Final Report AO-2015-009: Air traffic control incidents,
Hamilton aerodrome, 17 December 2015

The Transport Accident Investigation Commission is an independent Crown entity established to determine the circumstances and causes of accidents and incidents with a view to avoiding similar occurrences in the future. Accordingly it is inappropriate that reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

The Commission may make recommendations to improve transport safety. The cost of implementing any recommendation must always be balanced against its benefits. Such analysis is a matter for the regulator and the industry.

Final Report

Aviation inquiry AO-2015-009
Air traffic control incidents
Hamilton aerodrome
17 December 2015

Approved for publication: August 2018

Transport Accident Investigation Commission

About the Transport Accident Investigation Commission

The Transport Accident Investigation Commission (Commission) is a standing commission of inquiry and an independent Crown entity responsible for inquiring into maritime, aviation and rail accidents and incidents for New Zealand, and co-ordinating and co-operating with other accident investigation organisations overseas. The principal purpose of its inquiries is to determine the circumstances and causes of occurrences with a view to avoiding similar occurrences in the future. Its purpose is not to ascribe blame to any person or agency or to pursue (or to assist an agency to pursue) criminal, civil or regulatory action against a person or agency. The Commission carries out its purpose by informing members of the transport sector and the public, both domestically and internationally, of the lessons that can be learnt from transport accidents and incidents.

Commissioners

Chief Commissioner	Jane Meares
Deputy Chief Commissioner	Peter McKenzie, QC
Commissioner	Stephen Davies Howard
Commissioner	Richard Marchant
Commissioner	Paula Rose, QSO

Key Commission personnel

Chief Executive	Lois Hutchinson
Chief Investigator of Accidents	Captain Tim Burfoot
Investigator in Charge	Barry Stephenson
General Counsel	Cathryn Bridge

Email	inquiries@taic.org.nz
Web	www.taic.org.nz
Telephone	+ 64 4 473 3112 (24 hrs) or 0800 188 926
Fax	+ 64 4 499 1510
Address	Level 16, 80 The Terrace, PO Box 10 323, Wellington 6143, New Zealand

Important notes

Nature of the final report

This final report has not been prepared for the purpose of supporting any criminal, civil or regulatory action against any person or agency. The Transport Accident Investigation Commission Act 1990 makes this final report inadmissible as evidence in any proceedings with the exception of a Coroner's inquest.

Ownership of report

Citations and referencing

Information derived from interviews during the Commission's inquiry into the occurrence is not cited in this final report. Documents that would normally be accessible to industry participants only and not discoverable under the Official Information Act 1982 have been referenced as footnotes only. Other documents referred to during the Commission's inquiry that are publicly available are cited.

Photographs, diagrams, pictures

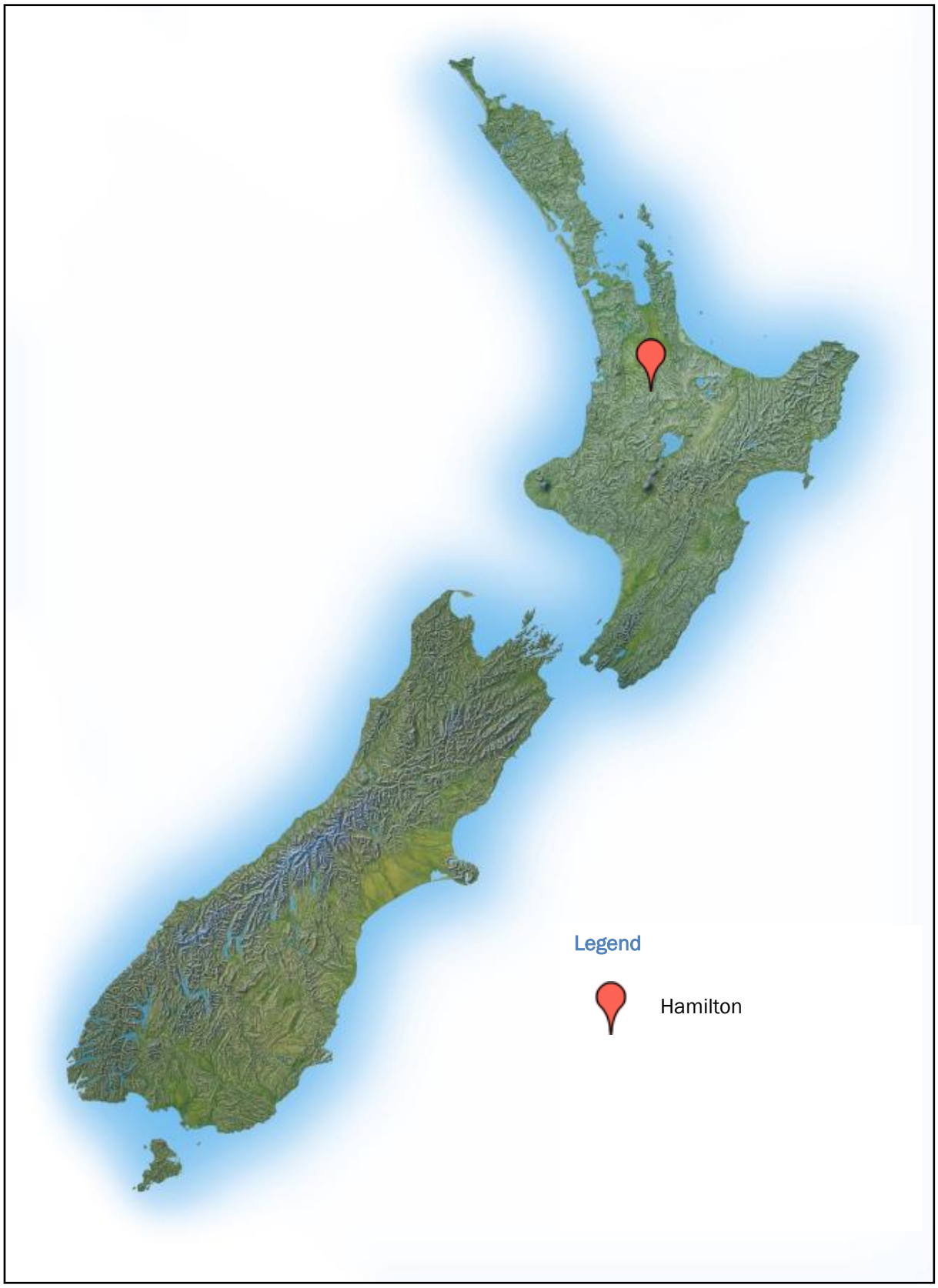
Unless otherwise specified, photographs, diagrams and pictures included in this final report are provided by, and owned by, the Commission.

Verbal probability expressions

The expressions listed in the following table are used in this report to describe the degree of probability (or likelihood) that an event happened or a condition existed in support of a hypothesis.

Terminology (Adopted from the Intergovernmental Panel on Climate Change)	Likelihood of the occurrence/outcome	Equivalent terms
Virtually certain	> 99% probability of occurrence	Almost certain
Very likely	> 90% probability	Highly likely, very probable
Likely	> 66% probability	Probable
About as likely as not	33% to 66% probability	More or less likely
Unlikely	< 33% probability	Improbable
Very unlikely	< 10% probability	Highly unlikely
Exceptionally unlikely	< 1% probability	

Hamilton aerodrome control tower



Source: mapsof.net

Location of incident(s)

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Abbreviations

AIPNZ	Aeronautical Information Publication
Airways	Airways Corporation of New Zealand Limited
assessment	annual proficiency assessment
ATC	air traffic control
CAA	Civil Aviation Authority of New Zealand
Commission	Transport Accident Investigation Commission
CTC	CTC Aviation Training (NZ) Limited (since renamed L3 Commercial Training Solutions)
IFR	instrument flight rules
movement	air traffic movement
nm	nautical mile(s)
Runway 18L	Runway 18 Left
TRM	team resource management
VFR	visual flight rules
zone	control zone

Glossary

air traffic movement	a take-off or a landing
cab	the air traffic control room on top of a control tower
circuit booking	a local system where training aircraft were booked to conduct circuit training in half-hour slots
human factors	the application of psychological and physiological principles to the (engineering and) design of products, processes and systems. The goal of human factors is to reduce human error, increase productivity and enhance safety and comfort, with a specific focus on the interaction between the human and the thing of interest
IFR flight	a flight conducted in accordance with the instrument flight rules, during which an aircraft is piloted solely by reference to instruments and without external reference points. Visibility may be limited due to weather or time of day, or be suitable for VFR flight
left-hand circuit	a circuit in which each turn in the circuit pattern is to the left. In a right-hand circuit the turns are to the right
Local Unit Orders	an Airways operational manual containing orders specific to the operation of a particular air traffic control unit
nautical mile	a unit of measurement defined as exactly 1,852 metres
Runway 18 Left	a runway aligned due south at 180 degrees magnetic, and the left-hand runway of two parallel runways. Runway 18R (18R) is the right-hand runway
VFR flight	a flight conducted in accordance with the visual flight rules, when meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling are equal to or better than specified minima

Data summary

Aerodrome controller's details

Controller's licence:	aerodrome controller, validated for Hamilton
Controller's age:	22
Controller's total control experience:	18 months since validation at Hamilton
Date and time	17 December 2015 at 1213 New Zealand Daylight Saving Time
Location	Hamilton aerodrome
	latitude: 37° 51´ 59" S
	longitude: 175° 20´ 07" E
Injuries	nil
Damage	nil

1. Executive summary

1.1. On Thursday 17 December 2015, an aerodrome controller (the controller) was undergoing an annual proficiency assessment in the Hamilton air traffic control tower. A two-person watch was on duty in the tower and air traffic in the circuit patterns was high but normal for the peak period of the day. A planner was working with the controller, and an assessor sat behind to observe and record the controller's actions.

