Report 09-005: Cessna 182N ZK-FGZ and Bombardier DHC-8 Q311 ZK-NEF, loss of separation and near collision, Mercer, 40 km south of Auckland, 9 August 2009

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.

Report 09-005

Cessna 182N ZK-FGZ
and
Bombardier DHC-8 Q311 ZK-NEF

loss of separation and near collision

Mercer
40 km south of Auckland

9 August 2009

Cessna 182N, ZK-FGZ
(Courtesy of NZ Skydive Limited)

Bombardier DHC-8 Q311, ZK-NEF
(Courtesy of Air Nelson Limited)

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Abbreviations

AARR	Auckland approach radar
AATP	Auckland terminal planner
AATMR	Auckland terminal radar
AIP	Aeronautical Information Publication New Zealand
Airways	Airways Corporation of New Zealand
ATC	air traffic control
CA	conflict alert
CAA	Civil Aviation Authority (of New Zealand)
GPS	global positioning system
ICAO	International Civil Aviation Organization
IMO	International Maritime Organization
km	kilometre(s)
MOU	memorandum of understanding
nm	nautical mile(s)
NOSS	normal operations safety survey
PDA	parachute drop area
RA	resolution advisory
STCA	short-term conflict alert
TA	traffic alert
TCAS	traffic alert and collision avoidance system
TEM	threat and error management
the Commission	the Transport Accident Investigation Commission
TRM	team resource management
UTC	universal coordinated time

Data Summary

Aircraft registrations:		**ZK-FGZ**	**ZK-NEF**
Types and serial numbers:		Cessna 182N, 18260537	Bombardier DHC-8 Q311, 620
Number and types of engines:		one Teledyne Continental Motors O-470-S2A reciprocating	2 Pratt and Whitney PW123 turboprop
Years of manufacture:		1970	2006
Operators:		NZ Skydive Limited	Air Nelson Limited[1]
Date and time:		9 August 2009, 1222[2]	
Location:		6 km east of Mercer Aerodrome latitude: 37° 12.9´ south longitude: 175° 08.6´ east	
Types of flight:		parachute dropping	scheduled air transport
Persons on board:	crew: passengers:	one nil	3 31
Injuries:		nil	nil
Nature of damage:		nil	nil
Pilots'-in-command licences:		commercial pilot licence (aeroplane)	air transport pilot licence (aeroplane)
Pilots'-in-command total flying experience:		710 hours (24 hours on type)	5992 hours (1854 hours on type)
Radar controller's experience:		26 years	
Radar planner's experience:		14 years	
Investigator-in-charge:		IR M^{c}Clelland	

[1] Part of the Air New Zealand Group of companies.
[2] All times in this report are in New Zealand Standard Time (UTC + 12 hours) and expressed in the 24-hour mode.

Executive Summary

Introduction

The Transport Accident Investigation Commission (the Commission) was notified of the incident about midday on Monday 17 August 2009. Following preliminary enquiries, an investigation was commenced and an investigator-in-charge appointed that afternoon. During the investigation the pilots of the 2 aircraft involved and the controllers concerned were interviewed. Meetings with representatives of the air traffic services provider and the aircraft operators were also held, and air traffic control (ATC) radar data and radio communication recordings were examined. An air traffic services expert was engaged to provide specialist advice during the investigation.

These sources of information have been used in presenting the factual section of this report, which in turn has been drawn upon to form the analysis and findings. As some sources of information are not available to the public, only those that are have been cited.

A draft report on this incident was sent to interested persons for comment on 3 March 2010. Following receipt of submissions, a second draft report was sent to interested persons for further comment on 24 May 2010. This report on the incident includes any changes accepted as a result of submissions received.

The incident

ATC issues led to a loss of required separation and a near collision between a Cessna 182 parachute-drop aircraft with a single pilot on board and a Bombardier DHC-8 Q311 airliner with 3 crew and 31 passengers on board near Mercer on 9 August 2009.

Both aircraft were operating as cleared by ATC when the airliner's equipment detected the conflict and directed it away from a potential collision with the parachute-drop aircraft, which had just dispatched 4 parachutists and commenced its descent.

The ATC issues identified were that:

- the 2-member ATC team managing the airspace did not ensure that a third member of the team was available as required
- the controller, in clearing the airliner to its destination, did not fully examine the route it was to take and along which a parachuting aircraft was operating
- the 2 controllers did not recognise the developing conflict as the 2 aircraft approached each other
- an automated collision warning in the control centre was missed.

During the investigation it was found that an Airways Corporation of New Zealand-sponsored audit had identified that the ATC centre had a rate of communication-related errors higher than those of other comparable control centres, although this type of error was not involved in this incident.

Since the incident, ATC has improved the visibility of the parachute drop area on controllers' screens, and is determining if the activation of the collision warning can be made more distinct. The parachute-drop aircraft has been fitted, beyond requirements, with collision-avoidance equipment similar to that on the airliner.

The Commission has made 5 recommendations to the Director of Civil Aviation to address safety issues relating to the operation and air traffic management of parachute drop areas, ATC's internal standards' monitoring, how the high number of general communication errors was being addressed, and controller actions following collision warning alerts. A sixth recommendation was made to the Director of Civil Aviation, to progress legislation for the acquisition and protection of controller-station recordings to assist future safety investigations.

(Note: this executive summary condenses content to highlight key points to readers and does so in simpler English and with less technical precision than the remainder of the report.)

Factual Information

1.1 History of the flight

1.1.1 On Sunday 9 August 2009, ZK-FGZ, a Cessna 182N aeroplane, was being used to conduct parachuting operations from Mercer Aerodrome, about 40 km south of Auckland International Airport (see Figure 1). At about 1150, following an uneventful first drop of parachutists, the pilot started loading a second group of parachutists on-board the aircraft. The group consisted of 4 jumpers and the pilot, making 5 persons on board.

1.1.2 At about 1159 ZK-FGZ took off and at 1202, as it was climbing through about 1000 feet, it appeared on ATC's radar screen. ZK-FGZ continued to climb within the boundary of D222, a promulgated danger area designed to alert local traffic to the potential of parachutists descending onto Mercer Aerodrome.[3] Approaching the lower limit of controlled airspace at 4500 feet, the pilot called the Auckland terminal radar (AATMR) controller,[4] using the call-sign Auckland Control. The pilot requested clearance to enter controlled airspace and climb in the Mercer parachute drop area (PDA)[5] to 12 000 feet. The controller, aware of a potential conflict with other aircraft, did not clear ZK-FGZ to operate in the PDA, but instead cleared it to continue climbing into controlled airspace to 12 000 feet, but to remain to the south-west of Mercer meantime.

