Australian Government
Australian Transport Safety Bureau

ATSB TRANSPORT SAFETY REPORT
Aviation Occurrence Investigation – AO-2009-005
Final

Midair collision – Parafield Airport, SA
7 February 2009
VH-TGM
Grob - Burkhaart Flugzeugbau G-115 Grob
VH-YTG
S.O.C.A.T.A.-Groupe Aerospatiale TB-10 Tobago

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Midair collision – Parafield Airport, SA – 7 February 2009 - VH-TGM, Grob - Burkhaart Flugzeugbau G-115 Grob and VH-YTG, S.O.C.A.T.A.-Groupe Aerospatiale TB-10 Tobago

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Figure 1 Background image courtesy of Google Earth
Figure 2 Background images provided by Airservices Australia
Figures 3,4 and 5 Original images provided by the aircraft operator

Abstract

On 7 February 2009, five aircraft were engaged in circuit training and one aircraft was departing runway 03 left (03L) at Parafield Airport, SA. All of the aircraft in the circuit at the time were operated by a local flight school. The control tower was not open and Common Traffic Advisory Frequency - carriage and use of radio required, CTAF (R), procedures were in place.

At about 0736 Central Daylight-saving Time, a S.O.C.A.T.A.-Groupe Aerospatiale TB-10 (Tobago), registered VH-YTG, with an instructor and student on board, was on final approach for a practice short field landing. In the circuit behind the Tobago was a Grob - Burkhaart Flugzeugbau G-115 (Grob), registered VH-TGM, with an instructor and student on board. The Grob was on final approach for a practice flapless approach and landing. The Grob collided with the Tobago from behind, damaging the Tobago's rudder with the Grob's right wing. Both aircraft remained controllable and were landed on runway 03L and 03 right.

The investigation found that the pilots of the Grob experienced sun glare and background visual clutter on the base leg for runway 03L and were unable to sight the preceding Tobago. The pilots of the Grob did not discern some broadcasts from the Tobago pilots, significantly diminishing their situational awareness. The pilots of the Grob continued the approach without positively identifying the preceding aircraft in the circuit.

Soon after the accident, the aircraft operator's flight safety officer produced a comprehensive accident investigation report that captured the key aspects of the accident. Included in the report were a number of recommendations, which were implemented by the operator.

The investigation identified a safety issue regarding definition of the circuit traffic limit in CTAF(R) and a safety issue related to the positive identification of traffic before turning final.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal bureau within the Australian Government Department of Infrastructure, Transport, Regional Development and Local Government. ATSB investigations are independent of regulatory, operator or other external organisations.

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 the object of an investigation to determine blame or 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.

The ATSB has decided that 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 (for example the relevant regulator in consultation with industry) to assess the costs and benefits of any particular means of addressing a safety issue.

About ATSB investigation reports: How investigation reports are organised and definitions of terms used in ATSB reports, such as safety factor, contributing safety factor and safety issue, are provided on the ATSB web site www.atsb.gov.au

FACTUAL INFORMATION

Sequence of events

At about 0735 Central Daylight-saving Time[1] on 7 February 2009, five aircraft were engaged in dual[2] circuit training and one aircraft was awaiting departure at the holding point for runway 03 left (03L) at Parafield Airport, SA. All of the aircraft in the circuit at the time were operated by a local flight school. The control tower was not open and Common Traffic Advisory Frequency - carriage and use of radio required, CTAF (R)[3], procedures were in place.

At the time, a S.O.C.A.T.A.-Groupe Aerospatiale TB-10 Tobago, registered VH-YTG (YTG), with an instructor and student on board, was turning onto the base leg of the 03L circuit (Figure 1) for a flapless approach and landing. The student, who was the pilot flying, made the recommended broadcast on 118.7 MHz, the assigned frequency for CTAF (R) use. Preceding traffic for landing was a Grob - Burkhaart Flugzeugbau G-115 (Grob) aircraft.

The instructor in the aircraft at the holding point, a Tobago registered VH-YTK (YTK), called YTG on 119.1 MHz, the flight school operations frequency. The instructor advised the pilots in YTG that he was hoping to depart after the Grob that was on final approach. The instructor in YTG responded by transmitting that they would reduce airspeed on final, believing that he transmitted on the CTAF so that other pilots would be aware of his intention. The instructor recalled that the base leg and final turn were widened to accommodate the departing Tobago and that the aircraft was reconfigured for a short-field approach and landing.

Behind the Tobago in the circuit sequence was another Grob aircraft, registered VH-TGM (TGM), with an instructor and student on board. The student was the pilot flying and, in order to reduce the student's workload, the instructor was making the radio broadcasts.

The instructor in TGM recounted that they had turned onto the downwind leg and made the recommended broadcast on the CTAF when she heard, on the operations frequency, the pilot of YTK arranging a takeoff before YTG. She did not, however, recall hearing YTG's broadcast intention to reduce speed on finals and, while not aware of YTG's position at the time, assumed that it was on the late downwind or base leg. The student continued the downwind leg of the circuit, extending it by 5 seconds in preparation for a practice flapless approach and landing, before turning base. The instructor made a turning-base broadcast. Due to the flapless approach, the aircraft's reported indicated airspeed on base was 80 kts, rather than the standard 75 kts.

