07 threshold and they recalled not seeing any aircraft. During this time, the Extra pilot made another radio call advising they were entering and backtracking runway 07. Shortly after, the aircraft crossed the hold point line without stopping and turned left onto the runway (Figure 3). The pilot stated that they did not usually stop at this line because they had unobstructed views towards the runway 07 threshold and final approach to runway 25 before this point. At a similar time, the student commenced the seventh wheel balance exercise from the runway 07 threshold. Both gyroplane pilots recalled that they did not see any aircraft on the runway at this time, nor could they recall making a 'rolling' radio call prior to this exercise.

As the Extra backtracked runway 07, the student was accelerating the gyroplane along the runway. About 30 seconds later, as the gyroplane approached the midpoint of the runway, the instructor and student observed the Extra about 20 m ahead and backtracking towards them. The instructor took control and banked the gyroplane right to avoid a collision. The rotor blades impacted the runway surface before the gyroplane veered off the runway and collided with terrain, coming to rest on its side. The gyroplane sustained substantial damage to the rotor blades, propeller blades, and landing gear. The instructor was seriously injured, with the student sustaining minor injuries. The Extra pilot saw the gyroplane veer off the runway to the left, stopped their aircraft and exited to provide assistance. The Extra was not damaged and its occupants were uninjured.

Figure 3: G1850 and VH-IOG ground tracks before accident



Labels 'A' and 'B' are timestamps for the approximate locations of each aircraft.
Source: Google Earth, annotated by ATSB

Context

Pilot information

G1850 pilots

The instructor pilot held an Australian Sport Rotorcraft Association (ASRA)[3] pilot certificate and was approved by ASRA as a chief flying instructor (CFI). They had accrued 2,254 hours of flying time in gyroplanes and about 751 hours on the Magni M16 and Magni M16C Tandem Trainer gyroplane, with 43 of those hours flown in the previous 90 days.

The student held an ASRA pilot certificate and a Private Pilot Licence (aeroplane). The student had accrued about 330 hours of flying time in aeroplanes, and 60 hours in gyroplanes, 10 of which were on the Magni M16C Tandem Trainer gyroplane in the previous 90 days.

VH-IOG

The Extra pilot held a Civil Aviation Safety Authority (CASA) Commercial Pilot Licence (Aeroplane). They had accrued 7,800 hours of flying time, with about 600 hours on the Extra EA 300L, of which 18.5 hours were flown within the previous 90 days.

Aircraft information

G1850

The Magni M16C Tandem Trainer is a 2-seat gyroplane with fixed tricycle landing gear (Figure 4). A 4-cylinder piston engine drives a 3-bladed pusher propeller, with an unpowered rotor to develop lift. The gyroplane has a pre-rotation system linking the engine to the rotor which, when engaged, can drive the rotor to start it spinning without needing forward motion.

[3] ASRA is a national sport and recreational association, representing people with an interest in building and flying gyroplanes. Under Civil Aviation Safety Authority (CASA) accreditation, ASRA administers sport gyroplanes through the certification of pilots and the listing of gyroplanes in Australia.

The Magni M16C is 4.7 m long, 2.7 m high (fuselage about 1.5 m high), and 1.8 m wide, with a rotor diameter of about 8.5 m. An external landing light was fitted to the front of the fuselage with strobe lights fitted to each side of the fuselage and one on the rear of the mast.

The front seat was instrumented for the pilot in command and was occupied by the student. The rear seat was not fitted with instrumentation but had flight controls, and was slightly higher than the front seat to improve forward visibility. Both seats were fitted with 4-point harnesses and both pilots were wearing them at the time of the accident.

Figure 4: G1850

Source: Airborne Flight Training

VH-IOG

The Extra EA 300L is a low-wing, 2-seat aerobatic monoplane with fixed tailwheel landing gear and the rear seat was instrumented for the pilot in command. A 6-cylinder piston engine drives a 3-bladed tractor propeller. VH-IOG was manufactured in Germany in 1999 and first registered in Australia in June 2005 (Figure 5).

The aircraft is about 7 m in length and 1.8 m high while on the ground with a wheel track of 1.8 m and a wingspan of 8 m. External navigation and strobe lights were fitted to the wingtips.