1.2. During the assessment, a series of four incidents occurred that related to the controller's management of air traffic in the vicinity of the aerodrome. Following the fourth incident, the assessor stopped the assessment and took over as the aerodrome controller to resolve the situation. There were no collisions and nobody was injured.

1.3. The Transport Accident Investigation Commission (Commission) found that the incidents occurred because the controller became overwhelmed by the circumstances on the day and lost situational awareness of the aircraft within the control zone.

1.4. The Commission also found that the usual briefing procedure before conducting the assessment was not fully followed, and that this likely affected the team dynamics in the control tower.

1.5. At a broader level the Commission found that Airways Corporation of New Zealand Limited's tradition of posting recently qualified controllers with limited experience to Hamilton aerodrome, one of the busiest in the country, had the potential to raise the risk profile of the air traffic control unit.

1.6. The Commission identified the following safety issues:

- the standard of team resource management in the Hamilton air traffic control tower did not match good industry practice
- some aerodrome controllers are 'over-controlling' visual flight rules traffic in and around the control zone, which is unnecessarily congesting the radio frequencies and risks causing difficulties for inexperienced pilots and those for whom English is their second language.

1.7. The Commission also identified the following safety issue in relation to the wider issues for Hamilton aerodrome:

- changes in the size and shape of the Hamilton control zone have shifted some visual flight rules traffic congestion to prominent points outside the control zone, and likely increased the risk of collision in those areas.

1.8. A number of safety actions were taken and the Commission made two recommendations to address key safety issues.

1.9. The key lessons arising from the inquiry were:

- operational assessments in a team situation have the potential to alter the normal team dynamics. It is essential that assessments are properly managed and that every team member is clear on their responsibilities and their involvement in the assessment process
- clear, succinct and short radio communication between air traffic control and aircraft is pivotal to safe operations.

2. Conduct of the inquiry

2.1. The Civil Aviation Authority of New Zealand (CAA) advised the Transport Accident Investigation Commission (Commission) of this occurrence on 17 December 2015. The Commission opened an inquiry in accordance with the Transport Accident Investigation Commission Act 1990, section 13(1)b, and appointed an investigator in charge.

2.2. Two investigators travelled to Hamilton on 21 December 2015 to conduct initial interviews and gather evidence.

2.3. One investigator returned on 26 January 2016 to conduct further interviews.

2.4. The Commission engaged a clinical psychologist to assist with the human performance line of inquiry.

2.5. Two investigators interviewed relevant staff at the CAA on 29 February 2016.

2.6. Two investigators visited the Airways Corporation of New Zealand Limited (Airways) office in Christchurch on 8 March 2016 to gather further evidence and conduct interviews with managers and tutors from the air traffic controller training centre.

2.7. Status updates were sought through telephone conversations and emails with some participants during December 2017.

2.8. On 20 June 2018 the Commission approved this draft report for circulation to seven interested persons for comment. Seven submissions were received. The Commission considered the submissions, and any changes as a result of those submissions have been included in the final report.

2.9. On 22 August 2018 the Commission approved the final report for publication.

3. Factual information

3.1. Introduction

3.1.1. On Thursday 17 December 2015, a series of air traffic control (ATC) related incidents occurred at Hamilton aerodrome while it was under the control of one aerodrome controller (the controller). The last of these incidents happened at 1213, when two light aircraft on training flights at Hamilton aerodrome were directed by the controller into a head-on converging path. The aircraft were a Diamond DA42 Twin Star (Twin Star) conducting an instrument approach and a Diamond DA20 Katana (Katana) flown by a pilot on their first solo flight.

3.1.2. The aeroplanes were both sequenced to land on Runway 18 Left[1] (Runway 18L). They were flying on the final leg of the circuit (Figure 2) at about two nautical miles[2] (nm) from the runway threshold[3] and about 600 feet (183 metres) above ground level.

3.1.3. Both pilots saw the other during this loss of separation occurrence and turned away to avoid a collision, but their aircraft came within 0.5 nm of each other.

3.1.4. The controller was about one hour into an annual proficiency assessment (assessment) at the time of the occurrence. The assessor immediately relieved the controller from duty and took over as the aerodrome controller.

3.2. Background information

Hamilton aerodrome traffic

3.2.1. Hamilton aerodrome has the highest number of air traffic movements[4] operating under visual flight rules[5] (VFR) in the country, the highest number of movements operating under instrument flight rules[6] (IFR) for a regional aerodrome, and the second-highest total number of movements for any aerodrome. The average number of movements per year in 2014 and 2015 was 100,000 VFR movements and 30,000 IFR movements. For comparison, there were about 150,000 total movements each year at Auckland International Airport during the same period.

3.2.2. Most of the air traffic at Hamilton comprised training flights using light aircraft. The rest was made up of: regular public transport; agricultural operations; private aircraft; and the occasional military aircraft.

3.2.3. A pilot operating under VFR is responsible for their separation from other aircraft, whereas under IFR, ATC provides that separation.

3.2.4. The main physical difference between air traffic landing under VFR and IFR rules at this aerodrome was how they joined the circuit pattern. A VFR aeroplane would usually fly a box pattern around the runway, with the pilot maintaining visual reference to the runway. A suitably qualified IFR pilot would typically conduct a straight-in approach using instruments and in accordance with a published procedure. The IFR pilot would pass a reporting point at

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[1] A runway aligned due south at 180 degrees magnetic, and the left-hand runway of two parallel runways. Runway 18 Right (18R) is the right-hand runway.
[2] A unit of measurement defined as exactly 1,852 metres.
[3] See point 1 in Figure 2.
[4] A take-off or a landing.
[5] A flight conducted in accordance with the visual flight rules, when meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling are equal to or better than specified minima.
[6] A flight conducted in accordance with the instrument flight rules, during which an aircraft is piloted solely by reference to instruments and without external reference points. Visibility may be limited due to weather or time of day, or be suitable for a VFR flight.

about 12 nm out along the extended runway centreline, where they would expect to receive clearance before continuing to land.

3.2.5. IFR operations were often conducted at Hamilton when the weather was also suitable for VFR aircraft to be operating. The aerodrome controller had to manage the mixed flow of IFR and VFR aircraft safely.

Hamilton ATC

3.2.6. In 2015 the Hamilton control zone (zone) covered an area 20 nm long and 8 nm wide centred over the runway (see Appendix 1). The controlled airspace was classified as a Class D[7] zone that extended from ground level up to 2,500 feet (760 metres) above mean sea level. ATC was responsible for providing separation between IFR aircraft within the zone. It was also responsible for managing circuit traffic and jointly responsible with pilots for avoiding collisions. ATC would achieve this by providing traffic information to conflicting aircraft or issuing instructions to pilots.

3.2.7. During peak periods, up to three staff could be working in the cab[8]. An aerodrome controller would be responsible for controlling the air traffic within the zone and could be assisted by a planner, who would also be a qualified aerodrome controller. The planner would organise aircraft entering the zone into an orderly flow. Aerodrome controllers and planners were tasked with working as a team to keep traffic flowing at a safe rate that they could both manage. A flight data assistant could also be present to assist the aerodrome controller with related administration tasks and circuit booking[9] during peak periods.

3.2.8. The duty rosters were arranged so that each aerodrome controller rotated through the aerodrome controller and planner roles during each shift. The shifts overlapped to maintain a two-person watch during peak hours and allow a person being relieved to take a break before returning for the next period. In off-peak periods, a single aerodrome controller was on watch.

3.2.9. The primary tool used to manage the traffic within the zone was the flight progress board. The details of each aircraft were displayed on a dedicated flight strip. The aerodrome controller would move these strips around the flight progress board to help visualise where aircraft were within the zone, and annotate them with progress details. The aerodrome controller also had two surveillance radar displays that were usually set at different ranges to help identify aircraft positions.

3.2.10. Aerodrome controllers in the cab could talk directly to each other. They used a telephone-type handset to communicate over the radio or phone and both radio channels were connected to loudspeakers.

Proficiency assessments

3.2.11. Each aerodrome controller was required to undergo an annual proficiency assessment. They had to demonstrate their competence with a standard set of performance indicators to retain their operational status.

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[7] Airspace is classified by a letter from A to G, which refers to the level of control provided by ATC. G is uncontrolled.
[8] The air traffic control room on top of the tower. The tower included equipment rooms and offices for managers, other staff and technicians associated with the operation of the ATC unit.
[9] A local system where training aircraft were booked to conduct circuit training in half-hour slots.

3.2.12. Each assessment was conducted by an assessor. Before they started, the assessor was required to follow the guidance provided in CAA Advisory Circular AC65-9[10], which included carrying out a briefing with the aerodrome controller undergoing assessment. The assessor was also to advise any others in the cab who could be affected by the assessment that an assessment was about to take place. The Advisory Circular further advised that the pre-brief should be conducted in an appropriate environment to help alleviate any pre-assessment stress and to allow time for the assessor to determine if the people involved were ready for the assessment.

3.2.13. The assessor was not part of the operational team on duty at the time, but had the capability and currency to operate in the position being assessed. The assessment would be conducted over a period of at least five hours. The assessor would sit behind the aerodrome controller to listen and observe and record how that person performed.

3.2.14. Some discussion could occur, but generally the aerodrome controller was encouraged to act as if the assessor were not present. If the assessor needed to comment about the aerodrome controller's performance or suggest improvements to meet the standard, this would normally be done during a scheduled break period.

3.2.15. Assessors were selected from a pool of experienced ATC instructors[11], then went through additional training to be assessors[12]. They followed written guidelines for the process and assessed aerodrome controllers' performance against a standard set of competencies.

3.2.16. Generally, an assessment was simply a confirmation that an aerodrome controller was performing to the standard. It rarely resulted in their being relieved of duty for not meeting the standard, but if it did, a specific training plan was developed to address any concerns and help that person to return to active duty as soon as possible.