1.1.3 In the next 5 minutes approximately, the controller coordinated the movements of other aircraft, as well as continuing to monitor the progress of ZK-FGZ. At 1214 the ATC short-term conflict alert (STCA)[6] warning system activated with a *conflict alert* (CA) display, indicating a potential conflict between 2 aircraft near Ardmore Aerodrome. The *conflict alert* required no intervention by the controller, who described it as a "nuisance warning" that occurred regularly around Ardmore.[7]

1.1.4 At 1215, Airlink 223, a Bombardier DHC-8 Q311 aeroplane, registered ZK-NEF, took off from runway 05 at Auckland on a scheduled flight to Tauranga. On board were 31 passengers and a crew of 3. The first officer was the nominated "pilot flying", with the captain performing the duties of "pilot monitoring". Shortly after take-off the captain changed frequency to AATMR and reported "Auckland Control, 223 airborne through 900 [feet] for 12 000 [feet], Whitford 5".[8]

1.1.5 The controller identified Airlink 223 on radar, cancelled the standard departure procedure and instructed the captain to turn the aeroplane right onto a heading of 090° magnetic and climb to 12 000 feet. The controller also requested that the aircraft climb at the "best angle" to 3000 feet to ensure it remained clear of aircraft operating in the various areas around Ardmore Aerodrome. The captain acknowledged the instructions and the aircraft was turned onto the new heading.

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[3] D222 was a danger area with a radius of one nautical mile (nm) centred on Mercer Aerodrome, and extending from the surface to 4500 feet. It was active during daylight hours only.

[4] For clarity, the AATMR controller is hereafter referred to as "the controller".

[5] The Mercer PDA was defined as a column of airspace of 3 nm radius centred on Mercer Aerodrome, and extending from the lower limit of controlled airspace to a specified upper limit. It effectively extended above D222. Refer paragraphs 1.2.12 to 1.1.18 for more information.

[6] Refer to paragraphs 1.2.19 to 1.2.25 for more information on the STCA.

[7] The alert was generated when an aircraft cleared for a visual approach to Ardmore and, descending, was going to pass close to an aircraft departing from Ardmore. The pilots of both aircraft were required to maintain their own visual separations.

[8] 12 000 feet was the planned altitude for the flight to Tauranga, and Whitford 5 was the standard instrument departure procedure being flown (Aeronautical Information Publication New Zealand [AIP], 2009).

1.1.6 At 1216:12 the pilot of ZK-FGZ reported "4 minutes to drop".[9] ZK-FGZ was climbing through about 10 000 feet at the time. The controller responded with "Foxtrot Golf Zulu is now cleared Mercer PDA". The pilot acknowledged the clearance, which, in accordance with an agreement between the operator and Airways Corporation of New Zealand (Airways), permitted the pilot to operate unrestricted within the Mercer PDA and release the parachutists (Mercer Skydiving Centre and Airways, 2007).

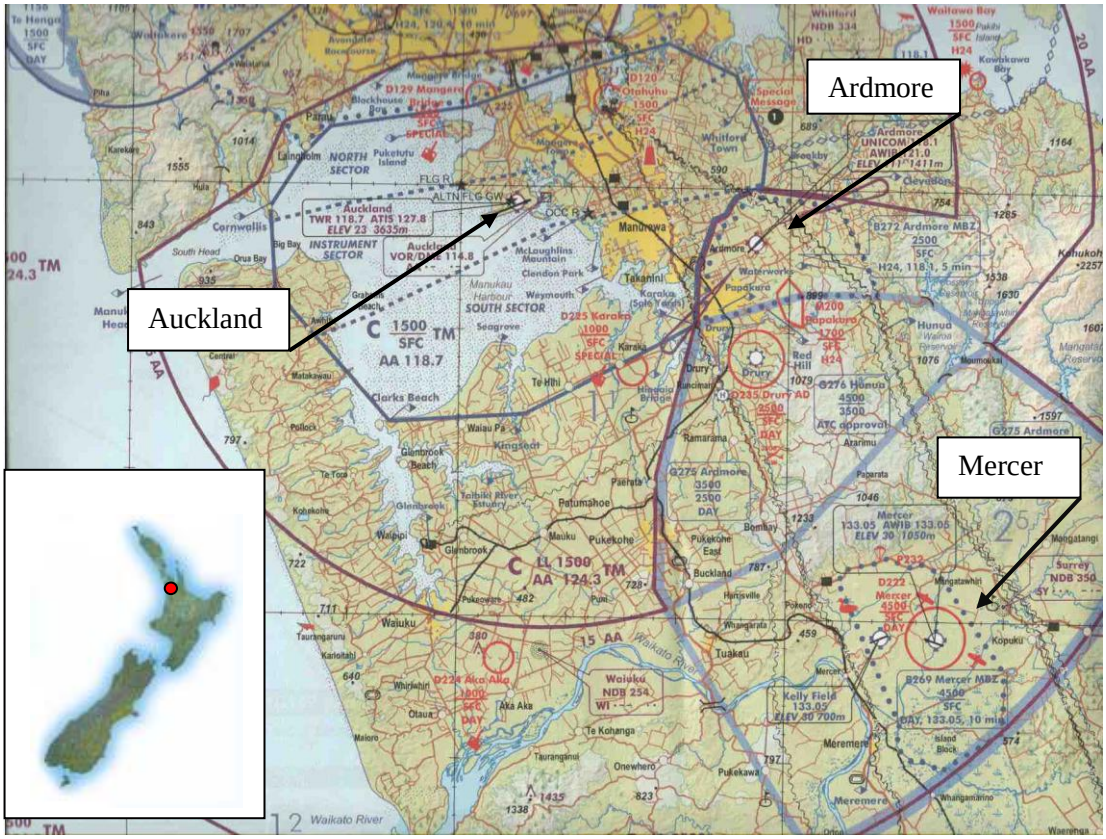

Figure 1
Visual navigation chart
(Courtesy of Airways)

1.1.7 Nearly 2 minutes later at 1218:03, after communicating with 2 other aeroplanes, the controller cleared Airlink 223 "direct TULMI". TULMI was a reporting point about midway between Auckland and Tauranga (see Figure 2; AIP, 2009a). The captain acknowledged the new clearance and the aircraft was turned right towards TULMI. At this time Airlink 223 was climbing through about 4500 feet and ZK-FGZ was to the west of Mercer Aerodrome, heading south and approaching 11 000 feet.