Figure 5: VH-IOG

Source: Inverted Downunder

Operational information

The gyroplane instructor planned for the student to perform several wheel balance exercises to teach the student the correct pitch attitude for take-off, and the exercise included many similar

aspects of a normal take-off. The United States Federal Aviation Administration (FAA) Rotorcraft Flying Handbook[4] described a normal gyroplane take-off as follows:

> The normal takeoff for most amateur-built gyroplanes is accomplished by prerotating to sufficient rotor r.p.m. to prevent blade flapping and tilting the rotor back with cyclic control. Using a speed of 20 to 30 m.p.h., allow the rotor to accelerate and begin producing lift. As lift increases, move the cyclic forward to decrease the pitch angle on the rotor disc. When appreciable lift is being produced, the nose of the aircraft rises, and you can feel an increase in drag. Using coordinated throttle and flight control inputs, balance the gyroplane on the main gear without the nose wheel or tail wheel in contact with the surface. At this point, smoothly increase power to full thrust and hold the nose at takeoff attitude with cyclic pressure. The gyroplane will lift off at or near the minimum power required speed for the aircraft.

The instructor stated that if the student obtained the correct pitch attitude, the gyro would lift-off briefly, before the instructor would take control and land on the runway, turn around, backtrack towards the runway 07 threshold, and repeat.

The instructor also stated that during the acceleration phase of the wheel balance exercise, the workload was high due to the multi-tasking required in monitoring the gyroplane's attitude, the student's flight control inputs, and the gyroplane's response.

The student stated that during the acceleration phase of each wheel balance exercise, they glanced down occasionally to look at the cockpit instrumentation, but their focus was primarily on looking out of the aircraft and monitoring the gyroplane's pitch attitude.

Meteorological information

The weather at Lake Macquarie Airport at the time of the accident was good with a light easterly wind, visibility greater than 10 km, and no cloud over the airport.

At the time the Extra's pilot was taxiing towards the runway from the apron (heading north), the sun was positioned at about the 10 o'clock (300°) position,[5] at an elevation of about 12°. This would have placed the sun in the pilot's field of view while looking towards the runway 07 threshold (Figure 6). It is likely that the gyroplane would have been illuminated by the sun at this time. The Extra pilot stated that as there was a light wind, a take-off from runway 07 was preferable since the sun was getting low in the west making it difficult to look in that direction. The pilot stated that they were wearing a tinted helmet visor, which would have reduced sun glare.

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[4] FAA Rotorcraft Flying Handbook – Chapter 20: Gyroplane Flight Operations.

[5] O'clock: the clock code is used to denote the direction of an aircraft or surface feature relative to the current heading of the observer's aircraft, expressed in terms of position on an analogue clock face. For example, twelve o'clock is ahead while an aircraft observed abeam to the left would be said to be at 9 o'clock.

Figure 6: VH-IOG turning left to backtrack runway 07

Source: Airport operator

While the gyroplane was accelerating towards the Extra on runway 07 during the seventh and final wheel balance exercise, the sun was positioned behind the gyroplane at about the 8 o'clock position. The Extra was likely illuminated by the sun while backtracking along the runway towards the gyroplane.

Airport information and procedures

Lake Macquarie Airport was an aircraft landing area,[6] located about 20 km southwest of Newcastle, New South Wales. It had an elevation of 5 ft above mean sea level, and a single, sealed 880 m long and 11 m wide runway designated 07/25, with trees lining each side.

As a non-controlled airport, separation between aircraft was maintained by 'alerted see-and-avoid' principles guided by Civil Aviation Safety Authority (CASA) advisory circulars[7]. Unalerted see-and-avoid relies on a pilot or crew visually detecting other aircraft without the assistance of other aids or information. This visual detection can be improved through pilots being alerted to an aircraft's presence by radio, electronic systems, or other means (alerted see-and-avoid).

At Lake Macquarie Airport, the carriage and use of a radio was required by the airport operator for all operating aircraft. Pilots were required to broadcast their position and intention so that nearby traffic would have an awareness of their aircraft and be able to plan or act accordingly.