3.3. Narrative

Before the duty shift

3.3.1. The Hamilton tower was in operation with a two-person watch consisting of an aerodrome controller and a planner only. Runways 18L and 18 Right (18R) were in use with a left-hand circuit[13]. The controller was scheduled to commence the shift in the aerodrome controller role at 1110, but arrived early to allow time to meet the assessor. The controller waited in the cab, listening to the aerodrome controllers and gaining an appreciation of the traffic in preparation for the shift.

3.3.2. The assessor arrived just before the controller was due to start the shift and did not conduct the usual briefing before an assessment, but mentioned to the controller something to the effect that it would just be like "a normal day". The assessor was a regular staff member at the ATC unit, so there was no need for personal introductions. The other aerodrome controllers said later that they had realised an assessment was about to take place when the assessor arrived, but the assessor had not discussed the process with them.

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[10] CAA document AC65-9 (CAA, 2016) describes this requirement in terms of the performance criteria for ATC instructors. The document is an 'Advisory Circular', which describes an acceptable means of compliance with the rules and legislation.
[11] ATC instructors are called Instructors (OJTI), for 'on the job training instruction'. The instructors are ATCs with ratings to carry out on-the-job training instruction.
[12] 'Assessor' is the term used in this report, but the Airways term is Instructor (CHK) for 'instructor check'. The instructor has a rating to carry out proficiency assessments.
[13] A circuit in which each turn in the circuit pattern is to the left. In a right-hand circuit the turns are to the right.

The first set of incidents (shift start plus one minute)

3.3.3. A normal handover took place from the previous aerodrome controller to the controller. The assessor plugged into the controller's audio to listen to radio and telephone conversations, then sat behind to observe and record the controller's performance.

3.3.4. Traffic was moderate, with four aircraft already in the circuit and one other cleared to join the circuit from near Cambridge. A helicopter was operating at low level within the zone near the start of the downwind leg. Four IFR aircraft were under approach control, waiting to enter the zone. A Beechcraft 1900 twin-engine turboprop had returned from a local VFR test flight and was lining up from a right-hand circuit as number two to land (see Figure 1 for photos of the aircraft and Figure 2 for the circuit pattern).

3.3.5. The Beechcraft 1900 pilot then made a request to make a "low approach and overshoot if available" rather than continue to land. The Beechcraft 1900 has higher operating speeds than light aircraft and is classified as a medium-weight aircraft. The controller approved the request on the condition that the Beechcraft 1900 remain in the circuit.

3.3.6. The controller then issued instructions to several other VFR aircraft in the circuit to accommodate the Beechcraft 1900 pilot's request. The controller was also required under these circumstances to warn following light aircraft of possible wake turbulence, but did not do so.

The second incident (shift start plus five minutes)

3.3.7. One light aircraft (a Katana) had intended to depart to the east, but been instructed to do a right-hand circuit to make space for the Beechcraft 1900. The controller then instructed the Katana to orbit at Rukuhia[14] and wait for a clearance to cross the runway to the east. The Katana was then instructed to leave the zone to the east by crossing overhead the tower at circuit altitude, which put it on a conflicting path with another light aircraft in the downwind leg of the left-hand circuit (a Robin). If the aircraft had maintained their headings, the Katana would have passed just behind the Robin.

3.3.8. This potential conflict was pointed out to the controller by the planner. The pilot of the Robin also asked the controller's intentions for the approaching Katana. The controller then instructed the Robin to orbit to the right, which instead of resolving the potential conflict placed the two aircraft on a potential head-on collision course. After a comment from the assessor, the controller instructed the Robin to "turn left now and extend downwind until advised".

The third set of incidents (shift start plus 45 minutes)

3.3.9. At this stage the previous aerodrome controller had returned from a break and taken over the planner position (and is hereafter referred to as the 'second planner'). The surveillance radar system included a 'conflict alert' system to alert aerodrome controllers if a projected path of two aeroplanes was likely to lead to a collision. Aerodrome controllers' task was to sequence aircraft in a way that avoided such alerts. Two conflict alerts occurred within a few minutes of each other as the controller sequenced separate pairs of IFR aeroplanes on approach. Both conflicts involved an aeroplane approaching to land and one ahead completing a circling manoeuvre. A description of this manoeuvre is given in section 3.6.3.

The fourth incident (shift start plus 58 to 64 minutes)

3.3.10. The controller was dealing with eight aircraft in three circuit patterns at this time. Four aeroplanes were in the left-hand circuit, with one of the pilots on their first solo flight. Two

[14] A visual reporting point to the west of the runway (see Appendix 1).

other aeroplanes were in a right-hand circuit and a further two IFR aeroplanes were on an instrument approach. A further 10 aircraft were holding outside the zone awaiting clearance to enter.

3.3.11. A Twin Star had been approved to land on Runway 18L and was turning right on to final after completing a circling manoeuvre. A Katana flown by a pilot on their first solo flight was established on final at the same height as the Twin Star, sequenced to land behind it. The controller then instructed the Twin Star to extend downwind, which required it to turn left, back towards the approaching Katana. Soon afterwards the controller had a change of mind and instructed the Twin Star to continue with the right-hand orbit, then immediately instructed the Katana to orbit left to avoid the Twin Star. These two aircraft came within 0.5 nm of each other on a near head-on converging path. At this point the assessor took control and assumed the position of aerodrome controller.

Resolution

3.3.12. The assessor and second planner worked together to resolve the conflicts and called the unit manager to the cab to take over. Soon after taking over, the unit manager was satisfied that the second planner could manage the traffic alone, so the unit manager merged both positions and handed the solo watch to the second planner until further relief could be arranged.

3.3.13. After discussing what had happened during the assessment, the unit manager stood down the assessor and the controller.

3.3.14. Airways' policy does not require post-incident drug and alcohol testing for minor incidents. These incidents were initially classified as minor, so the controller and assessor were released without being tested. Upon receipt of further information later in the day, the main incident was upgraded to major.

3.4. Personnel information

The controller

3.4.1. The controller had gained high pass marks on all subjects at the Airways air traffic controller training centre in Christchurch. The basic training lasted nine months then the trainee controller was posted to an operational training hub at Palmerston North for consolidation training and practical experience.

3.4.2. The Palmerston North ATC unit had a similar traffic composition as Hamilton but with fewer movements per year. Trainees were first introduced to task-sharing and teamwork for the two-person watch during their consolidation training. The controller met the proficiency standard to be licensed as an aerodrome controller, but had to remain a trainee until the minimum age of 21. After gaining an ATC licence and aerodrome controller rating, the controller was posted to the Hamilton ATC unit.

3.4.3. A licensed aerodrome controller must also have a validation for their ATC unit before being able to operate alone. Validation training at Hamilton took six months, during which time a new aerodrome controller became familiar with the Local Unit Orders[15], reporting points, arrival and departure sectors, instrument procedures and general aerodrome operations specific to the Hamilton ATC unit. This training also included the Hamilton procedures for operating a two-person watch.

3.4.4. Once competent with operating at Hamilton, the controller went through the final proficiency assessment then commenced a regular roster. Newly validated aerodrome controllers at

[15] An Airways operational manual containing orders specific to the operation of a particular ATC unit.

Hamilton were reassessed after six months, then joined the standard annual assessment cycle. The controller had a current ATC licence and had gained validation at Hamilton in May 2014, then passed the six-month reassessment on 19 December 2014. These incidents occurred during the controller's second assessment after validation at Hamilton.

3.4.5. The controller had a current Class 3 medical certificate that was valid through to mid-2016 with no restrictions, conditions or endorsements.

The assessor

3.4.6. The assessor was an air traffic controller with 10 years of experience in several control towers in New Zealand and Australia. The assessor had gained an initial on-the-job-instructor rating in 2009 and had been upgraded to a check instructor rating in May 2014. The assessor had about 18 months' experience as an assessor at the time of this assessment.

3.4.7. The assessor was the Hamilton ATC unit's senior air traffic controller and training manager.

The first planner

3.4.8. The first planner started the early shift at 0540 and was due to finish at 1220. The first planner remained in position with the controller for the first 30 minutes, then left the building soon after handing over to the second planner.

3.4.9. The first planner had about two and a half years' experience as an aerodrome controller in Hamilton and about six months' experience at Palmerston North.

The second planner

3.4.10. The second planner started a shift at 0820. The second planner was in the aerodrome controller position when the controller arrived, and handed over to the controller at 1110. The second planner took a scheduled 30-minute break then relieved the first planner at 1140.

3.4.11. The second planner had about one year of experience at Hamilton as an aerodrome controller.

3.5. Aircraft information

3.5.1. The aircraft involved in the final incident were a Diamond DA20 Katana single-engine trainer and a Diamond DA42 Twin Star light twin-engine trainer.

3.5.2. The Beechcraft 1900 was the aircraft that did the low approach and overshoot. The two aircraft that were directed into conflict with each other in the downwind leg were a Robin and a Katana.