1.1.8 In the next 4 minutes the controller managed 2 aeroplanes requesting visual approaches to Auckland, 3 aeroplanes departing Auckland and another 2 international flights joining from the west. Also during this time the STCA activated a second time, showing a *conflict alert* between another 2 aeroplanes operating near Ardmore. Again no intervention was required.

1.1.9 At 1222:20 the STCA again activated and indicated a *conflict alert* between ZK-FGZ and Airlink 223. The radar recording showed that ZK-FGZ had crossed overhead Mercer at 11 900 feet and was heading north-east. Airlink 223 was about 5 nm to the north of ZK-FGZ,

[9] ZK-FGZ was equipped with 2 radios, one for communicating with ATC and the second for broadcasting intentions to other aircraft operating below controlled airspace near Mercer Aerodrome.

climbing through 9300 feet and heading south-east, with the velocity projections for the 2 aeroplanes crossing each other (see Figures 3 and 4). During this time the controller's computer cursor was on one of the inbound international flights, then moved to an aeroplane departing from Auckland, and the controller was talking to both of these aeroplanes. There was no curser movement or audible recording to indicate that the controller reacted to the *conflict alert* between Airlink 223 and ZK-FGZ.

1.1.10 On board Airlink 223, the first officer scanned his instruments and on looking at the aircraft traffic alert and collision avoidance system (TCAS)[10] observed unidentified traffic ahead being displayed. He alerted the captain and about 5 seconds later the TCAS sounded an audible traffic message and displayed a "traffic alert" (TA) for an aircraft "in their 1.30",[11] about 1600 feet above their altitude at a distance of 3-4 nm. The first officer reduced the rate of climb of the aircraft and both pilots started looking for the indicated traffic. Shortly afterwards, the captain saw an aircraft about 2-3 nm away, in a descending left turn. At the same time the TCAS indication changed from a *traffic alert* to a *resolution advisory* (RA) and the system gave a "descend" audible command. The first officer disconnected the autopilot and started an immediate descent while reducing power. The manoeuvre was described by the pilots as moderate and the flight attendant said she became very light on her feet. There were no injuries.

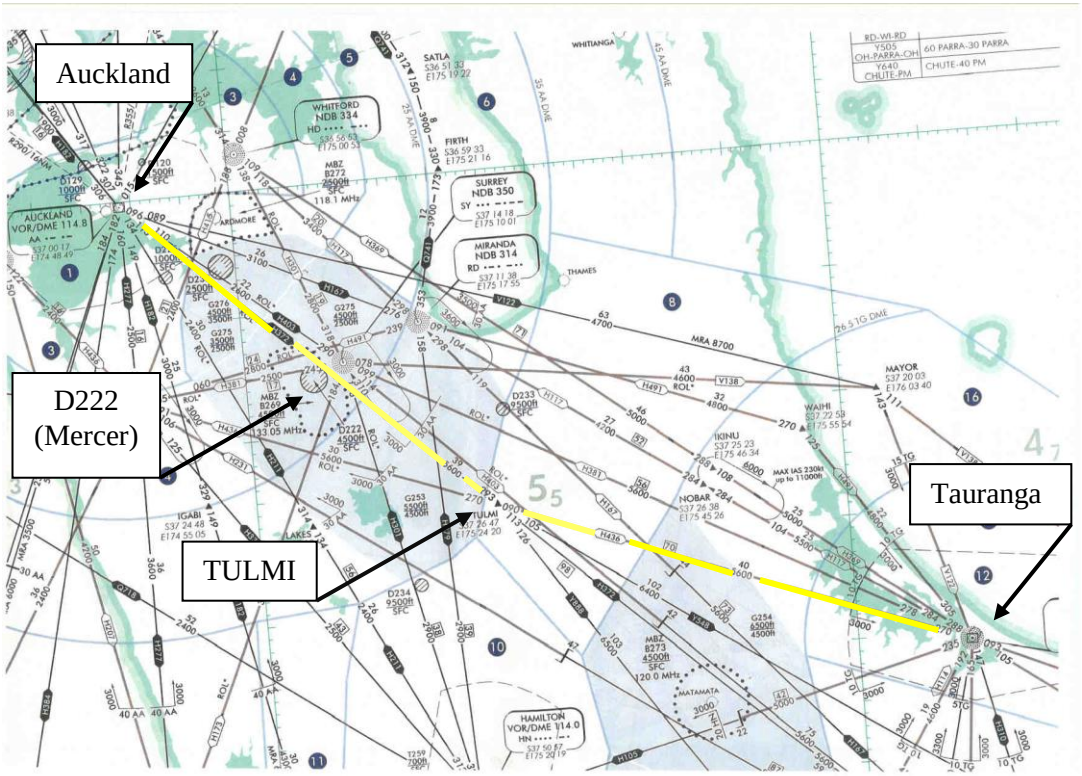

Figure 2
En-route chart
(Courtesy of Airways)

1.1.11 The pilot of ZK-FGZ, having passed overhead Mercer and dropped the parachutists nearly 2 nm to the east of the aerodrome, had continued flying straight and level for a short time before entering a descending left turn near the boundary of the PDA. As the pilot looked in

[10] TCAS was the common term for an airborne collision avoidance system.
[11] Using the clock code, 12 o'clock was directly ahead, therefore 1.30 was about 45° to the right of the aircraft heading.

the direction of the turn he saw a Q300-type aeroplane pass almost directly underneath him in the opposite direction. He later reported that he had had no time to react and estimated the aeroplane was about 400 feet below as it passed. He was able to see clearly the detail of the aeroplane.