All 3 pilots were familiar with the airport operations and had operated at Lake Macquarie for many years. Both aircraft were on the correct CTAF frequency before the accident, with all pilots having 2-way communications with other aircraft. None of the pilots reported hearing the other aircraft's radio calls. The gyroplane pilots could not recall whether they had made a rolling call at the start of the final wheel balance exercise.

The Extra pilot reported that once they had taxied clear of the apron toward the hold point line, there was nothing obstructing their view of the runway 07 threshold other than the lighting

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[6] An aircraft landing area is an airfield that has not been certified by CASA. These airfields are non-controlled, unregulated facilities. It is the responsibility of pilots and operators to determine whether these airfields are suitable for use.

[7] CASA AC 91-10 Operations in the vicinity of non-controlled aerodromes, and AC 91-14 Pilots' responsibility for collision avoidance.

conditions. The gyroplane instructor similarly reported no limitations with visibility of the entire runway when viewed from the runway 07 threshold.

The Extra pilot stated that there had been historically poor radio usage at the airport, and that they needed to use visual lookout 'aggressively' and not rely on radio communications. The gyroplane instructor considered radio to be a secondary means of collision avoidance to visual lookout.

Limitations of see-and-avoid

The see-and-avoid principle has been an effective defence in preventing aircraft collisions, but has several limitations (ATSB, 1991).

Workload

See-and-avoid can only be effective when the pilot is looking outside the cockpit. However, many tasks require pilots to direct their attention inside the aircraft, particularly when conducting operations and tasks that involve a high workload.

There was an opportunity for the Extra pilot to become aware of the gyroplane while they were on the Extra's wing preparing the passenger's seat, when they looked up briefly toward the gyroplane turning around on the runway. However, the Extra's pilot recalled being unaware of any other operations being conducted at the airport while on the apron preparing the passenger for the flight. It is possible that the pilot's focus on preparing the aircraft and passenger for flight resulted in them not detecting the gyroplane despite appearing to look towards it.

Although the Extra had occupied the runway for about 30 seconds before the gyroplane pilots saw the aircraft, the gyroplane pilots' focus on other traffic in the runway environment was probably limited due to the complex training exercise being conducted. The instructor and student's attention was primarily focused on the gyroplane's motion and attitude to ensure the exercise was being conducted appropriately.

Visual search

In daylight, a pilot must look almost directly at an object to see it and it is possible for a pilot to look past an object if they do not see it directly. An FAA advisory circular recommended scanning the entire visual field outside the cockpit with eye movements of 10 degrees or less, with about a second spent on each 10 degree sector, to ensure effective detection of conflicting traffic.[8]

It was estimated that the Extra pilot would have spent about 10 seconds on their visual lookout which included viewing both ends of the runway and associated approaches. While the Extra's pilot was approaching the runway from the apron, the runway 07 environment would have been captured in a sector about 30 degrees horizontal by 10 degrees vertical. This suggests that the Extra pilot would have required at least 3 seconds for an effective visual scan of the runway (without accounting for any other factors). While the pilot probably spent at least that length of time viewing the runway 07 environment, there were other factors that likely affected their visual scan and their ability to detect the gyroplane in that time.

Cockpit visibility

Items such as window pillars, sun visors, and front seat occupants may impact on the pilot's ability to see an aircraft. The FAA Airplane Flying Handbook[9] described the reduced forward visibility of tailwheel aircraft:

> In the normal nose-high attitude, the engine cowling may be high enough to restrict the pilot's vision of the area directly ahead of the airplane while on the ground. Consequently, objects directly ahead are difficult, if not impossible to see...In taxiing such an airplane, the pilot should alternately turn the nose

[8] FAA AC 90-48E Pilots' Role in Collision Avoidance.

[9] FAA Airplane Flying Handbook – Chapter 14: Transition to Tailwheel Airplanes.

> from one side to the other (zigzag) or make a series of short S-turns. This should be done slowly, smoothly, positively, and cautiously.

The pilot reported that the Extra EA 300L had limited visibility from inside the cockpit between 11-1 o'clock directions while on the ground. Their usual procedure at Lake Macquarie Airport was to undertake a 'zig-zag' manoeuvre at the half-way point of the runway to allow them to see the runway environment and ensure the final approach was clear of traffic. The manoeuvre was only performed once as the narrow runway required the aircraft to slow down significantly. On this occasion, the accident occurred before the Extra had reached the half-way point on the runway.