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[1] The 24-hour clock is used in this report to describe the local time of day, Central Daylight-saving Time, as particular events occurred. Central Daylight-saving Time was Coordinated Universal Time (UTC) + 10.5 hours.

[2] Student pilot is accompanied by a flight instructor, who is the pilot in command.

[3] The CTAF(R) is the frequency on which pilots operating at a non-towered aerodrome should monitor and transmit positional broadcasts. More information is provided in the *CTAF procedures and communication* section of this report.

The instructor in YTG recounted that the student slightly overshot the turn onto final and, when established on final, made the standard 'on final' broadcast. The student slowed YTG to the 70 kts specified for a short-field landing. Initially, the instructor could not recall if there was an on final broadcast from TGM. However, the instructor later recalled that, shortly after they made the on final broadcast, he heard a standard on final broadcast from TGM. He reported that he immediately looked to the left and right for the other aircraft, but did not see it. Concerned about the risk of a collision, he then instructed the student to make a 'short final' broadcast.

Figure 1: Overhead view of Parafield airport with runway 03L circuit descriptors

The instructor and student in TGM did not recall hearing any ‘on final or short-final broadcasts from YTG, but were aware that YTG was ahead of them and were looking for the aircraft. The glare from the sun at a low angle was reported to have made it difficult to see aircraft on final approach. The only traffic they reported sighting was a Tobago on the runway 03L threshold. The student recalled agreeing with the instructor that the Tobago on the ground was YTG, the aircraft they were following. The instructor, however, recalled that she never mistook the departing Tobago as YTG and that it was only when the Tobago taxied onto the runway that she realised that YTG was still on final approach.

At about 0736, TGM was on mid-final, at about 300 ft above ground level, when the student suddenly became aware of an aircraft in front of them in close proximity and moving from right to left. He pulled up and to the right, but was unable to avoid a collision. The instructor took over and landed on runway 03 right (03R) without any control difficulties. Neither pilot was injured.

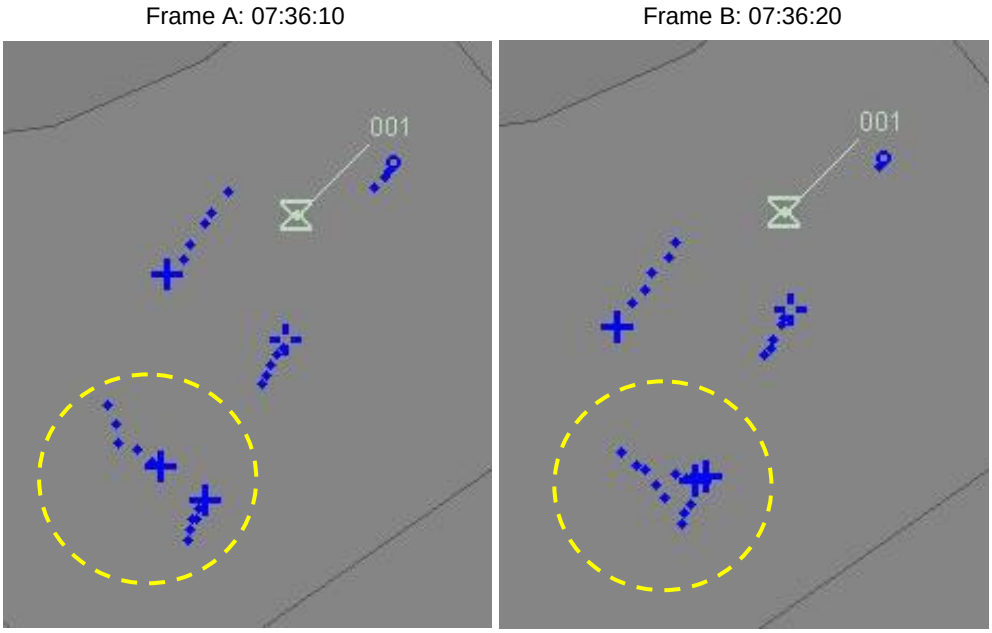
In YTG, the instructor and student heard an impact and felt the aircraft’s nose yaw to the left. The student advised of rudder control difficulties, at which point the instructor took over and landed on runway 03L. Neither pilot was injured.

Radar information

The tracks of aircraft operating in the Parafield CTAF (R) circuit were automatically recorded by the Airservices Australia (Airservices) radar system. There was no Mode C altitude information from the aircraft in the circuit.

Each aircraft position was represented by a cross depicted with a ‘history trail’, that provided an indication of the relative motion between recorded tracks (Figure 2). Frame A shows that at 07:36:10, TGM was approaching YTG from the left and Frame B shows that, 10 seconds later, the tracks merge.