1.1.12 The crew of Airlink 223 saw the Cessna aeroplane pass "very close" overhead. The captain of Airlink 223 tried calling Auckland Control several times before he was able to report the incident, stating, "Control Link 223 TCAS descent there. We missed a white 172 by about 200 feet, would have been a collision".[12] This was the controller's first realisation that a possible conflict had occurred. Soon afterwards the pilot of ZK-FGZ also reported the incident to Auckland Control, stating, "Control FGZ, a link aircraft passed underneath me about 500 feet".

1.1.13 Both aeroplanes continued to their destinations without further incident. The controller was relieved from duty by another controller, as was normal Airways practice (Airways, 2009b).

Figure 3
Radar recording- area
(Courtesy of Airways)

[12] The Cessna 172 type of aircraft was very similar in design to the 182.

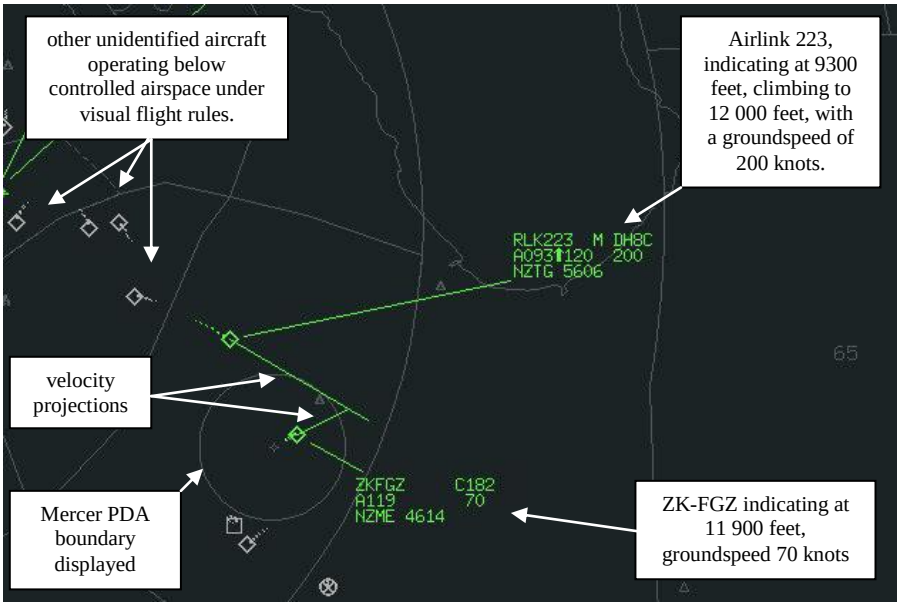

Figure 4
Radar recording – local
(Courtesy of Airways)

1.2 Air traffic services and airspace information

Air traffic services

1.2.1 Air traffic services in New Zealand were provided by Airways. The ATC element of air traffic services included control towers at various aerodromes around New Zealand and at the Auckland Oceanic centre. Domestic ATC, termed "main trunk", was based in the Airways Centre in Christchurch, and included the 3 major terminal sectors of Auckland, Wellington and Christchurch, with the adjacent en-route sectors that covered most of the rest of New Zealand.

1.2.2 The controlling positions for each of the sectors were all co-located in one control room in the Centre, allowing the functions of some of the adjacent sectors to be combined when the workload was low, for example Bay[13] or Raglan with Auckland Terminal. Controllers were typically qualified on one or 2 of the sectors. The organisational set-up and staff rosters meant that sectors, in particular the 3 terminal sectors, were run independently of each other. Airways advised that a duty manager was always to be present in the control room, and this was the case at the time of the incident.

1.2.3 Air traffic services were performed under Civil Aviation Rules Part 172 Air Traffic Services Organisations – Certification (Civil Aviation Authority [CAA], 2008a), and Part 65 Air Traffic Service Personnel Licences and Ratings (CAA, 2006). The Rules required Airways to establish an internal quality assurance system. Initially the auditing functions, including elements of safety and incident investigation, were the responsibility of each terminal sector leader or manager. In late 2008, changes were initiated to make the auditing and safety functions more centralised, to help enhance safety across each of the sectors and towers, and provide greater consistency or standardisation. Airways advised that at the time of the

[13] The Bay of Plenty.

subject incident the proposed changes were nearing completion with some positions yet to be filled.

1.2.4 To ensure compliance with the Rules, the CAA conducted audits of the various functions of Airways, including aerodrome towers and main trunk radar operations. The CAA advised that although controller records were checked on occasions, the CAA did not conduct practical assessments of individual controllers. For this, each controller completed an annual Airways check where a check controller would observe the controller's performance by observing the controller during a complete shift. During this time the controller would perform all of the functions of a controller, planner and approach radar controller. The controller would also complete a simulator session where their ability to handle emergencies would be assessed.

Airspace

1.2.5 The incident took place in the Auckland terminal control area, in class C controlled airspace, where aircraft being operated under visual and instrument flight rules were provided with specified separation (AIP, 2006). The classification of airspace directed that an ATC service be present to provide separation between aircraft operating in the area. Aircraft were to be equipped with functioning radios and transponders to assist in identification and separation. The minimum separation applicable at the time of the incident was 1000 feet vertically, or 3 nm laterally (AIP, 2008).

1.2.6 The controlling of aircraft in the Auckland terminal sector was performed by the AATMR controller. A planner would sit alongside the controller and assist as directed (see Figure 5). The duties of the planner included, among other things, issuing route clearances, creating flight plans, briefing the controller on updated weather reports and alerting the controller "to potential opposite direction traffic conflictions" (Airways, 2008b).[14]

1.2.7 An approach controller position was established to share increased workload in a terminal area. The approach controller would manage inbound traffic closer to Auckland or Ardmore, leaving the controller to concentrate on outbound traffic and other aircraft further away from Auckland. The approach controller position was to be operating during the rostered hours described in the Auckland Terminal Main Trunk Procedures manual and when there was an aircraft inbound to Auckland or Ardmore, or there was excessive workload for the controller (Airways, 2008c).

1.2.8 The manual directed that "as soon as it was likely there would be 3 or more arrivals in the AATMR controller's area of responsibility at one time, then AARR [the Auckland approach radar controller] must be used". The approach controller was to be in place and ready to operate prior to the first of the arrivals entering the area.