Figure 1
The aircraft involved

3.6. Aerodrome information

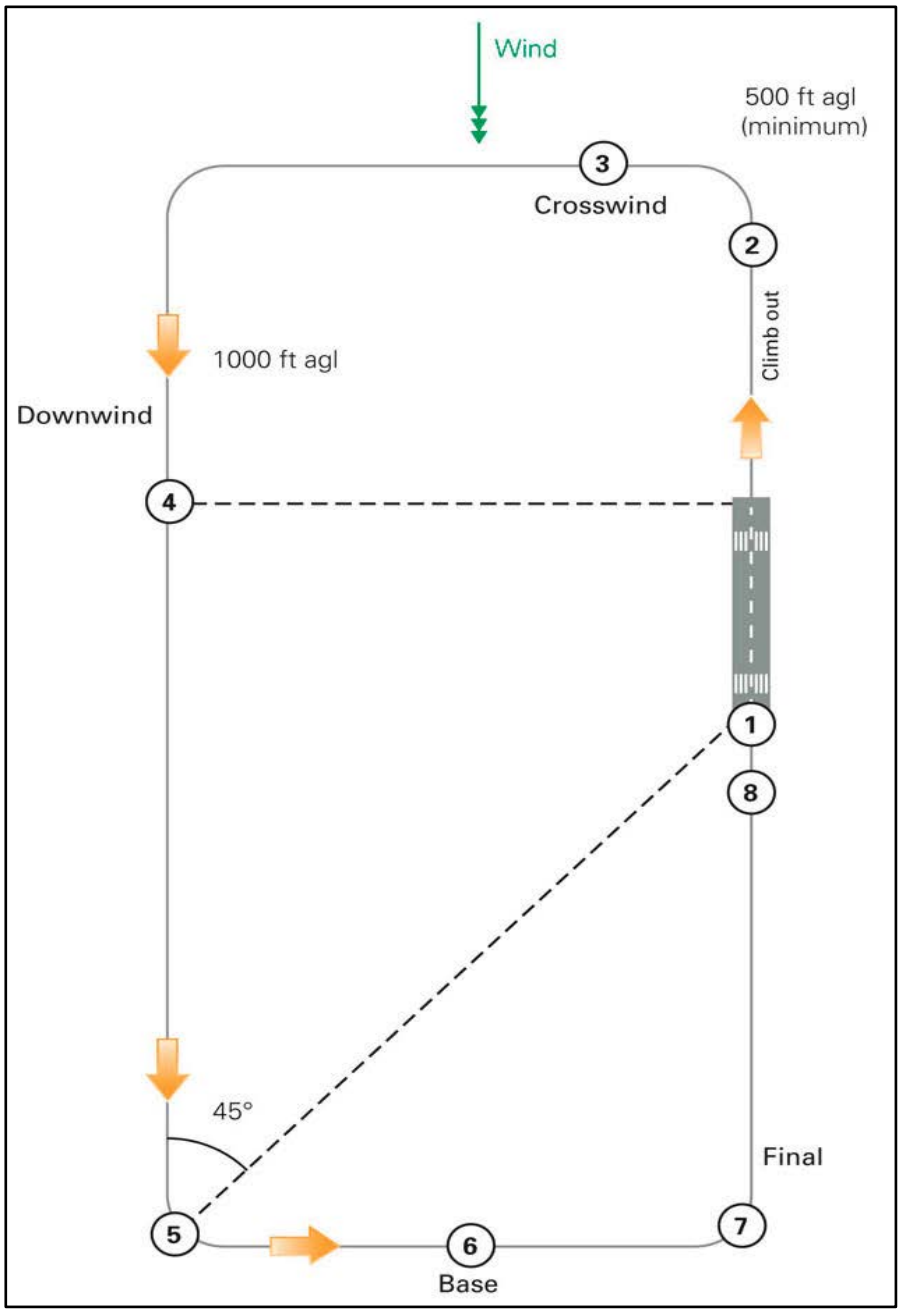

Figure 2
Standard left-hand circuit pattern
(from CAA website)

3.6.1. The zone at Hamilton aerodrome is shown in Appendix 1. The runways in use at the time were Runway 18L, which was sealed for 2,059 metres, and the parallel Runway 18R, which was sealed for 630 metres.

3.6.2. The downwind leg for the left-hand circuit started at point 4 in Figure 2. Aeroplanes following the visual circuit pattern would normally turn onto final 1-2 nm out from the threshold at point 7. IFR aircraft would also enter this circuit pattern at point 7 after a straight-in approach from a reporting point 12 nm out (off the bottom of Figure 2). The right-hand circuit traffic would follow a mirror version of the left-hand circuit and also enter the final leg at point 7.

Circling procedure

3.6.3. Circling is a standard IFR procedure that may be used when the final instrument approach track does not align with the landing direction. Circling is conducted so that the pilot keeps in sight the end of the runway that is to be used for landing. The pilot training syllabus for an instrument rating includes practice in the circling manoeuvre.

3.6.4. The Hamilton flight training organisations and ATC had agreed to a non-standard circling procedure after an IFR straight-in approach. An IFR training aeroplane would request a circling procedure on the flight plan. The pilot would then reconfirm with the aerodrome controller during the approach that it was still acceptable.

3.6.5. The circling procedure followed a standard instrument approach from about 10 nm out. At around point 7 on Figure 2, at about 800 feet (245 metres) above sea level and with the runway in sight, the pilot would overshoot and maintain that altitude to the runway threshold (point 1), or another point nominated by the aerodrome controller, where they would commence a right-hand circle. This would bring the aircraft back to point 7 for a normal landing. Usually the pilot would be cleared to land next, but they could also be instructed to extend downwind or reposition for a different sequence.

3.6.6. Although the circling manoeuvre was flown with visual reference to the ground, the aircraft was still an IFR flight. ATC was required to provide separation between an IFR aeroplane performing a circling manoeuvre and other IFR traffic, and to advise IFR traffic of the whereabouts of nearby VFR traffic.

4. Analysis

4.1. Introduction

4.1.1. An aerodrome controller's prime objective is to maintain a safe flow of air traffic within the vicinity of the aerodrome and to provide clearances, instructions and information to pilots in order to prevent collisions. This is generally achieved in standard circuit patterns by sequencing aircraft to minimise speed differentials and allow pilots maximum time to identify and avoid other aircraft.

4.1.2. Any loss of separation between aircraft is of concern, but it is more so when ATC actions intended to prevent a collision are responsible for creating the potential conflict.

4.1.3. The following safety issues are discussed:

- the standard of team resource management (TRM) in the Hamilton ATC tower did not match good industry practice
- changes in the size and shape of the Hamilton zone have shifted some VFR traffic congestion to prominent points outside the zone, and likely increased the risk of collision in those areas
- some aerodrome controllers are 'over-controlling' VFR traffic in and around the zone, which is unnecessarily congesting the radio frequencies and risks causing difficulties for inexperienced pilots and those for whom English is their second language.

4.1.4. The Commission also considered previously reported airspace incidents and issues that had been raised in the CAA's public consultation on a review of the Hamilton airspace for their potential influence on this incident. The flight activity at Hamilton was the most intensive in the country, with a high number of airspace incident notifications. It was not clear whether the number of incidents was due to a diligent reporting culture among the flight training organisations, was due to the volume of air traffic, or reflected underlying safety issues.

4.1.5. The significant issues that have been of concern to users of the Hamilton airspace are described in section 4.5, along with actions that have been taken to address them.

4.2. What happened

4.2.1. The controller arrived about 30 minutes before the shift with the expectation that there would be time to discuss the assessment process with the assessor. The assessor arrived five minutes before the shift was due to start and met the controller in the cab. The briefing was reduced to a short exchange in the cab as the controller prepared for the handover. The assessor made comments along the lines of it just being "a normal day". However, the other two aerodrome controllers in the cab were not part of this discussion, so the usual 'setting of the scene' and agreeing on team expectations were not achieved before the assessment began.

4.2.2. The traffic remained moderate for the first 30 minutes, with a constant demand from aircraft wanting to enter the zone. It then increased because most IFR training aircraft had requested circling approaches, which slowed the circuit flow and increased the controller's workload. Circuit training was also taking place with up to four aircraft at a time.

4.2.3. Soon after accepting the handover as aerodrome controller, there were indications that the controller was not in total control of the situation. The situation became increasingly worse until the assessor relieved the controller. The controller had tried to accommodate all pilot requests, but in doing so had not achieved an orderly flow, anticipated conflict or managed the number of aircraft within the circuit. The controller had also been unable to keep the flight strips current to reflect traffic in the circuits and the instrument approach.

4.2.4. The first incident began when the controller allowed the Beechcraft 1900 to conduct a low approach and overshoot in an already moderately busy circuit. The Beechcraft 1900 pilot's

request could have been declined, which would have avoided an unnecessary increase in the controller's workload and a disruption to aircraft already in the circuit. The controller then omitted to advise two light aircraft following the Beechcraft 1900 of the risk of wake turbulence.

4.2.5. In the second incident the controller issued instructions that brought the Katana and Robin unnecessarily into conflict. When the potential conflict was pointed out by the planner, the controller reacted by issuing an instruction that further increased the risk of a collision.

4.2.6. In the third set of incidents the radar conflict alert warnings were indicating that the final approach area was congested. The controller had approved consecutive IFR aircraft to do circling approaches, then sequenced them too close to each other. The first one was circling back to line up when the radar detected the potential conflict as the next one approached.

4.2.7. An analysis of the ATC recordings revealed the controller's pace of speech increasing near to the end of the assessment period. The controller also spoke more often in an effort to provide traffic information to the pilots of all the aircraft under control. Trainee pilots had less time to comprehend and respond to the controller's instructions and others were blocked from transmitting.

4.2.8. The fourth incident included two serious aspects. The first was a loss of separation for an IFR aeroplane under the controller's instructions and the second was the non-standard instructions given to a VFR student pilot who was on their first solo flight. It was normal protocol at Hamilton for aerodrome controllers to provide a clear space around first solo flights to allow the pilots to concentrate on their flying. The VFR student's flight instructor had advised the controller that this student was on their first solo flight and the controller had acknowledged this before the instructor left the aircraft.

4.2.9. At this point the assessor took over as aerodrome controller and cleared all aircraft from the approach area for the VFR student pilot to be the first to land. The second planner assisted the assessor to identify and resolve traffic conflicts and to re-establish an orderly flow.

Related factors

4.2.10. The controller had been working at the Hamilton ATC unit for about 18 months. The controller had been assessed multiple times during the initial six-month validation training. The most recent assessment had been the first during operational duty at six months' experience, and the assessment on this day was the second. The controller had worked the afternoon shift on the day before without incident. The controller's actions on this day were uncharacteristic.