Figure 2: Radar replay images (TGM and YTG in circled area)



Following the accident, Airservices reviewed[4] the recorded information and identified the midair collision.

Background information

In the 2 weeks prior to the collision, Adelaide experienced a heat wave, with daily temperatures exceeding 40° C. In accordance with a standard operating procedure, the operator cancelled flying when the outside air temperature exceeded 40° C. That meant that there was a backlog of flying training tasks and, on the day of the collision, a number of pilots were flying early to complete tasks before the temperature exceeded 40° C.

The pilots in the Grob did not consider themselves to have been unduly influenced by the backlog of flying. Before the collision, there had been a number of go-arounds, including the Grob, due in some cases to aircraft entering the runway to gain a departure slot.

Pilot information

Table 1: VH-TGM (Grob) pilot details

	Instructor	**Student**
Licence type	Commercial Pilot (Aeroplane) Licence	Student Pilot Licence
Instructor rating	Grade 2 (Issued Dec 08)	Not applicable
Medical certificate	Class 1	Class 1
Total flying hours	1,000 hours	25.2
Hours on type	82.0 hours	25.2
Nationality	Canadian	Canadian

Table 2: VH-YTG (Tobago) pilot details

	Instructor	**Student**
Aeroplane Licence type	Airline Transport Pilot (Aeroplane) Licence	Student Pilot Licence
Instructor rating	Grade 2 (Issued April 07)	Not applicable
Medical certificate	Class 1*	Class 2*
Total flying hours	13,800 hours	188.4
Hours on type	872 hours	188.4
Nationality	Japanese	Japanese

* With the requirement for distance vision correction.

[4] Parafield tower cabin had a tower situational awareness display (TSAD) that used radar information from the Australian Advanced Air Traffic System (TAAATS) to assist air traffic controllers in maintaining situational awareness. As the tower was not operating at the time of the collision, the TSAD was unmonitored.

Aircraft information

The Grob is a low-wing aircraft, with side-by-side seating for two occupants. The Tobago is a low-wing aircraft, with seating for four occupants. In both aircraft, during pre-licence flight instruction, the student operates the controls on the left side of the aircraft and, when required, the instructor uses the controls on the right side.

Both aircraft were fitted with two radios and a pilot-to-pilot intercom system. The pilots of the Grob and the Tobago reported that radio reception was satisfactory.

Both aircraft were equipped with a Ryan Traffic and Collision Alert Device (TCAD). The devices provided a warning tone and displayed altitude and distance separation from other transponder-equipped aircraft that were within 3 miles horizontally and 1,000 ft vertically. The operator reported that the devices were unable to be used by the pilots of aircraft in the circuit due to multiple returns and alerts.

The Tobago was manufactured with wingtip strobe lights and incorporated an approved modification to install a strobe light with a red lens on the top of the vertical stabiliser. The lights were reported to be selected on in accordance with standard operating procedures and to be serviceable. Both aircraft had landing lights, which were routinely selected on.

The aircraft windscreen was reported by the pilots of TGM to be of adequate transparency and to be clean.

Aircraft damage and impact information

VH-TGM damage

The right wing leading edge and right side of the fuselage near the wing root sustained paint abrasion consistent with contact with the Tobago rudder (Figure 3). The adjacent canopy sustained minor scratching.