1.2.9 An internal Airways notice expanded on the procedures for the activation of the approach controller's position (Airways, 2009b). Between 0700 and 1900 during the week and on Saturday mornings and Sunday afternoons, a controller and planner could elect not to use an approach controller. However, during these times the approach controller was to remain in the control room, either on position or readily available. Outside these hours the approach controller was permitted to leave the control room, but was to remain in the building and be readily contactable

[14] Airways advised that this was intended to apply to strategic planning, where an inbound flight might not be showing on a controller's screen, and not necessarily to traffic being displayed on the screen where normal coordination would take place.

Figure 5
A radar planner's position
(Courtesy of Airways)

1.2.10 The training of controllers meant that a controller could fill any one of the 3 controller positions: controller, planner and approach controller. Controllers would typically rotate through 2 or 3 of the positions as part of their normal rosters.

1.2.11 On Sunday 9 August, the controller and planner positions were operating. The 2 controllers considered that the workload at around the time of the incident was manageable and the approach controller position did not need to be operating. At the time of the incident the duty approach controller was within the building but not in the control room as required.

The Mercer PDA

1.2.12 On 1 May 2007, to better manage parachuting operations out of Mercer Aerodrome and improve safety, a memorandum of understanding (MOU) was signed between Mercer Skydiving Centre, the operator of ZK-FGZ, and Airways.[15] The MOU established the Mercer PDA and contained procedures for parachute descents within controlled airspace over Mercer Aerodrome, thereby helping to ease controller and pilot workload and minimise radio traffic.

1.2.13 The MOU defined the dimensions of the PDA, noting that it extended from the lower limit of controlled airspace (4500 feet) up to an altitude approved by the AATMR controller. The PDA was deemed to be active only from the time the parachuting aircraft was cleared to operate in the PDA until the aircraft and parachutists had descended below controlled airspace. A clearance to operate within the PDA constituted a clearance to climb, drop parachutists and descend to vacate controlled airspace. The PDA was to be deactivated when the pilot of the parachuting aircraft reported clear of controlled airspace.

1.2.14 Normal controlled airspace separation rules applied. However, it was normal practice that when an aircraft was approved to operate in the PDA, because that aircraft was able to move about freely within it, ATC was to provide separation between the PDA and all aircraft operating under instrument flight rules in the area. ATC did not have to advise other pilots

[15] Mercer Skydive Centre was part of NZ Skydive Limited's operation.

of the status of the PDA. However, ATC was to provide mutual traffic information where possible between aircraft operating under visual flight rules within the PDA.

1.2.15 Where a climb outside the PDA was approved, a specific clearance to operate within the PDA was to be issued. The PDA was then considered active once the cleared aircraft had entered the PDA. The pilot of the parachuting aircraft was then to call "parachutists away", "when the parachuting aircraft commences descent" and when the aircraft had "vacated controlled airspace below the PDA".

1.2.16 To assist the duty AATMR controller in managing the PDA, a circle showing the lateral dimensions of the PDA could be added to the display on the controller's radar screen. If parachuting operations were planned to run for the day, the PDA display would normally be left on and only turned off at the conclusion of the day's operations. While danger areas and other PDAs around the country were coloured red, the Mercer PDA was coloured white, the same as airspace boundary lines. The reason given for this by Airways was that the PDA was not a permanently activated area and it had low utilisation when compared to other PDAs. White was therefore considered a more appropriate colour.

1.2.17 The MOU for the Mercer PDA also varied from most other MOUs covering parachuting operations, in that pilots operating in other PDAs were required to give 2-minute warnings before parachute drops and await ATC clearance. In some cases, if a descent in a particular direction were required, pilots were to make specific requests. ATC could then issue a combined parachute drop and descent clearance. A reason given for the differences was the need to minimise radio chatter in the Auckland airspace, which was regarded as the busiest upper-level controlled airspace in New Zealand.

1.2.18 Controllers spoken to during the investigation reported that while parachuting aircraft operating out of Mercer Aerodrome did complicate the controlling of aircraft flying into and out of Auckland, the Mercer PDA and its associated MOU did assist in minimising the additional workload. A review of the CAA's incident database identified 2 "loss of separation" incidents at Mercer, one in 1997 and one in 1998. There had been no reported separation-related incidents after this, including after the signing of the MOU in May 2007.

The STCA and airborne collision-avoidance systems

1.2.19 In 1998, Airways installed the STCA warning system to help provide an additional defence against collisions between aircraft that were subject to ATC control. The STCA provided 2 levels of alert, the *conflict alert* and a *proximity alert*. The criteria for the activation of the alerts varied according to the classification of the airspace. For terminal airspace like the Auckland terminal control area, the *conflict alert* would activate when an aircraft was predicted to infringe a 2.5 nm horizontal or 800-foot vertical buffer around another aircraft. In a straight and level converging situation, this could give up to 95 seconds' warning to a controller. The warning time would reduce if one or both of the aircraft were manoeuvring (see Figure 6 showing a recording of the tracks of ZK-FGZ and Airlink 223).

1.2.20 Activation of the *conflict alert* was indicated by 2 audible beeps through the controller's keyboard. The radar label displays for the conflicting aircraft would change to a brighter intensity and the letters "CA" would be annotated on the display labels for the conflicting aircraft. The identities of conflicting aircraft would also be displayed on the controller's screen. The planner would receive the same indications. On receiving a *conflict alert* a controller was to assess the situation and either ignore the alert if it was not valid or take action to separate the subject aircraft.

1.2.21 A *proximity alert* activated when the computed lateral separation would be less than 1.5 nm and the aircraft were within 1000 feet vertically.

1.2.22 Whereas the STCA was a radar-based, controller-managed system, the TCAS fitted to Airlink 223 was an aircraft-fitted, pilot-managed warning system. Civil Aviation Rules required aircraft being operated under Part 121 or 125, large and medium aircraft, to be fitted with airborne collision-avoidance systems, and the TCAS was one such system (CAA, 2008b).

1.2.23 In an aircraft conflict situation, like the incident near Mercer, and where there was radar coverage, the STCA and the TCAS were designed to be complementary. The STCA *conflict alert* should activate first followed by the TCAS *traffic alert* then the STCA *proximity alert*. Ideally this enabled a controller to prevent separation requirements being infringed or promptly restore separation while retaining control of the situation and not generating additional dangers.