4.2.11. The weather conditions on the day were fine, clear and not a factor in this incident. The amount of traffic was not out of the ordinary for Hamilton, nor was it unmanageable. The controller had managed situations like this safely before. Shortly after the controller was relieved, the unit manager was confident that the less experienced second planner could take over as a solo watch until a relief could be arranged. The air traffic movement frequency remained similar to that during the incident.

4.2.12. The Monday and Tuesday before the incidents had been scheduled days off for the controller, then the controller worked the Wednesday afternoon shift. The controller had received private flying lessons on Monday, Tuesday and Wednesday morning. The controller later admitted not feeling the best at the start of the Thursday shift, but had felt well enough to not call in sick. For these reasons, fatigue and illness were discounted as factors.

4.2.13. However, the controller was nervous about the assessment and wanted time to discuss this with the assessor before the assessment began. When the pre-briefing was replaced with a short exchange in the cab, the controller was concerned. The controller was anxious to demonstrate proficiency. The issue of how the assessment was performed is discussed in the following sections.

4.2.14. It was evident from the four incidents noted in this report and the written comments from the assessor that the controller was reacting to pilot requests rather than being in control of

managing the traffic flow and the team. The rapid issuing of traffic information and increased rate of speech late in the assessment were both indicators that the controller was feeling under pressure (EATCHIP, 1997, p. 31).

4.2.15. The Commission engaged a clinical psychologist[16] to assist at interviews of key participants and to analyse the controller's actions from a psychological perspective. The psychologist's assessment of the controller's actions stated, in part:

> The controller appears to have experienced 'choking under pressure', a phenomenon defined as "a critical deterioration in the execution of habitual processes as a result of elevation in anxiety under perceived pressure, leading to substandard performance" (Mesagno, Harvey, & Janelle, 2012). The effect is commonly observed in athletes and students and characterised by levels of performance which are below those that would normally be expected. While such an event may be embarrassing rather than life-threatening in a sporting event, its occurrence in an aviation context represents a potential risk to safety.

4.2.16. For a number of reasons, the controller did not achieve their normal standard of proficiency on that day. However, one person's actions or inactions should not result in accidents or incidents if other preventive measures are in place. Properly followed policies and procedures and, above all else, teamwork should prevent an accident or incident occurring. The following sections discuss other safety issues with the wider system in which the controller was working.

Finding

1. The series of incidents occurred because the controller became overwhelmed by the circumstances on the day then lost situational awareness of the aircraft within the control zone.

4.3. The air traffic control assessment process

Proficiency expectations

4.3.1. The ATC assessment process includes 10 competencies that an aerodrome controller must demonstrate. The top three core competencies are: apply situational awareness; manage the traffic situation to achieve an orderly flow; and critically analyse traffic for potential conflict and apply timely resolutions. These core competencies provide the foundation skills that an aerodrome controller needs to manage air traffic safely.

4.3.2. An aerodrome controller develops their primary situational awareness by looking for aircraft out of a window and listening to local radio frequencies. Their main tool is the flight progress board with which they track aircraft through sectors and stages of arrival and departure. They can also use the surveillance radar to confirm the identity of a distant visual contact and to check on aircraft positions.

4.3.3. An aerodrome controller also manages the operational team's workload. That is, they manage their own performance and any interpersonal factors that might prevent the team performing in a supportive manner. In the broader sense, this means the aerodrome controller must be aware of each individual's workload and set the pace of traffic flow to match the team capacity.

[16] Keith McGregor, Personal Psychology NZ Ltd, Lower Hutt

4.3.4. By the time an aerodrome controller has gained their licence, they will have progressed through a rigorous training system with regular progress assessments and tests followed by a period of on-the-job instruction. After further check observations and simulated assessments, they are assessed for their licence. By the time they are licensed, validated and operational at an active ATC unit, they are considered to be acting competently and responsibly.

4.3.5. Consequently, a proficiency assessment would normally be a routine process resulting in minor changes to improve their technique. It would therefore be unusual for an assessment to be terminated for operational reasons.

4.3.6. Individual aerodrome controllers may react differently to the same stimulus. In order to conduct a fair assessment of proficiency, the assessment process must not impose an artificial pressure on the person being assessed or the operational team. The CAA Advisory Circular AC65-9 contains a checklist of items against which an instructor is assessed to become an assessor. The list covers for example, the instructor's ability: to conduct a pre-assessment briefing[17] with the person to be assessed in an appropriate environment; to reduce stress the person being assessed may be feeling; and to advise others who may be affected by the assessment that it is going to take place, including any special requirements the assessor may have for them.

This assessment

4.3.7. Due to the assessor's time of arrival, the standard pre-assessment briefing was replaced by a brief conversation in the cab, then the assessment started with the handover of ATC to the controller. The assessor did not conduct the required key de-stressing actions before the assessment began or determine whether the controller was ready to be assessed.

4.3.8. The assessor noticed a degree of tension in the cab upon arrival. The assessor attributed the tension to something between the three aerodrome controllers. The other two aerodrome controllers in the cab were unaware until then that an assessment was to be performed. In the absence of a formal briefing, the others were left to assume what the assessor expected of them during the assessment.

4.3.9. The assessor became increasingly uncomfortable with the controller's performance during the assessment, particularly the management of potential traffic conflicts. The assessor had been involved with the controller's training at the Hamilton ATC unit and was familiar with the controller's style. It was clear to the assessor that the controller was not operating normally or to the required standard, but the assessor was unsure if the assessment could be terminated early. The assessor intended to discuss this with the unit manager at the next scheduled break.

4.3.10. According to a senior Airways ATC examiner at the air traffic controller training centre, if a person being assessed does not meet any one of the 10 competencies, they are not competent to remain in control and the assessment should be terminated. The examiner also said that an assessor should not let a situation develop to an extent that an incident occurs but acknowledged that it "was a subjective judgement call". The examiner further explained that "the aerodrome environment is particularly tricky as things happen so much more quickly and aeroplanes are much closer to each other".

4.3.11. Based on these comments from the examiner, it would have been good practice to stop the assessment or withdraw the controller from their active position within the first 30 minutes. Other qualified aerodrome controllers were present at the time to take over. The unit manager could also have been signalled to go to the cab if required.

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[17] The assessment briefing is outlined in Appendix C of AC65-9 and the guidance provided in the International Civil Aviation Organization's Air Traffic Services Planning Manual (Doc 9426-AN/924)

4.3.12. Airways submitted that it "will undertake a review of the assessment procedure to determine any further improvements across Airways on how assessment should be carried out, including steps to support staff to make better judgement calls in such assessment situations".

4.3.13. The circumstances of the assessment appear to have affected the team dynamics in the cab; this is addressed in the following section.

4.4. Team resource management

Safety issue: The standard of team resource management in the Hamilton ATC tower did not match good industry practice.

Operational teamwork

4.4.1. Airways says that it operates with a 'just culture' in which people are encouraged to provide essential safety-related information. A just culture is defined as:

> One where front line operators are not punished for actions, omissions or decisions taken by them which are commensurate with their experience and training but where gross negligence, wilful violations and destructive acts are not tolerated (EUROCONTROL, 2018).

4.4.2. The European Air Traffic Control Harmonisation and Integration Programme[18] has been co-ordinating ATC standards across Europe for more than 20 years and has an extensive library on related human factors[19]. In 2009, EUROCONTROL identified that teamwork was one of the top 10 priority areas for ATC that needed further work if it was going to improve on the current level of safety. It produced a guideline for good TRM in ATC (EUROCONTROL, 2015). The International Civil Aviation Organization (ICAO) introduced an associated framework, called 'Threat and Error Management' (ICAO, 2008), to help ATC managers understand and manage system and human performance in operational contexts to enhance aviation safety.

4.4.3. The aim of TRM is to provide a strategy for air navigation service providers, such as Airways, to make the best use of all available resources (information, equipment and people) to optimise the safety and efficiency of air traffic services (EUROCONTROL, 2007). In such an environment, a member of an operational team should feel free to raise a safety concern with another member of the team during a situation and that person should be able to accept and use that feedback to improve the team performance. To be effective, the team must also have a clear vision of what behaviour is preferred and what is unacceptable in terms of their professional responsibilities and standards. The team members must also understand and put into practice the human factors concepts that contribute to an efficient team and teamwork.

4.4.4. Airways trains aerodrome controllers to be competent in solo-watch positions. Teamwork, interpersonal communication and other teamwork-related human factors are covered in the basic ATC course, then again through the aerodrome controller course in Christchurch. During the on-the-job instruction phase in Palmerston North, they learn to task share with planners, but this is specific to Palmerston North. During the validation training at Hamilton they are taught the specific task-sharing for that ATC unit. However, task-sharing is not the same as TRM or teamwork.

4.4.5. The aerodrome controller is in charge of the operational team, which includes a planner for dual watch periods and may include a flight data assistant. Both aerodrome controllers are

[18] This was one of the initiatives launched in 1990 by the member states of the European Union to create a seamless European ATC system.
[19] Human factors is the application of psychological and physiological principles to the (engineering and) design of products, processes, and systems. The goal of human factors is to reduce human error, increase productivity, and enhance safety and comfort with a specific focus on the interaction between the human and the thing of interest.

qualified in each role and they usually swap roles during a shift. Although an assessor was present for this incident, the assessor is not normally part of the operational team. However, in an emergency the assessor is able to perform the aerodrome controller or planner role and is a resource available to the operational team. The assessor's presence can also have an effect on the operational team dynamics.

4.4.6. Airways had developed a training course to improve teamwork and raise the professional standards of controllers, but at the time of this incident none of the Hamilton controllers had completed the course.