Threshold for acuity

The eye's ability to recognise an object also depends on the relative size of the object and an approaching aircraft might be too small to be seen. Studies have estimated the size an object needs to be for it to be sighted, with estimations of visual angle varying from about 0.02° to detect features of an alphabet letter (Howett, 1983), to at least 0.2° (NTSB, 1988) to reasonably detect an overall object. However, visual acuity varies widely across the retina of the eye and therefore, these values are only of relevance when looking directly at an object. Additionally, these observations were conducted under certain conditions, for example high object contrast with the background and moderate illumination (Howett, 1983), while the particular conditions experienced by the pilots involved in this occurrence were likely different.

With the Extra's pilot at the hold point line and the gyroplane at the runway 07 threshold lined up with the runway, the estimated angular size of the gyroplane's fuselage including landing gear would have been between 0.11° (height) and 0.14° (width). If the gyroplane pilots were at the runway 07 threshold and looked towards the runway 25 end with the Extra facing them on the runway, the estimated angular size of the Extra's fuselage would have been about 0.14° (height and width). While the angular size of the Extra's wingspan and the gyroplane's rotor would be larger, these were both thin making them difficult to detect at such a distance compared to each aircraft's fuselage.

Background features

Detecting an aircraft can become more difficult against a complex background that has different colours, contours, and objects. Aircraft are more easily spotted if they have a high contrast with their background. Images taken from around the midpoint on the runway about 20 minutes after the accident (Figure 7) provided some indication of the background features present at the time of the accident:

- The background behind the runway 07 threshold end had some small dark areas of shrub where the gyroplane's white fuselage illuminated by the sun would have provided good contrast. However, the fuselage and background area covered by the shrub were small, and the light blue of the lake, and lighter terrain areas covered with haze in the distance, would have a presented a lower contrast difference with the white fuselage.
- Behind the runway 25 threshold was a highway at the same elevation as the runway, which video footage showed was busy with traffic around the time of the occurrence, with trees illuminated by the sun behind the highway. Although the Extra's yellow nose and spinner would have been illuminated by the sun during the wheel balance exercise, the background behind the Extra had the sideways motion of traffic at the same level as the Extra creating a more complex scene. In addition, the trees in the background were also illuminated by the sun potentially reducing the contrast of the nose and spinner as the Extra moved closer to the gyroplane.

Figure 7: background features at runway ends

Source: Inverted Downunder

Other factors affecting visibility

In regard to aircraft lighting, research has shown that lights are generally ineffective in daylight at making an aircraft more visible, especially against bright sky backgrounds and can be less conspicuous than the aircraft itself, but may make aircraft more visible against terrain or in conditions of low light. The Extra's strobe lights were off while the aircraft was backtracking runway 07. The gyroplane strobe lights were on at the time of the accident and the landing light was off.

Glare occurs when unwanted light enters the eye. Glare can come directly from the light source or can take the form of veiling glare, reflected from crazing or dirt on the windscreen. The Extra's pilot reported that the cockpit canopy was cleaned between flights and had some scratches as it was the original canopy fitted from manufacture. Although the pilot was wearing a sun visor to reduce glare, the sun would have been in the pilot's field of view while looking towards the runway 07 threshold before entering the runway. The associated glare, which may have been exacerbated by the cockpit canopy, would have probably reduced the pilot's ability to detect the gyroplane.

Additionally, it is difficult to see another aircraft when there is little relative motion between one aircraft and the other, such as when they are moving towards the same location in space. There was little relative movement between the 2 aircraft while (a) the gyroplane pilots were accelerating towards the backtracking Extra and (b) the gyroplane was positioned near the runway 07 threshold while the Extra pilot was visually looking towards that location before turning onto the runway.

Recorded data

Airport video footage from several locations captured the Extra pilot's pre-flight activities, taxi, and backtrack towards the runway 07 threshold. The footage also showed segments of the gyroplane's wheel balance exercises when in view from around the middle of the runway towards the runway 25 threshold. Footage of the runway 07 threshold up to the runway midpoint was not captured by any available video camera.