1.2.24 The final defence against a collision was the TCAS *resolution advisory*, which provided direct and immediate instructions to a pilot to commence a manoeuvre to avoid an opposing aircraft. To avoid any confusion a TCAS *resolution advisory* took priority over an ATC clearance.[16] Having commenced a manoeuvre in response to a TCAS instruction, a pilot was to advise ATC as soon as possible that a TCAS climb or descent had been initiated.

1.2.25 During the sequence of events on 9 August, *conflict alert*, *traffic alert* and *resolution advisory* warnings were generated but no STCA *proximity alert* was given. A review of the STCA computer logic and radar data by Airways and the Transport Accident Investigation Commission (the Commission) determined that the entry into the descending left turn by ZK-FGZ was too rapid and did not give sufficient time for the STCA program to react before the 2 aircraft crossed. The STCA update or refresh rate was slower than the rate for the TCAS and therefore as a final defence the TCAS was more accurate, especially where rapid manoeuvres were involved.

[16] For example, as happened in a mid-air collision over Switzerland on 1 July 2002, when the crew of a TU-154 followed ATC instructions and the crew of a B575 followed TCAS instructions.

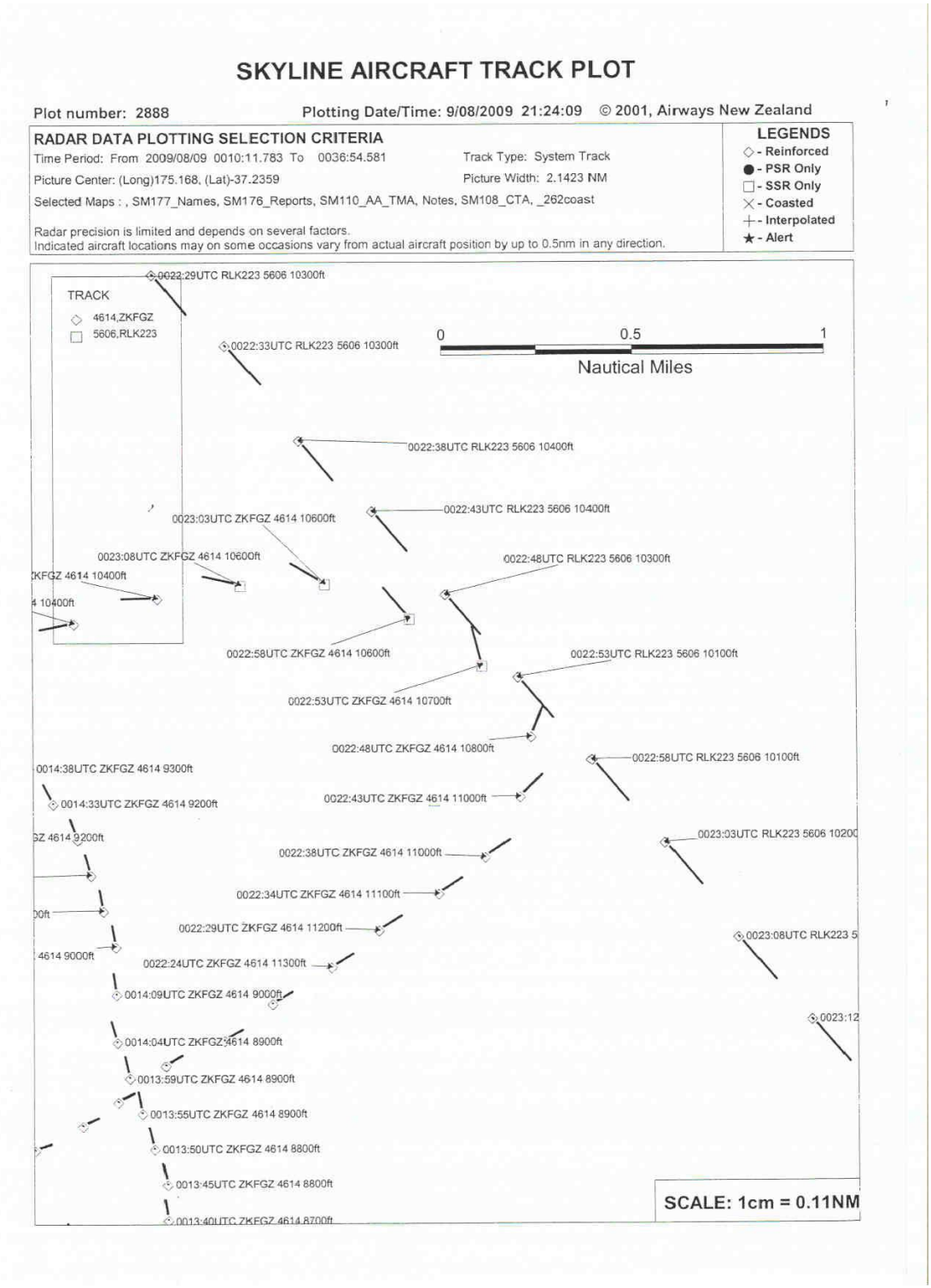

Figure 6
Radar recording of incident
(Courtesy of Airways)

Threat and error management (TEM)

1.2.26 Controllers are often required to manage complex and demanding situations, balancing the expectations of individual pilots and operators while at the same time ensuring safety standards are maintained. Anything that affects the ability of a controller to maintain full situational awareness and results in poor decision-making and a breakdown in procedures can have disastrous results. Distractions can include stress, equipment failure, poor console design, inadequate operating procedures and noise, for example loud background noise and non-work-related conversations.

1.2.27 In recognising the challenges facing air traffic services, the International Civil Aviation Organization (ICAO) issued Circular 314, Threat and Error Management in Air Traffic Control (ICAO, 2008). The Circular outlined the TEM framework, types of threat, countermeasures and TEM itself.

1.2.28 To assist in TEM, Airways introduced "team resources management" (TRM) as part of the training syllabus for all controllers. TRM was defined as strategies for the best use of all available resources – information, equipment and people (EuroControl, 2009). TRM was a development of "crew resource management", which originally had a flight crew focus. TRM and crew resource management recognised that many accidents and incidents had their origins in human factors failures, both individual and crew or team failures. For Airways, TRM helped to promote timely and effective communication between controllers managing a sector. As a result, it enabled controllers to better identify and manage threats and errors.