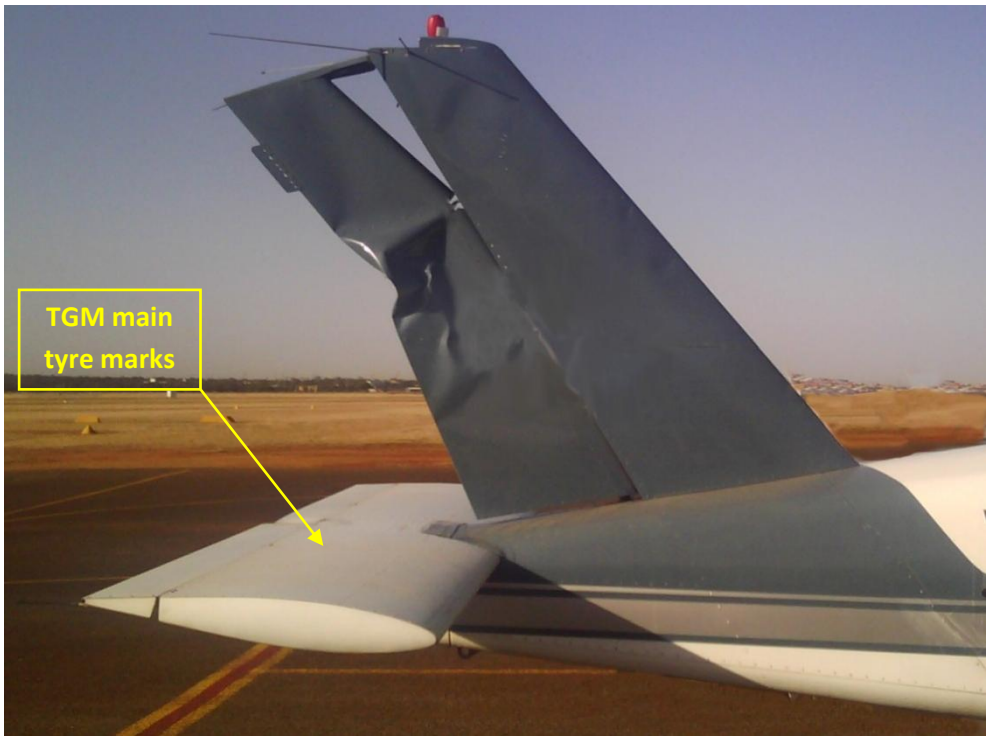
Figure 3: G-115 Grob, VH-TGM

Note: Image digitally altered to remove operator identification marks.

VH-YTG damage

The rear section of the rudder was damaged (Figure 4) and there were tyre impact marks on the upper surface of the stabilator. A representation of the collision angle between the aircraft is at Figure 5.

Figure 4: TB-10 Tobago, VH-YTG



Note: Image digitally altered to remove operator identification marks.

Figure 5: Representation of collision angle

Note: Image courtesy of aircraft operator

Environmental conditions

The Bureau of Meteorology produced an aerodrome forecast (TAF) and aviation routine weather reports (METAR) for Parafield Airport. The TAF valid at the time

of the collision, forecast wind to be from 350° T at 10 kts and visibility greater that 10 km with no significant weather. By 0830, the wind was expected to have changed to be from 340° at 20 kts gusting to 35 kts.

The 0730 METAR recorded the wind from 330° T at 2 to 7 kts, visibility greater than 10 km and temperature of 25.4° C. At 0733, an aviation special weather (SPECI) was issued with wind from 030° degrees at 10 to 14 kts, visibility greater than 10 km and temperature of 31.6° C.

A number of the pilots operating in the circuit at the time of the collision reported that their visibility on the base leg of the circuit was impaired by sun glare. The nominal alignment of the base leg was 120° M (128° T). At the time of the accident, the sun azimuth was about 100° T and the altitude was about 11°.[5]

Parafield Airport is located in the northern part of the city of Adelaide and is surrounded by houses and other buildings. The operator reported that that background visual clutter made traffic detection difficult.

CTAF procedures and communications

Parafield Airport had a control tower, which was used when the General Aviation Aerodrome Procedures (GAAP) airspace was active. On the day of the accident, the tower was due to become operational at 0800.

Outside of tower operating hours, CTAF (R) procedures applied. Those procedures, which were introduced on 24 November 2005, were designed to reduce incidents in the vicinity of aerodromes and to create an effective see-and-avoid environment. The CTAF was the frequency on which pilots operating at non-towered aerodromes were required to monitor and make positional radio broadcasts.

The Aeronautical Information Publication (AIP) included a summary of the broadcasts for all aircraft when operating at non-towered aerodromes. Those broadcasts were intended to improve situational awareness by allowing pilots to visually identify other aircraft and adjust flight paths accordingly, reducing frequency congestion. For aircraft in the circuit pattern, the following broadcasts were specified:

- before taxying
- entering the runway
- turning downwind
- turning base
- turning final
- when clear of the runway.

The CTAF frequency was not recorded, nor was the flight school operations frequency. As such, the investigation relied on the recollections of the other pilots operating in the circuit with regard to the radio broadcasts made by the pilots involved in the collision. Understandably, the recollections of the pilots varied, and

[5] The sun position was obtained from the Geoscience Australia website www.ga.gov.au. Azimuth is the clockwise horizontal angle from true north to the sun. Altitude is the vertical angle from an ideal horizon to the sun.

the broadcasts made by the pilots of TGM and YTG were unable to be verified with any certainty. What was consistent in the pilots' recollections was that radio traffic at the time was 'busy'. There was only one report of an over-transmission, and there were no reports of anyone experiencing problems with radio readability.

The En route Supplement Australia (ERSA) entry for Parafield Airport included the conditions applicable to CTAF (R) operations outside of tower hours. One of those conditions was that a maximum of five aircraft were permitted in the circuit at any one time. It was not specified if that limit included or excluded departing and arriving aircraft, and the understanding of the pilots consulted by the investigation in that regard varied.

The operator reported that shortly before the midair collision, there had been six of their aircraft engaged in circuit training. That situation had been recognised, and a senior instructor had instructed a solo student to land and return to the flight school. The aircraft departing ahead of TGM and YTG for the training area (YTK) was additional to the five aircraft still engaged in circuit training.

Applicable operator procedures and pilot practices

The operator's standard operating procedures included a section on radio procedures. The procedures for CTAF(R) reflected the AIP specifications with the following additional guidance:

> [...] discretion should be used in making other than the required radio calls. In principle, they should only be broadcast if they contribute to separation.