CTAF radio broadcasts were not recorded at Lake Macquarie Airport. Of the airports that operated on the same CTAF, Warnervale Airport (28 km south-west of Lake Macquarie Airport) was the only airport that recorded radio transmissions. Due to distance and line-of-sight limitations, radio calls on or near the ground at Lake Macquarie were not normally received at Warnervale Airport. The ATSB reviewed recorded radio calls from Warnervale while both the Extra and gyroplane were operating at Lake Macquarie Airport, however, no radio calls from either aircraft were recorded. No recorded data was available from either aircraft.

Safety analysis

Radio alerting

The gyroplane student pilot recalled making backtracking radio calls when turning around at the end of every wheel balancing exercise. However, the final backtracking call was made before the Extra pilot had turned the aircraft's radio on, and therefore, they would not have heard this radio call. Additionally, the gyroplane pilots could not recall making a rolling call at the commencement of the final wheel balancing exercise prior to the accident, and there were no other sources of evidence to assist in establishing whether this call was made. In any event, the Extra pilot reported that they did not hear any call.

The Extra pilot reported making 2 radio calls before entering the runway. However, for reasons that could not be determined, the gyroplane pilots reported that they did not hear these calls. Consequently, neither aircraft's pilots were alerted to the other's presence over the radio and therefore, aircraft separation became solely reliant on each aircraft's pilots seeing each other.

Visual search

The gyroplane was operating on the runway for about 11 minutes while the Extra pilot was on the apron preparing for the flight. During this time, the gyroplane was primarily on an area of the runway some distance from the pilot and not directly in sight, limiting the Extra pilot's ability to detect it during this time.

The Extra pilot did not sight the gyroplane before entering the runway. The gyroplane pilots also did not sight the Extra at the start of their seventh and final wheel balance exercise, or while accelerating on the runway until a collision was imminent. While the reasons for this could not be determined, there were likely many common factors that reduced the ability of the pilots to identify each other such as the small angular size of each aircraft, the complex and cluttered background with reduced contrast difference, and the minimal relative movement between each aircraft.

The effectiveness of the Extra pilot's visual scan was likely also affected by sun glare before entering the runway, and the tailwheel configuration of the aircraft which limited forward visibility while backtracking. The gyroplane pilots were likely also influenced by the higher workload associated with the training exercise, which probably reduced their available attention for identifying conflicting aircraft.

Findings

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

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

From the evidence available, the following findings are made with respect to the collision with terrain involving Magni M16C Tandem Trainer gyroplane, G1850, while avoiding Extra EA 300L, VH-IOG.

Contributing factors

- Before entering the runway, the pilot of VH-IOG did not see G1850 occupying the runway and subsequently backtracked towards G1850. As VH-IOG was a tailwheel aircraft, the pilot was unable to sight G1850 while backtracking.
- While accelerating on the runway, the instructor and student in G1850 did not see VH-IOG backtracking towards them until a collision was imminent. While manoeuvring to avoid a collision, G1850 collided with terrain.

Safety actions

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Safety action by Lake Macquarie Airport

In May 2023, the airport operator released a bulletin reminding all operators based at Lake Macquarie Airport of several aspects of safe operational practice highlighted by this event, including that:

- aircraft should stop forward motion at the hold point line (or equivalent for helicopters) to ensure a good lookout prior to entering the runway environment
- pilots are to ensure they know and use correct radio terminology while operating at the airport and to broadcast their intentions
- although radio discipline was required, it cannot be relied upon for safety, and that the visual lookout was paramount
- for operations involving a backtrack for runway 07, aircraft should turn through 90° in the turning node at the far end, stop to lookout, then broadcast a radio call on lining up
- the runway should only be occupied for the minimum time required to either taxi, take off, or land.

The airport operator also advised that:

- the hold point line at the apron end of the runway (near the runway 25 threshold) had been repainted and a hold line also painted at the runway 07 end
- CTAF radio recording equipment was purchased and anticipated to be installed in February 2024. This will ensure all communications can be reviewed periodically, and in the event of an incident.

Safety action by Inverted Downunder

The operator of VH-IOG advised the ATSB that operational procedures were updated to include requirements for:

- a ground employee to have a hand-held radio, switched on and in reach for all operations, and to monitor any departure and arrival radio calls
- pilots to stop at the hold point before entering the runway for departures.