1.2.29 In 2008, Airways participated in a normal operations safety survey (NOSS) for the first time. Run by The NOSS Collaborative, the NOSS was developed under the direction of ICAO with the objective of providing "guidance material for the monitoring of safety during normal air traffic service operations". It was a follow-on from the ICAO-endorsed line operations safety audit for airlines, commonly called LOSA[17], and was modified specifically for air navigation service providers. It was also a means of determining the effectiveness of TEM and TRM.

1.2.30 The objective of a NOSS was to evaluate normal en-route and terminal-sector radar operations against a TEM model. Threats were defined as events or errors by others that occurred outside the influence of a controller, but required a controller's attention and management if safety margins were to be maintained. Examples of threats were a sudden deterioration in weather conditions and a pilot making an incorrect radio call. Errors were defined as a deviation from organisational expectations or controller intentions, for example the subject controller passing an incorrect or inappropriate clearance (The NOSS Collaborative, 2008).

1.2.31 The New Zealand survey identified that the most common threats and errors were related to communication. A closer analysis of the errors determined that 38% were communication errors, with 25% of these being procedural errors and 20% being instruction errors by controllers to pilots. The survey further determined that 89% of threats and errors were detected by controllers and either stopped or corrected immediately. However, 11% of all errors were mismanaged and resulted in additional errors or undesired states. Equipment management errors, for example incorrect data displayed, and instruction errors were the most likely to cause or lead to other errors.

[17] A joint development by the University of Texas Human Factors Research Project and Delta Airlines in 1994. See http://www.losacollaborative.org.

1.2.32 The survey found that the Christchurch Centre generated more communication threats and errors than other centres on The NOSS Collaborative's worldwide database. The reasons were often incomplete pilot read-backs, the use of non-standard phraseology and clipped calls. A greater percentage of aircraft instruction errors were also noted, with the Auckland Terminal being "the biggest source of clearance instruction errors". Compared to other ATC centres, the survey determined that the Christchurch Centre was less likely to generate additional or subsequent errors.

1.3 Personnel information

Pilots

1.3.1 The pilot of ZK-FGZ held a commercial pilot licence (aeroplane) and a current class 1 medical certificate. He had accrued about 710 flying hours, including 24 hours on the Cessna 182 type aircraft. His most recent biennial flight review had been on 13 May 2009.

1.3.2 The pilot had joined the operator in August 2007 to fly parachuting operations from Mercer Aerodrome. The pilot commented that he used a global positioning system (GPS) to help with navigation and to ensure he remained within the Mercer PDA and complied with ATC instructions. He reported that the incident flight had proceeded normally and that it was not uncommon to have restrictions placed on the climb by ATC. This was typically due to other aircraft flying into or out of Auckland. He further commented that in addition to alerting any traffic in D222, he would where possible call ATC and report "jumpers away and descending". However, on this occasion he was unable to do so because of other radio traffic.

1.3.3 The captain of Airlink 223 held an airline transport pilot licence (aeroplane) and a current class 1 medical certificate. He had accrued 5992 flying hours, including 1854 hours on the Q300 type aircraft. He had gained his captaincy qualification on the Q300 type aircraft on 19 February 2008. His most recent annual competency, instrument and simulator checks had been conducted on 11 May 2009.

1.3.4 The first officer held a commercial pilot licence (aeroplane) and a current class 1 medical certificate. He had accrued 2050 flying hours, including about 800 hours on the Q300 type aircraft. The first officer had qualified on the Q300 aircraft on 16 June 2008 and his most recent simulator and instrument checks had been conducted on 23 March 2009.

1.3.5 The pilots of Airlink 223 were both Tauranga based and regularly flew the Auckland-Tauranga route. The pilots reported that the normal route from Auckland to Tauranga was via TULMI, at either 10 000 or 12 000 feet. On the day of the incident the first officer elected to fly at 12 000 feet to keep above some low-level turbulence generated by a moderate easterly wind. The subject incident was the first time the crew had encountered a problem along the route.

Controllers

1.3.6 The (AATMR) controller had qualified as a controller in 1982 and then been primarily based in the Auckland radar centre. Following the relocation of New Zealand domestic radar services to Christchurch in about 1989, the controller had remained in Auckland before moving overseas in 1999 to work. He returned to New Zealand in 2005 and re-qualified as a radar controller, spending several years controlling sectors covering the central and north-eastern North Island. In October 2008 he commenced retraining on the Auckland Terminal sector, completing his validation in April 2009.

1.3.7 As was normal, the controller was validated on the 3 positions that covered the Auckland Terminal sector, namely AATMR, Auckland terminal planner (AATP) or planner, and Auckland approach radar (AARR) or approach controller.[18] The controller's managers considered that he was a competent controller. His training records held no performance issues. At the time of the incident the controller had been on duty for about one hour and had about another 40 minutes to work before a scheduled break. He commented that he had not felt fatigued or ill and that the workload had been busy but had reduced at around the time of the incident. He also commented that he did not recall the STCA activating to show a potential conflict between ZK-FGZ and Airlink 223.

1.3.8 At the time of the incident the planner position next to the controller was also occupied. The planner had qualified as a controller in April 1995 with EuroControl. In 2000 he returned to New Zealand and obtained his New Zealand controller's licence and gained ratings on several radar controller positions, including the Auckland sector in 2002. In 2005 he completed an incident investigation course and latterly had become an instructor. In February 2009, following a short tour in the safety office and 20 months as the Bay Sector Team Leader, the planner began revalidation on the Auckland Terminal sector positions. His revalidation had been completed in March 2009.

1.3.9 The planner was considered by his managers to be a competent controller and his training records stated he showed a "high level of SA [situational awareness]". The planner recalled commencing his shift shortly before 1200, following a handover with the outgoing planner. He reported that he had not been fatigued and the workload had been light. He had therefore been able to engage in some light social conversation with the controller when he first commenced his duties. This was later reported by the controller to be for a few minutes only and ceasing by the time ZK-FGZ was cleared into the Mercer PDA.