The operator advised their pilots that monitoring two radios should be avoided where possible, as it could have an adverse effect on situational awareness. The operations frequency was generally used for company messages and traffic awareness in the training area.

Standard student briefings (mass briefs) regarding introductory circuits included many references to the need for a lookout for traffic in the circuit, including that a lookout for traffic on base and on final was to be completed before the base turn. The standard circuit emergencies briefings included collision avoidance as a group discussion point, and excellent lookout as an airmanship consideration.

There was no specific guidance regarding actions such as a go-around if potentially conflicting traffic was not sighted by a certain point in the circuit, such as when turning final. The operator reported that 'this is an airmanship issue and SOP [standard operating procedures] cannot include what to do for every situation.' The operator's flying training syllabus did include training for a go around from base and from final approach.

The instructor in the Grob reported that visual scanning in a turn was taught as a lookout from the opposite side of the turn, through centre, and then into the turn while moving the scan up and down. She could not recall if the student was actively scanning for traffic.

The student in the Grob reported that when conducting a turn to the left, he would look right, centre and left before the turn. He was aware of the need to vary the depth of focus. Although not making the radio broadcasts, the student expected that he and the instructor would both maintain a lookout for traffic.

There were no aircraft-scheduling procedures to proactively manage the maximum number of the operator's aircraft in the circuit during daylight flying training operations. The operator reported that the pilot in command was responsible for ensuring that the number of aircraft in the circuit was in accordance with the maximum specified in ERSA.

Lookout, situational awareness and decision-making training

The *Day VFR Syllabus – Aeroplanes* included a flying training unit titled 'Manage flight'. That unit included the following elements:

- maintain effective lookout
- maintain situational awareness
- assess situations and make decisions.

The maintain-effective-lookout element was linked to performance criteria that included: 'maintains radio listening watch and interprets transmissions to determine traffic location and intentions of traffic'.

Situational awareness was defined as 'monitor and evaluate the flight environment to identify all threats relevant to the safe progress of a flight'.

Civil Aviation Advisory Publication (CAAP) 5.59-1(0) Teaching and assessing Single Pilot Human Factors and Threat and Error Management contained guidance on how to teach and assess effective lookout, situational awareness and decision-making.

The operator's ground training syllabus included a lesson on situational awareness, decision-making and human errors. The operator's flying training syllabus included a requirement for the student to demonstrate the correct technique for lookout and reporting traffic. The syllabus also included in the emergencies and abnormal procedures guidance: 'explain the actions to prevent an in-flight collision'.

Limitations of the see-and-avoid principle

In 1991, the then Bureau of Air Safety Investigation produced a research report titled *Limitations of the see-and-avoid principle*. The report identified a number of limitations relating to unalerted see-and-avoid, many of which also applied to alerted see-and-avoid. The issues related to see-and-avoid included:

- cockpit visibility restrictions – aircraft design features such as window posts, engine cowling and wings
- target conspicuity factors - aircraft size and colour, contrast, sun glare, anti-collision lighting
- visual search influences - scan technique, pilot workload, pilot expectancies
- vision effectiveness - blind spot, acuity threshold, accommodation, empty field myopia, focal traps.

Interestingly, the research report suggested that there wasn't an ideal aircraft paint scheme for conspicuity as contrast varied with background. The report also

concluded that white strobes were more effective than red flashing lights, but were not likely to be helpful against bright sky backgrounds.

The operator's ground training syllabus included lessons on human visual limitations and factors conducive to midair collisions. The operator's flying training syllabus included a requirement for complete knowledge of the principles of see-and-avoid.

Applicable regulations

Civil Aviation Regulations 1988 (CAR) contained rules for right of way (CAR 161), prevention of collision (CAR 162), operating near other aircraft (CAR 163), and responsibility of flight crew to see and avoid aircraft (163A). CAR 163A stated:

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

The regulations quoted above, other than CAR 163A, were predicated on pilots of aircraft sighting other aircraft with sufficient time to take avoiding action if required.

Australian midair collision history

In 2004, the ATSB produced an aviation safety research and analysis discussion paper (B2004/0114) titled *A review of midair collisions involving general aviation aircraft in Australia between 1961 and 2003*. In that period, there were 37 midair collisions at a rate of about one collision per year since 1968. All of the collisions occurred during good weather conditions, with visibility being 10 km or more (when recorded).

Significantly, most of the midair collisions (78%) occurred in or near the circuit area and a large proportion of the collisions (30%) occurred on final approach or during the base-to-final turn. Most of the circuit collisions (62%) involved one aircraft colliding with another from behind, or both aircraft converging from a similar direction.

In the 12 months prior to this occurrence, there were four midair collisions in Australia involving VH-registered aircraft. The ATSB investigated, or is investigating those occurrences (see Appendix A).