Team resource management in the cab

4.4.7. Both planners were familiar with the controller's style and recognised that the controller was not performing well at the time. The second planner was of the view that it was the controller's licence at stake and did not see that as a shared responsibility. The assessor had not clarified with the two planners what was expected of them during the assessment.

4.4.8. There were some elements of co-operation and some advice given to the controller, but overall the circuit patterns were regularly overloaded, which indicated that the team had not managed the traffic flow well.

4.4.9. At one point while on a rest break at the rear of the cab, the second planner observed the emerging situation that resulted in the second incident. The second planner voiced their concern to both the first planner and the assessor. The first planner relayed that concern to the controller. The controller then attempted to resolve the conflict but was not successful in doing so.

4.4.10. The second planner said later that both planners had suggested to the controller at different times that they land some of the aeroplanes on circuit training to ease the workload, but that did not happen. Landing some of the circuiting aircraft was a standard tool used by aerodrome controllers at Hamilton to relieve traffic congestion. The planner organised aircraft waiting to enter the zone so was usually more in touch than the aerodrome controller with the immediate future traffic demand and able to advise the controller if a peak was due.

4.4.11. When the assessor eventually took control, the team dynamics suddenly changed. The second planner immediately became more co-operative and took proactive steps to assist the assessor to reduce congestion in the zone. There could have been several reasons for this change, such as the assessment having been terminated or the immediate risk of further incidents. However, it also emphasised how the team had not worked during the assessment.

4.4.12. The incident highlighted the importance of working together as a team. It also emphasised the importance of setting the scene for the team before an assessment. Normally, regardless of who is in control, it would be a team responsibility to manage traffic in a zone. This should not change when an assessment is being conducted. Although an assessment may be focused on an individual's proficiency, it should also include the proficiency of other members of that team in supporting the team objectives.

Team dynamics at the Hamilton ATC unit

4.4.13. A well performing team needs to put personal differences aside and work together. However, some of the interpersonal dynamics at the ATC unit were likely to have influenced the operational team's performance on this day.

4.4.14. The unit manager had been in the role for just over three years at the time of these incidents and had previous management training and experience as a manager with Airways and other employers. The unit manager said that Airways had provided management support and guidance in the current role. The unit manager was responsible for all activities within the ATC unit, including operational standards, training, recruiting and maintaining the unit's business relationships with other users and customers. The unit manager had attempted unsuccessfully to resolve personality conflicts between several aerodrome controllers. The

last measure was to separate those aerodrome controllers to some extent with roster adjustments.

4.4.15. Hamilton employed only qualified aerodrome controllers, and most were recently licensed through the Airways ATC training system. During an aerodrome controller's last stage of training at the Palmerston North ATC unit, the unit manager there spent a lot of time in the cab working with the trainees and offering mentoring advice and guidance. The Hamilton ATC unit manager was unable to provide this level of support in the cab, and relied on other methods of feedback to check on service delivery and team performance.

4.4.16. The unit manager had attempted to roster more experienced aerodrome controllers to work alongside the new ones as unofficial mentors, but it had not always been possible with a high proportion of inexperienced aerodrome controllers working in the Hamilton ATC unit, nor had it been effective. For example, in one situation, well intended mentoring advice had led to conflict.

4.4.17. The Commission was informed repeatedly that the Hamilton ATC unit was an undesirable place for aerodrome controllers to work. This was claimed to be mainly associated with the heavy workload at Hamilton compared to other locations where aerodrome controllers had the same employment conditions. Consequently, staff turnover was high and tenure was short at Hamilton. Replacements proved difficult to engage and, overall, the workload had a detrimental effect on staff. The main source of replacements was the Airways training centre, where graduates had little choice for their first posting.

4.4.18. This default influx of recent graduates lowered the average experience level of aerodrome controllers at Hamilton. Once qualified, an aerodrome controller gains experience in the role but will take time to develop judgement to handle situations that are different from their training environments. It was difficult for the unit manager to manage this risk when there were only eight aerodrome controllers in the establishment and more than 50% had less than two years' experience as licensed aerodrome controllers. The unit manager had employed aerodrome controllers from overseas at times in order to meet the unit's minimum-experience target.

4.4.19. The aerodrome operator[20] was concerned about the relative inexperience of aerodrome controllers and their high turnover rate. It had recommended in its aeronautical study in 2012 (refer to section 4.5.5) that Airways "consider options associated with ensuring aerodrome controller turnover is minimised". CTC Aviation Training (NZ) Limited (CTC), the major flight training operator at Hamilton, had raised the risk rating for its Hamilton operations in December 2017 as a consequence of its concern about the average experience of the aerodrome controllers.

4.4.20. The potential risk presented by the lack of experienced aerodrome controllers at Hamilton and the predominance of recent graduates appears to have reduced with the introduction of a mentoring role. This risk is well known and a focus point within the aerodrome safety system. Airways submitted that the relevant practices at the Hamilton unit did not differ because of the level of aerodrome controller experience. However, others operating at the aerodrome disagreed. As the existing aerodrome safety systems have been further developed, this issue can be managed at a local level. For this reason, a safety recommendation has not been issued to Airways.

4.4.21. Actions taken by Airways, including an organisational restructure and training provided to the unit manager and aerodrome controllers, is expected to improve teamwork and free up some of the unit manager's time to raise service delivery standards. This has alleviated the need for a safety recommendation to Airways in relation to teamwork.

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[20] Waikato Regional Airport Limited.

Findings

2. The assessment that was being conducted of the controller affected the normal team dynamics in the control tower, partly because a standard pre-assessment briefing was not conducted and the expectations of the team during the assessment were not explained.

3. During the assessment there was a breakdown in the team approach to managing the traffic in the aerodrome circuit, which was a significant factor contributing to this series of incidents.

4. Airways' practice of posting a high proportion of recently qualified aerodrome controllers with limited experience to Hamilton aerodrome, one of the busiest in the country, had the potential to raise the risk profile of the ATC unit.

4.5. The wider safety issues for Hamilton aerodrome

4.5.1. Participants in the aviation system are required by Civil Aviation Rules Part 12, Accidents, Incidents, and Statistics, to notify the CAA of accidents and certain incidents. They are also required to investigate incidents that they notify and to provide the CAA with the results of those investigations. Hamilton aerodrome had a high rate of incident notifications to the CAA. The CAA's involvement with the aerodrome safety system had been largely confined to monitoring events, until it was prompted to examine the aerodrome safety system after a near-collision in 2013.

4.5.2. The Commission had also been monitoring the incidence of airspace notifications at Hamilton. This inquiry provided an opportunity for the Commission to examine the underlying issues in the wider aerodrome safety system. The more significant safety issues that were of concern to participants at Hamilton aerodrome are described below.

The aerodrome safety system was ineffective

4.5.3. In 2005 CTC started up operations at Hamilton aerodrome. The high number of trainee pilots greatly increased the workload for aerodrome controllers. During 2015 CTC had about 15 aircraft in the air during the peak training period each day, with several in the circuit at any time.

4.5.4. The CAA encourages the creation of user groups to improve safety at aerodromes where there are multiple users, often with different airspace requirements. Airways took the lead in setting up a user group at Hamilton and ran it until the aerodrome operator took over.

4.5.5. In 2011, as a result of a safety concern, the CAA required the aerodrome operator to conduct an aeronautical study[21] under Civil Aviation Rules Part 139, Aerodrome – Certification, Operation and Use. The study was intended to review the aerodrome and operations to ensure that appropriate safety criteria were in place. The aerodrome operator provided the aeronautical study report to the CAA in May 2012.

4.5.6. The CAA used the incident data notified by aerodrome participants in accordance with Civil Aviation Rules Part 12 to prepare statistical safety performance data for each aerodrome. An aerodrome operator needed to know the relevant data and analyses in order to fulfil its responsibilities in accordance with Civil Aviation Rules Part 139. Until 2014 the CAA had not provided aerodrome operators with this data. The Hamilton aerodrome operator had obtained

[21] An aeronautical study is defined in CAA Advisory Circular AC139-15.

copies of the information from Airways. The CAA now sends monthly incident data reports to all Part 139 aerodrome operators.

4.5.7. In January 2013 the CAA investigated a near-collision at Hamilton, which led to an investigation of wider issues related to the airspace incidents[22]. The safety investigation revealed a strained relationship between Airways and CTC and a failure by participants to identify the root causes of the incidents. The CAA assisted the parties to resolve these issues and in May 2013 conducted a two-day workshop at Hamilton with all users. The parties changed their behaviour and by the end of that year the aerodrome operator had taken over its responsibility under Part 139 to lead the aerodrome safety system.

4.5.8. The previous user group was disbanded and replaced with a structured governance group with sub-committees for aerodrome management, safety and operations. Meetings were held regularly, and minutes produced with action items to complete for the next meeting. Airways and CTC rebuilt their damaged relationship and were fostering their future co-operation.

4.5.9. By 2017 aerodrome users were reporting that the aerodrome operator's safety management system was an effective platform for resolving local safety issues.

The zone was too large and boundaries not clearly defined

Safety issue – Changes in the size and shape of the Hamilton zone have shifted some VFR traffic congestion to prominent points outside the zone, and likely increased the risk of collision in those areas.

4.5.10. The zone covered the aerodrome and the instrument approach paths to the north and south. VFR entry and exit sectors were located on the eastern and western sides. It was classified as Class D airspace, which required ATC to provide separation between IFR traffic and between IFR and special VFR traffic. VFR traffic was responsible for its own separation.

4.5.11. The size of the zone was claimed by some users as too large, because it resulted in one aerodrome controller having too many aircraft to manage. Another concern was that the boundary of the zone was difficult to identify from the air. There was also criticism that the Hamilton zone was depicted across the edges of adjacent navigation charts, which was a challenge for novice pilots as they swapped between charts in busy airspace.