Safety action by Australian Sport Rotorcraft Association

The Australian Sport Rotorcraft Association (ASRA) advised the ATSB that, in response to this accident and other previous sport rotorcraft accidents, ASRA intends to replace the one-off human factors exam, which is completed as a requirement of the ASRA pilot certificate, with an updated exam to be completed recurrently as part of each biennial flight review.

General details

Occurrence details

Date and time:	12 May 2023 15:56 Eastern Standard Time	
Occurrence class:	Accident	
Occurrence categories:	Runway incursion, Collision with terrain, Near collision	
Location:	Lake Macquarie Airport, New South Wales	
	Latitude: 33.0658° S	Longitude: 151.6473° E

Aircraft 1 details

Manufacturer and model:	Magni M16C Tandem Trainer	
Registration:	G1850	
Operator:	Airborne Flight Training	
Type of operation:	Part 103 Sport and recreational aircraft-Australian Sport Rotorcraft Association (ASRA)	
Activity:	General aviation / Recreational-Instructional flying-Instructional flying - dual	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 1 serious, 1 minor	Passengers – 0
Aircraft damage:	Substantial	

Aircraft 2 details

Manufacturer and model:	Extra EA 300L	
Registration:	VH-IOG	
Operator:	Inverted Downunder	
Serial number:	100	
Type of operation:	Part 135 Australian air transport operations - Smaller aeroplanes-Standard Part 135	
Activity:	Commercial air transport-Non-scheduled-Joy flights / sightseeing charters	
Persons on board:	Crew – 1	Passengers – 1
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	None	

Sources and submissions

Sources of information

The sources of information during the investigation included the:

- pilot and passenger of the VH-IOG
- instructor and student of G1850
- VH-IOG operator photos
- New South Wales Police Force photos
- CCTV footage from Lake Macquarie Airport and Westpac Rescue Helicopter Service

References

Australian Transport Safety Bureau (1991), *Limitations of the See-and-Avoid Principle*.

CASA (Civil Aviation Safety Authority (2021), *Operations in the vicinity of non-controlled aerodromes*, AC 91-10v1.1.

CASA (Civil Aviation Safety Authority (2021), *Pilots' responsibility for collision avoidance*, AC 91-14v1.0.

FAA (Federal Aviation Administration) (2021), *Airplane Flying Handbook*, FAA-H-8083-3C, United States.

FAA (Federal Aviation Administration) (2000), *Rotorcraft Flying Handbook*, FAA-H-8083-21, United States.

FAA (Federal Aviation Administration) (2022), *Pilots' Role in Collision Avoidance*, Advisory Circular 90-48E, United States.

Howett, G. L. (1983), *Size of letters required for visibility as a function of viewing distance and observer visual acuity* (National Bureau of Standards Technical Note 1180).

National Transport Safety Board (1988), *Aircraft Accident Report - Midair Collision of Skywest airlines Swearingen Metro II, N163SW, and Mooney M20, N6485U, Kearns, Utah, January 15, 1987*.

Submissions

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

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

- Pilot of VH-IOG
- instructor and student of G1850
- operators of VH-IOG and G1850
- Lake Macquarie Airport
- the Australian Sport Rotorcraft Association (ASRA)
- the Civil Aviation Safety Authority (CASA).

Submissions were received from:

- instructor and student of G1850
- operator of G1850.

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

Australian Transport Safety Bureau

About the ATSB

The ATSB is an independent Commonwealth Government statutory agency. It is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers.

The ATSB's purpose is to improve the safety of, and public confidence in, aviation, rail and marine transport through:

- independent investigation of transport accidents and other safety occurrences
- safety data recording, analysis and research
- fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia, as well as participating in overseas investigations involving Australian-registered aircraft and ships. It prioritises investigations that have the potential to deliver the greatest public benefit through improvements to transport safety.

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

Purpose of safety investigations

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

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

It is not a function of the ATSB to apportion blame or provide a means for determining liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner. The ATSB does not investigate for the purpose of taking administrative, regulatory or criminal action.

Terminology

An explanation of terminology used in ATSB investigation reports is available on the ATSB website. This includes terms such as occurrence, contributing factor, other factor that increased risk, and safety issue.