On 26 February 2009, about 3 weeks after the Parafield Airport midair collision, there was a near miss between a Grob G-115 and a Piper Aircraft Corporation PA-28-R-180 (Arrow) at Jandakot Airport, WA. Before the tower opened, the Grob was engaged in circuit training on runway 06L and the Arrow was inbound from the south. The pilot of the Arrow flew a non-standard left circuit entry to runway 06L, while the pilots of the Grob were conducting a right circuit as required. Both aircraft were in close proximity on final approach when an air traffic controller, who was in the tower, but not yet on duty, transmitted an alert. The pilot of the Arrow conducted a go-around and the pilots of the Grob conducted a normal touch-and-go.

Civil Aviation Safety Authority reviews

The Civil Aviation Safety Authority (CASA) has undertaken two reviews in relation to the recent midair accidents:

- the General Aviation Aerodrome Procedures (GAAP) Training Review
- the General Aviation Aerodrome Procedures (GAAP) Utility Review.

The GAAP Training Review report, dated May 2009, stated that the review was instigated following two midair collisions at GAAP aerodromes in the latter half of 2008. The review was undertaken to establish whether additional GAAP-related training material could be developed by CASA to benefit the flying training sector. The review was expanded to examine any potential technology advances that may assist in addressing the risk of collision. That aspect of the review is yet to be completed.

The report identified three key themes that emerged from the review:

1. Situational awareness training and assessment is not being achieved in a consistent manner, with a lack of formal training tools available to assist instructors develop this safety critical competency;

2. A general lack of standardization, both within an individual flying school and at specific GAAP locations was observed; and

3. A poor understanding of some fundamental GAAP procedural matters was detected.

The review identified a range of issues, predominantly involving poor situational awareness, and made a number of recommendations. The recommendations were aimed at enhancing training and education in and around GAAP aerodromes.

CASA reported that, in June 2009, it will release a safety educational message through a mail-out to all pilots. The message includes information about some of the key safety factors involved in midair collisions and practical recommendations to assist pilots in avoiding midair collisions.

Consistent with the recommendations of the GAAP training review, CASA, along with members of the flying training industry, are currently preparing a more comprehensive training package to help combat midair accidents and incidents. This training package will be made available as soon as possible.

In relation to the GAAP Utility Review, at the time of writing this report, the that review had not been completed.

ANALYSIS

Introduction

As is the case for almost all midair collisions, this accident was a result of the convergence of two aircraft flight paths with a lack of pilot situational awareness. Despite definite contact between the two aircraft, including serious damage to the Tobago's rudder, the pilots were fortunate that the aircraft remained controllable. The circuit environment in which the pilots were operating was complex and dynamic, and there were a number of factors that probably contributed to the collision.

Collision factors

The aircraft were on converging flight paths, in part, because the preceding Tobago was flown at a slower speed than usual on final (in preparation for a short-field landing) and the Grob was flown at a faster speed than usual on base and final (flapless approach). The difference in speed was probably not sufficient in isolation to result in the convergence and acted in conjunction with a wider base, and longer final leg by the Tobago. The alignment of the aircraft on a similar final approach profile and track brought them into close lateral and vertical proximity.

Pilot situational awareness regarding traffic in Common Traffic Advisory Frequency - carriage and use of radio required, CTAF (R), airspace was predicated on alerted see-and-avoid, and was facilitated by regular positional radio broadcasts. To be effective, pilots needed to hear those broadcasts, interpret them correctly and respond appropriately. With five aircraft conducting circuit training and one aircraft departing, the airspace and CTAF(R) frequency was very busy, contributing to a high pilot workload. That workload, in the context of student flying and instructor monitoring/directing workloads, probably contributed to the Grob pilots not discerning some of the Tobago pilots' radio broadcasts, significantly diminishing their situational awareness. That degradation had effect in regard to the Grob pilots' understanding of the Tobago's position, and its pilots' intention regarding a speed reduction on final.

Although the Grob pilots did not discern the base, final and short-final broadcasts from the Tobago, they were aware that they were behind a Tobago and were looking for it. The student in the Grob misidentified the departing Tobago as the preceding traffic, VH-YTG, and thus might have relaxed his search for that aircraft. The instructor in the Grob was aware that the Tobago on the ground was not the Tobago they were following, but could not sight it. It is likely that sun glare and background clutter contributed to the Grob pilots not sighting the preceding Tobago. Given the Grob pilots were not aware that the Tobago was extending its circuit, or slowing down on final approach, they might have focussed their search in the wrong area.

Although the pilots of the Grob did not sight the preceding Tobago prior to the collision, there was no evidence that the pilots of the Grob were operating with inadequate vigilance in their lookout for traffic in the circuit. The pilots of the Grob were aware of the standard visual scanning techniques and reported using them. The

pilots of the Tobago had endeavoured to maximise their aircraft's conspicuity by operating with the strobe lights, anti-collision light and landing lights ON.

The pilots of the Grob, by continuing the approach onto the final leg of the circuit without positive identification of the preceding traffic, significantly increased the risk of a midair collision.