4.5.12. The CAA conducted a review and public consultation as part of its continuing airspace review conducted under Civil Aviation Rules Part 71, Design and Classification of Airspace. In late 2016 the zone was redesigned and reduced in size. The chart issue was still being considered.

4.5.13. After these changes were promulgated, the rate of airspace occurrences started to decrease. Data for the 12 months following the airspace changes showed a significant and sustained drop in airspace occurrences at Hamilton.

4.5.14. However, the changes had the effect of shifting congestion to uncontrolled airspace, and some features of the proposed circular flow in the circuit were not implemented. The crucial benefit that the CAA expected from the airspace changes was a more efficient circuit traffic flow, but this has not been achieved. According to CTC, departures had improved, but arrivals are still directed to join at the start of the downwind leg or late downwind, only to be extended further downwind. This has led to a concentration of VFR aircraft just outside the zone near easily recognisable landmarks, and has likely increased the risk of a collision near those points.

[22] CAA internal investigation, draft 13/SIP/0003 Hamilton Aerodrome.

4.5.15. Consequently, the airspace design around Hamilton and the traffic density have created a hazard in uncontrolled airspace. The VFR arrival procedures described in the Aeronautical Information Publication (AIPNZ)[23] draw pilots to a reporting area within a 300-foot (91-metre) height band adjacent to the lower limit of the 2,000-foot (609-metre) control area above the aerodrome. This height band is further limited if a pilot wishes to stay clear of the overhead control area with a self-imposed safety buffer. Multiple VFR aircraft could be holding in this narrow band, with the pilots keeping a lookout for other aircraft.

4.5.16. There is no guidance for VFR pilots on a safe approach procedure to the zone while awaiting clearance to enter. Nothing is mentioned in the VFR arrival charts or documented in the Hamilton control tower Local Unit Orders for aerodrome controllers to manage potential queues of aircraft holding outside the zone. Local users have asked the CAA to produce a 'Good Aviation Practice' booklet for the Hamilton area, but one has not yet been written. Local users mitigate this congestion through their own operational procedures, but itinerant users of the aerodrome are unlikely to be aware of them and are not bound by them.

4.5.17. The airspace changes have reduced the rate of incident reports in the zone, but it is apparent from user feedback obtained in late 2017 for this investigation that not all issues have been resolved and that the CAA needs to remain actively involved with the aerodrome safety groups. A safety recommendation to the CAA has been made to this effect.

ATC over-controlling and excessive traffic information

Safety issue – Some aerodrome controllers are 'over-controlling' VFR traffic in and around the zone, which is unnecessarily congesting the radio frequencies and risks causing difficulties for inexperienced pilots and those for whom English is their second language.

4.5.18. During 2010 a CAA audit of the Hamilton ATC unit found that it was providing separation between VFR aircraft inside the Class D airspace zone. This was not part of the required service for Class D airspace and it created the possibility for pilots to misinterpret what to expect from ATC. Users also claimed that ATC was often over-controlling.

4.5.19. Over-controlling was also found to be occurring by the CAA investigation in 2013, which also noted incidents of non-standard phraseology, overly long communications and ambiguous messages. The audio records reviewed during this series of incidents in 2015 identified that the aerodrome controllers were passing excessive traffic information to aeroplanes when there was no need. CTC continued to raise similar concerns about over-controlling in 2017 through the aerodrome safety system, and emphasised that protracted traffic information was a challenge for most trainees, including those with English as their first language.

4.5.20. The majority of air traffic in the Hamilton zone is VFR, for which ATC does not provide separation. ATC is required to provide information or instructions to pilots within the zone when necessary, to help them to avoid collisions and to create a patterned and sequenced flow. Many of the aircraft in the Hamilton circuit patterns would be irrelevant to a pilot about to join downwind for the left-hand circuit, when that pilot would just expect a sequence and to be able to identify the aeroplane ahead.

4.5.21. The guidance provided in AIPNZ Gen 3.3.13[24] states that traffic information is issued "to alert a pilot to other known or observed air traffic that may be in proximity to the position or intended route of flight and to help the pilot avoid a collision". This is the same as the definition for traffic information in Airways' Manual of Air Traffic Services.

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[23] AIPNZ AD 2 – pages 35.4 and 35.5.
[24] Aeronautical Information Publication (AIPNZ), published by the CAA.

4.5.22. However, the text within Airways' Manual of Air Traffic Services has a broader interpretation for when ATC is required to provide information. It states[25] that pilots shall be advised of "traffic operating in the 'vicinity of the aerodrome' that may constitute a hazard to the aircraft concerned" and leaves it to the judgement of the aerodrome controller to determine when it is necessary in the interests of safety. The 'vicinity' of the aerodrome includes all aircraft within the circuit patterns and the zone.

4.5.23. The CAA investigation in 2013 found several anomalies between the interpretation of written procedures and the requirements for ATC services in documents produced by the CAA, Airways and ICAO. It also found that Airways' Local Unit Orders for the Hamilton ATC unit were the responsibility of the unit manager, which opened the possibility of different interpretations for the same airspace category around the country.

4.5.24. As the issue of aerodrome controllers over-controlling and passing excessive information is still evident at Hamilton, the cause seems to be embedded in the ATC training system and the predominance of inexperienced aerodrome controllers at the Hamilton ATC unit, as referred to in previous sections. A safety recommendation has been made to Airways to address this issue.

Language barriers

4.5.25. Most of the pilot trainees at Hamilton come from outside New Zealand, and for many English is not their first language. They have to be able to communicate in English before they can start training, but accents remain strong. This can hinder communication with ATC and highlights the importance of standard phraseology and pace of delivery.

4.5.26. Language was a concern to Airways, but CTC considered that a greater risk was to ignore the cultural differences. Some cultures are reluctant to express differences of opinion and some pilot trainees may attempt to comply explicitly with ATC instructions. The concern was that such obedience could expose a pilot to exceeding their own abilities or their aircraft's capabilities if an ATC instruction were impractical.

IFR circling procedure

4.5.27. The IFR training syllabus was required to cover the circling procedure after an instrument approach. The local arrangement for this procedure required an IFR pilot to become visual with the runway and conduct a right-hand circle from the threshold of Runway 18 at 800 feet (245 metres) above sea level. If traffic allowed they would be sequenced as number one, but otherwise they would be required to extend downwind at low level away from the threshold to join with a different sequence.

4.5.28. As an exercise, this local procedure did not instil the correct procedure for circling because the pilot lost sight of the runway and then came back to the same vector. More importantly, as seen during these incidents, the orbit in the final approach area created congestion and a collision risk.

4.5.29. The parties involved have since agreed on a more practical and realistic method that positions aircraft into the normal active circuit pattern.

Circuit booking system

4.5.30. In order to help reduce the peak number of aircraft doing circuit training, a booking system was established to spread circuit use across the day. CTC has three 'slots' and Waikato Aviation one slot. The slots are managed online, with aircraft being booked for half-hour slots. When the allotted time is up, the pilot lands or leaves the circuit pattern. CTC and Waikato

[25] Manual of Air Traffic Services RAC 4, section 4.1.2.

Aviation may sometimes negotiate more slots from each other's allocation, but four aircraft in the circuit at once is the maximum available.

4.5.31. Airways may reduce traffic density by instructing a pilot on circuit training to land for a period. This allows the aerodrome controller to clear the traffic peaks within the zone.

4.5.32. CTC agreed to fund a flight data assistant part-time in the tower to assist the aerodrome controllers with administration tasks and managing the circuit booking system. This funding was increased during 2017 to employ the flight data assistant five days per week.

Summary conclusions

4.5.33. Hamilton aerodrome has had many issues over many years that have caused acrimony between users and led to airspace incidents. By 2017 the aerodrome operator, Airways and other users had made significant progress in resolving those issues and improving aerodrome safety. Some issues still remain, but these can be managed through the aerodrome safety system with assistance from the CAA.

4.5.34. CAA statistical data indicate that there has been a significant safety improvement at Hamilton since late 2016, one year after the incident that initiated this inquiry. This improvement is coincident with changes introduced to the Hamilton zone by the CAA and Airways.

Findings

5. Airspace incidents within the Hamilton control zone have reduced since airspace changes, but not all user concerns have been resolved and the risk of a conflict outside the zone has increased as a result.

6. Some aerodrome controllers at Hamilton were passing more traffic information to pilots than was necessary, which instead of improving aviation safety was creating radio congestion and difficulties for pilots, particularly those for whom English was their second language.

5. Findings

5.1. The series of incidents occurred because the controller became overwhelmed by the circumstances on the day then lost situational awareness of the aircraft within the control zone.

5.2. The assessment that was being conducted of the controller affected the normal team dynamics in the control tower, partly because a standard pre-assessment briefing was not conducted and the expectations of the team during the assessment were not explained.

5.3. During the assessment there was a breakdown in the team approach to managing the traffic in the aerodrome circuit, which was a significant factor contributing to this series of incidents.

5.4. Airways' practice of posting a high proportion of recently qualified aerodrome controllers with limited experience to Hamilton aerodrome, one of the busiest in the country, had the potential to raise the risk profile of the ATC unit.

5.5. Airspace incidents within the Hamilton control zone have reduced since airspace changes, but not all user concerns have been resolved and the risk of a conflict outside the zone has increased as a result.

5.6. Some aerodrome controllers at Hamilton were passing more traffic information to pilots than was necessary, which instead of improving aviation safety was creating radio congestion and difficulties for pilots, particularly those for whom English was their second language.

6. Safety issues

6.1. The standard of team resource management in the Hamilton ATC tower did not match good industry practice.

6.2. Changes in the size and shape of the Hamilton zone have shifted some VFR traffic congestion to prominent points outside the zone, and likely increased the risk of collision in those areas.