Management of midair collision risk

There were four midair collisions in Australia in the 12 months prior to this accident. Although that exceeded the 1961 to 2003 yearly average of one midair collision, the type of operations and airspace in which the 2008 accidents occurred varied and, at time of writing the report, no trend in safety factors had been identified.

Aircraft separation in a CTAF(R) was based on alerted see-and-avoid. As the then Bureau of Air Safety Investigation research report concluded, and this accident reflected, see-and-avoid (alerted or unalerted) has a number of limitations. To manage the risk of midair collisions, there is a need to minimise the effect of those limitations through pilot awareness and procedures, and to employ countermeasures that enhance pilot situational awareness.

Common Traffic Advisory Frequency procedures were intended to reduce incidents in the vicinity of aerodromes and to create an effective see-and-avoid environment. At airports with towers, such as Parafield Airport, the CTAF (R) procedures that were active during non-tower hours limited the maximum number of aircraft in the circuit to five. However, the investigation found that there was no clear understanding as to whether that included departing and arriving traffic and, from this accident, it is apparent that five aircraft conducting circuits, and one aircraft departing, resulted in a busy circuit and high pilot workload that probably contributed to the collision. The operator recognised that risk, and subsequently limited its circuit training traffic for their operation in the CTAF(R) to four.

The midair collision statistics show that the risk of collision on final approach is high compared to other phases of flight. Given that risk, it is important that pilots are aware of the risk of intercepting a final approach without the positive identification of preceding traffic, and have a plan for that situation. There was, however, no guidance available to the pilots involved in this midair about the appropriate action, such as a go-around, if preceding traffic in a circuit was not sighted before turning final. Furthermore, the investigation was unaware of any such guidance generally being available to pilots in Australia.

FINDINGS

From the evidence available, the following findings are made with respect to the midair collision at Parafield Airport, SA on 7 February 2009 involving a Burkhaart Flugzeugbau G-115 (Grob), VH-TGM and S.O.C.A.T.A.-Groupe Aerospatiale TB-10 (Tobago), VH-YTG and should not be read as apportioning blame or liability to any particular organisation or individual.

Contributing safety factors

- There were five aircraft (including VH-TGM and VH-YTG) engaged in dual circuit training and one aircraft departing runway 03 left (03L), resulting in busy airspace and a high level of radio traffic on the traffic advisory frequency.
- During the base leg of the circuit, the pilots of the Grob (VH-TGM) experienced sun glare and background clutter on the base leg for runway 03L and were unable to sight the preceding Tobago (VH-YTG).
- The pilots of the Grob (VH-TGM) did not discern the Tobago (VH-YTG) pilots' broadcast intention to reduce speed on final, or broadcasts on final and short-final, significantly diminishing their situational awareness in regard to the Tobago's position and its pilots' intentions.
- The pilots of the Grob continued the approach onto the final leg of the circuit without positively identifying the preceding aircraft in the circuit.
- The aircraft flight paths converged because the Grob (VH-TGM) was flown at a slightly faster speed on a flapless approach than the Tobago (VH-YTG) flying a short-field approach; the Tobago was flown on a wider base and longer final approach; and both aircraft were being aligned to the same runway approach track and profile.

Other safety factors

- The limit of five aircraft in the circuit during Common Traffic Advisory Frequency - carriage and use of radio required, CTAF (R), operations at certain airports was not well defined, resulting in potentially more aircraft operating in the circuit than intended. *[Safety issue]*
- The operator did not provide guidance, and there was no generally available guidance, to pilots regarding the appropriate course of action should preceding traffic in the circuit not be sighted before the final approach is intercepted. *[Safety issue]*

SAFETY ACTION

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

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

Aircraft operator

Soon after the midair collision, the aircraft operator's flight safety officer produced a comprehensive accident investigation report that captured the key aspects of the accident. Included in the report were a number of recommendations for the operator to consider. Edited versions of those recommendations included that:

- A procedure should be incorporated into the standard operating procedures that 'no solo students to conduct circuit work in the mornings when CTAF [Common Traffic Advisory Frequency] operations apply at YPPF [Parafield]'.
- A procedure should be incorporated into standard operating procedures that 'only four dual aircraft are allowed to conduct circuit work in the mornings when CTAF operations apply at YPPF, aircraft can still depart and arrive at the airfield, but cannot conduct circuit training when there is four aircraft in the circuit.'
- A procedure should be incorporated into standard operating procedures that 'all radio transmissions between aircraft in the YPPF circuit when CTAF operations apply, which will adversely affect the spacing and separation of the circuit traffic, should be transmitted on the relevant CTAF frequency.'
- The pilot in command of the Grob 115 (VH-TGM) should fly a check flight/s with the Chief Flying Instructor before recommencing flight operations.
- All company flight instructors to be briefed regarding above mention procedures by the company flight safety officer
- Circuit separation and procedures to be incorporated as a standing agenda point on the monthly safety meeting; this should be conducted by the company flight safety officer on a monthly basis.
- The company flight safety officer to brief all company instructor[s] regarding small differences in circuit training between various airline syllabi.
- Company flight instructors should brief their students regarding the airmanship of keeping quiet when a radio broadcast is received until the importance and applicability of such a radio call has been assessed.

Subsequently, the operator provided evidence that all of the flight safety officer's recommendations had been adopted.

Civil Aviation Safety Authority/aircraft operator

Guidance re circuit traffic

Safety issue

The operator did not provide guidance, and there was no generally available guidance, to pilots regarding the appropriate course of action should preceding traffic in the circuit not be sighted before the final approach is intercepted.

Action taken by CASA

In response to the recommendations of the GAAP Training Review, CASA developed a number of safety cards that included the following guidance regarding an effective lookout:

> Ensure you sight any preceding traffic before turning finals, otherwise consider going around.

Action taken by aircraft operator

The aircraft operator amended their flying training syllabus to include the following item within their threat and error management training:

> Circuit flying – awareness of other aircraft in the circuit. When and how to go around.

ATSB assessment of action taken by CASA and the aircraft operator

The action taken by CASA and the aircraft operator appears to adequately address the safety issue.

Civil Aviation Safety Authority

Parafield Airport CTAF(R) circuit limit

Safety issue

The limit of five aircraft in the circuit during Common Traffic Advisory Frequency - carriage and use of radio required, CTAF (R), operations at certain airports was not well defined, resulting in potentially more aircraft operating in the circuit than intended.

CASA response/action

As part of its directly involved party response, CASA advised that:

> The limit for five aircraft in the circuit outside of tower hours was documented in ERSA [En route Supplement Australia]. It is not clear from the report why the school did not comply with these guidelines. The statements "A MAX of 5 ACFT are permitted in the circuit at any one time" and CTAF(R) radio carriage and use requirements do not seem ambiguous or unclear.

CASA also advised that:

> A number of these issues relating to operations at such aerodromes will be addressed in the findings of CASA's GAAP reviews.

ATSB comment

The ATSB recognises the potential for CASA's GAAP reviews to address this safety issue.

APPENDIX A: RECENT HISTORY OF MIDAIR COLLISIONS

Reference	Abstract text
AO-2008-010	On 13 February 2008, a Piper Aircraft Corporation Super Cub aeroplane and a Robinson Helicopter Company R44 Raven helicopter collided in midair during feral goat culling operations. The aeroplane impacted the ground at a steep angle, fatally injuring the two occupants. The helicopter, though damaged, was safely landed. The investigation became a public document on 26 June 2009 and is available at www.atsb.gov.au
AO-2008-014	At 0930 Eastern Daylight-saving Time on 26 February 2008, Air Tractor Inc. 502 registered VHCJK (CJK), whose pilot was engaged in the aerial spraying of a field approximately 10 km NE of Wee Waa township, NSW, and Air Tractor Inc. 502B registered VH-ATB (ATB), that had just departed from an airstrip approximately 13 km north-east of Wee Waa, collided. The pilot of CJK was fatally injured and the aircraft destroyed by collision forces with the other aircraft and by ground impact. It did not catch fire. The pilot of ATB was seriously injured and the aircraft destroyed by collision forces with the other aircraft, ground impact, and a post impact fire. The investigation is continuing.
AO-2008-059	On 27 August 2008 at 1238 Eastern Standard Time1, a Cessna Aircraft Company A150M and a Piper PA-28-161 collided 3 km north-west of Moorabbin Airport, Vic. The Cessna impacted the ground following the collision and fatally injured the student pilot. The instructor in the PA-28 was able to land the aircraft at Moorabbin Airport without any further damage. The investigation is continuing.
AO-2008-081	On 18 December 2008, a Cessna 152 aircraft and a Liberty XL2 aircraft collided in midair over Casula, NSW, in the proximity of the 2RN reporting point, south-west of Bankstown Airport. The Liberty remained flyable and landed at Bankstown approximately 6 minutes later, while the Cessna descended to the ground and was destroyed. Both occupants of the Cessna were fatally injured. The investigation is continuing.

APPENDIX B: SOURCES AND SUBMISSIONS

Sources of information

The sources of information for this investigation included:

- the aircraft operator
- the instructor and student pilot of VH-TGM
- the instructor and student pilot of VH-YTG
- other pilots operating in the Parafield Airport circuit at the time of the collision
- the Bureau of Meteorology
- the Parafield Airport operator
- the Civil Aviation Safety Authority (CASA).

Submissions

Under Part 4, Division 2 (Investigation Reports), Section 26 of the Transport Safety Investigation Act 2003, the Executive Director may provide a draft report, on a confidential basis, to any person whom the Executive Director considers appropriate. Section 26 (1) (a) of the Act allows a person receiving a draft report to make submissions to the Executive Director about the draft report.

A draft of this report was provided to the aircraft operator, the pilots of both aircraft and CASA.

Submissions were received from the aircraft operator and the instructors in VH-TGM and VH-YTG. The submissions were reviewed and where considered appropriate, the text of the report was amended accordingly.