6.3. Some aerodrome controllers are 'over-controlling' VFR traffic in and around the zone, which is unnecessarily congesting the radio frequencies and risks causing difficulties for inexperienced pilots and those for whom English is their second language.

7. Safety actions

General

7.1. The Commission classifies safety actions by two types:

(a) safety actions taken by the regulator or an operator to address safety issues identified by the Commission during an inquiry that would otherwise result in the Commission issuing a recommendation

(b) safety actions taken by the regulator or an operator to address other safety issues that would not normally result in the Commission issuing a recommendation.

Safety actions addressing safety issues identified during an inquiry

7.2. Subsequent action taken by Airways gave it the confidence to return the controller to full operational duty at Hamilton. The controller has passed at least two annual proficiency assessments since this series of incidents, and has since been posted to another ATC unit.

7.3. Airways introduced an aerodrome controller mentoring system at Hamilton and is considering rolling it out nationwide.

7.4. All aerodrome controllers at Hamilton have attended an Airways-developed course called Coaching on the Go, which is intended to improve professional working standards and ethical conduct. It has recently been reported that the team is working together better and that other aerodrome controllers are now more open to being posted to Hamilton.

7.5. Airways restructured its national management in early 2016. This separated Airways' business development and national training functions from the responsibility of unit managers. This change should relieve the Hamilton unit manager of some administrative tasks and allow them to focus on managing the team and maintaining operational standards.

7.6. The circling procedure has been reviewed by the parties involved and a new method of conducting this exercise has been agreed. The change removes the low-level orbit and sequence congestion near the final leg of the circuit.

Safety actions addressing other safety issues

7.7. The CAA completed its revision of the Hamilton airspace after public consultation, and promulgated the new zone boundary in November 2016. It was adjusted two more times during 2017 in response to user feedback.

8. Recommendations

General

8.1. The Commission may issue, or give notice of, recommendations to any person or organisation that it considers the most appropriate to address the identified safety issues, depending on whether these safety issues are applicable to a single operator only or to the wider transport sector. In this case, recommendations have been issued to Civil Aviation Authority and Airways.

8.2. In the interests of transport safety, it is important that these recommendations are implemented without delay to help prevent similar accidents or incidents occurring in the future.

Recommendation to the CAA

8.3. The CAA has conducted public consultations to address safety issues with the Hamilton zone and promulgated changes. These changes have focused on problems within the zone but have also created new hazards outside the zone. The high VFR traffic volumes around Hamilton create a risk of mid-air collisions near the common entry routes to the zone that local operators cannot manage effectively without CAA involvement. One suggestion from the local users to manage this risk is for the CAA to publish a 'Good Aviation Practice' booklet that explains the best practice for VFR entry to and exit from the zone.

On 23 August 2018 the Commission is therefore recommending that the Director of Civil Aviation raise public awareness of the VFR traffic around the Hamilton area and work closely with aerodrome safety groups to resolve congestion hazards and traffic flow routes into and out of the zone. (020/18)

On 12 September 2018, Civil Aviation Authority replied:

> The CAA in its acceptance of final recommendation 020/18, will carry out the following:
>
> 1 The ongoing proactive liaison will continue with the user group for the purposes of supporting active airspace risk mitigation.
>
> 2 In the longer term, a GAP booklet that will focus on the airspace in and around Hamilton will be compiled with a publishing date envisaged by August 2020.

Recommendation to Airways

8.4. The situation where some aerodrome controllers at the Hamilton ATC unit have been 'over-controlling' by providing VFR pilots with excessive and unnecessary traffic information was described by the CAA in a 2013 report. Evidence of it still occurring was found during this inquiry in 2015 and it was still being raised as a safety issue through the aerodrome safety system and CAA notifications in 2017. It presents an ongoing safety risk to the high number of trainee pilots based in Hamilton.

On 23 August 2018 the Commission is therefore recommending that the Chief Executive Officer of Airways review the current practices of aerodrome control at Hamilton to ensure that the level of ATC service is consistent with CAA rules and the aerodrome safety system. (021/18)

On 6 September 2018, Airways replied:

> Airways wishes to confirm that it will implement the final recommendation of the Transport Accident Investigation Commission pertaining to the Hamilton ATC unit. Much has already been done by way of changes made to the Hamilton airspace to reduce potential conflictions and the need for traffic information, however the following additional actions along with a proposed timeline will be undertaken.

Action	Task	Completion date
1	A senior Performance Coach to conduct an independent live observations audit of current traffic information provision practice. This audit will also include: • A review of national and local unit training and operational guidance material to ensure it adequately sets expectations of the required performance outcome. • Measure current traffic information provision compliance against regulatory expectations. • Canvasing local users for evidence of specific areas of non- compliance • Making recommendations where necessary that would ensure compliance and best practice expectations are meet.	31 October 2018 Hamilton
2	Conduct a program of remote random radio telephone sampling of unit transmissions to measure actual performance against expectations. This sampling will include at least 3 sets of at least 10 transmissions each month for a period of 3 months. Feedback supplied to unit and improvement action plan agreed where necessary.	31 December 2018 Hamilton
3	A review of Radio Telephone performance (including the provision of Traffic Information) to be included as a standard agenda item for the quarterly Hamilton Safety Sub Committee Meetings for a period of 6 months. Where deficiencies in performance are identified a plan is to be agreed by the committee that will address area of deficiency at the root cause level to ensure best practice is achieved by ATC and Pilots alike.	31 March 2019
4	Report summary compiled of actions 1-3 above including relevant evidence for the CEO Airways to satisfy the Commission that actions have been completed and that best practice in relation to the provision of Traffic Information is in place at Hamilton.	30 April 2019

I [Airways] will advise you when these actions have been completed in accordance with your requirements.

9. Key lessons

9.1. Operational assessments in a team situation have the potential to alter the normal team dynamics. It is essential that assessments are properly managed and that every team member is clear on their responsibilities and their involvement in the assessment process.

9.2. Clear, succinct and short radio communication between ATC and aircraft is pivotal to safe operations.

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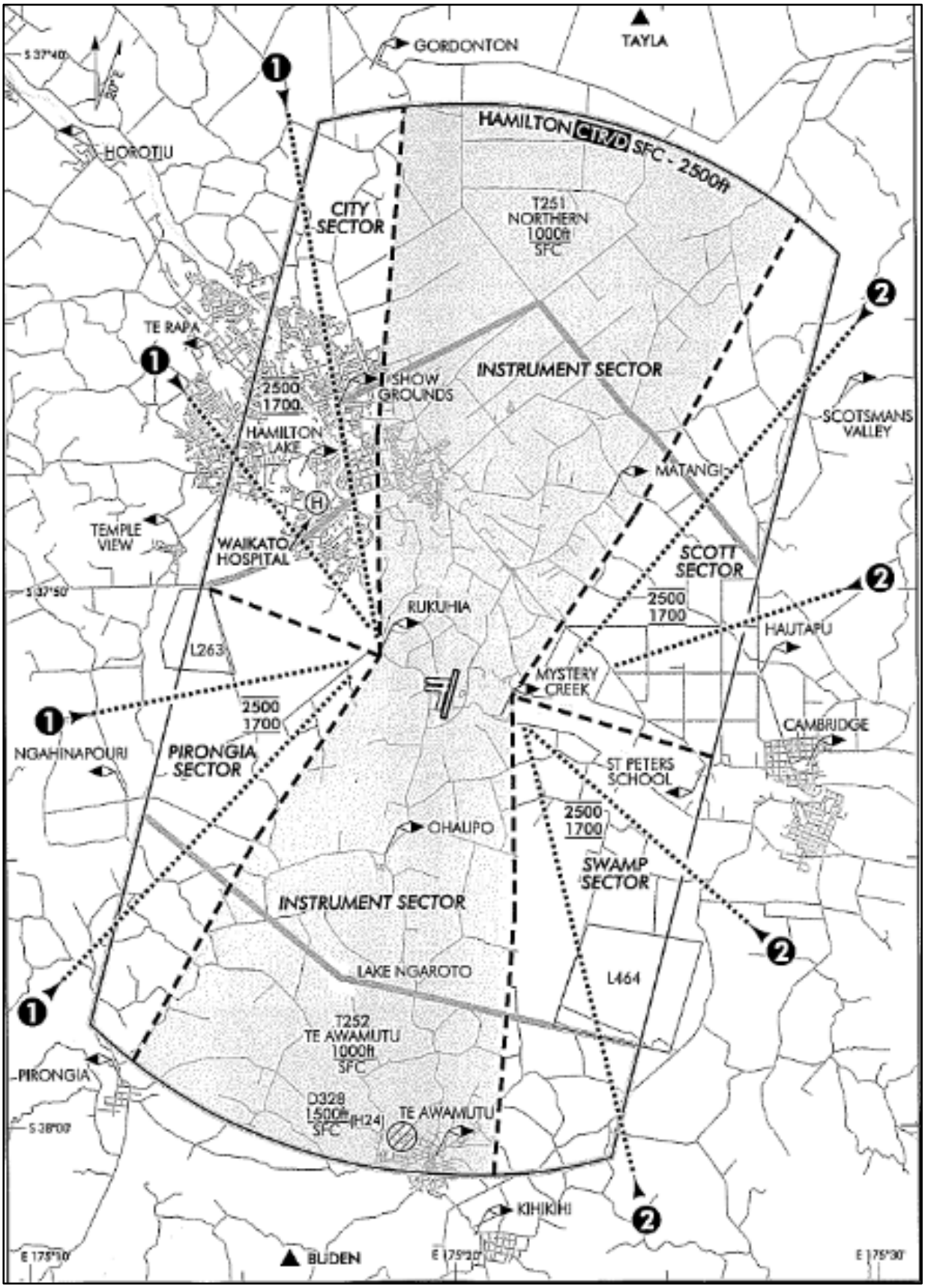
Appendix 1: Hamilton VFR arrival (as at 2015)



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