1.3.10 The planner, like the controller, did not recall hearing or noticing the *conflict alert* activation between ZK-FGZ and Airlink 223. The planner did comment after the incident that he thought that the controller had instructed the pilot of ZK-FGZ "do not drop". He was therefore under the impression that the controller was aware of the potential conflict between the 2 aircraft and had placed a restriction on ZK-FGZ to permit Airlink 223 to pass safely.

1.3.11 As was normal for all controllers, the controller and planner had both undertaken TRM training to help collectively identify and manage threats or unusual situations that they might encounter while working.

1.4 Meteorological information

1.4.1 The applicable weather at the time of the incident was reported by MetService New Zealand and Airways as a visibility of 30 km and a broken layer of cloud at 4000 feet. The pilots of both aircraft reported they were in visual meteorological conditions leading up to the incident and there was a strong north-easterly wind aloft.

1.5 Communication

1.5.1 All communications relevant to the incident were on the Auckland Control very high frequency of 124.3 megaHertz. A copy of the ATC recording was obtained for the investigation.

1.5.2 The radar display recording showed the progress of the 2 incident aircraft and movement of the controller's cursor about the screen, including the highlighting or moving of the labels

[18] See paragraphs 1.2.6 to 1.2.8 for job descriptions.

for aircraft. The recording also showed whatever alarms were active, including the STCA warnings. These were displayed on the radar screens for each of the 3 controller positions.

2 Analysis

2.1 On Sunday 9 August 2009, while ZK-FGZ was conducting parachuting operations in the Mercer PDA in accordance with ATC instructions, ATC cleared Airlink 223 to fly directly to reporting point TULMI at 12 000 feet. The clearance caused a loss of required separation between the 2 aircraft and subsequently a near collision. The incident was defined as a serious incident and near collision because there was a loss of required separation between the aircraft and the pilots considered that the situation was hazardous to the extent that avoiding action was necessary.

2.2 The actions of the crew of Airlink 223, in initially reducing their rate of climb from 2000 to 900 feet per minute after becoming aware of ZK-FGZ, then descending as the aircraft approached each other, increased the separation of the 2 aircraft. Had these actions not be taken, extrapolation of the available data showed that the aircraft would have been within 200 feet vertically of each other, with a lateral separation of about 75 m as they passed.

ZK-FGZ

2.3 ZK-FGZ was on a routine parachute-dropping flight and operating under an ATC clearance within the Mercer PDA. After releasing the parachutists, the pilot continued into wind on an easterly heading for about 15 seconds to ensure that he was clear of the parachutists before turning and descending. The use of GPS helped ensure that he remained within the PDA during this time, albeit near the boundary of the area.

2.4 Immediately after releasing the parachutists, the pilot of ZK-FGZ was unable to transmit an advisory descent radio call because of the radio transmissions of other aircraft. Blocked transmissions in congested airspace areas were not uncommon and reinforced the need for radio calls to be kept to a minimum, in both number and duration. The descent call was there as a reminder for the controller, and the MOU covered the situation of blocked or crossed calls by stating that "a clearance to operate within the PDA constitutes a clearance to climb, drop parachutists and descend to vacate controlled airspace". Had the pilot of ZK-FGZ been able to transmit a descent call, there would still have been insufficient time for the controller to respond and prevent the loss of separation.

2.5 The MOU for the Mercer PDA was designed to facilitate and streamline local parachuting operations, and thereby improve safety. It also meant that by being given a clearance to enter the PDA and climb to a drop altitude, for example 12 000 feet, because of the time to climb and descend a pilot could potentially operate in the PDA for a further 15 minutes without talking to ATC. This was a significant period of time for an aircraft operating in a congested area of controlled airspace, albeit still monitored by radar. Most other PDAs sampled during the investigation required pilots to make intermediate radio calls, for example prior to dropping. Had the pilot of ZK-FGZ made a radio call prior to dropping parachutists there may have been sufficient time for the controller to react and divert Airlink 223, thereby avoiding a loss of separation.

Airlink 223

2.6 At the time of the incident the crew of Airlink 223 were operating in accordance with their ATC clearance, flying direct to the TULMI reporting point and climbing to a cruise altitude of 12 000 feet. The Auckland-TULMI-Tauranga routing was normal for aircraft flying to Tauranga, with opposite-direction traffic flying a route further to the east to facilitate traffic flow.

2.7 The Auckland-TULMI track ran along the north-eastern edge of the Mercer PDA. The relevant en-route navigation chart depicted the danger area D222 adjacent to this track and extending from the surface to 4500 feet. Because the PDA was active only occasionally, it was not displayed on aeronautical charts. Pilots therefore would not necessarily know that parachuting aircraft could be operating above 4500 feet and up to 2 nm outside the lateral dimensions of the danger area. The crew of Airlink 223 were not aware of the Mercer PDA, nor were they required to be, as positive separation had to be provided by ATC, specifically the AATMR controller.

2.8 Controllers were not required to inform pilots of all traffic in their area. This would add unnecessary radio chatter and hinder a controller's ability to manage the safe flow of traffic. However, where 2 aircraft were knowingly given clearances to operate in close proximity, a controller would normally inform the pilots, for example when sequencing aircraft for landing.

2.9 The actions of the crew of Airlink 223 in reacting correctly to the information provided by the TCAS, specifically the *traffic alert* and the *resolution advisory*, helped ensure a collision was avoided. The TCAS information was timely and accurate, and its usefulness as an important last defence against collision was demonstrated in this incident.

ATC

2.10 The controller, assisted by the planner, was managing the flow of traffic within the Auckland terminal area. Both controllers had recently re-qualified on the Auckland Terminal sector positions, so they were both appropriately qualified and fit for their respective roles on the day. The 2 controllers were early into their shifts and had no health issues, so fatigue was not considered a factor.

2.11 The workload leading up to the time of the incident was not heavy, and although within the capabilities of the 2 controllers, the timing and volume of traffic meant that consideration needed to be given to activating the third controller in the approach position. That was reportedly done and the third controller was not considered necessary. However, by not ensuring the third controller was at least in the room, the 2 controllers, and possibly others if they were aware, were not acting in compliance with written procedures. While this point on its own might not appear significant, it was an example of non-compliance with procedures, which if routine could indicate a wider systemic issue.

2.12 While errors by an individual can be expected, persons operating in a properly functioning team should be able jointly to identify, prevent, minimise and manage errors. Had the approach controller position been operating, the third controller might have questioned the clearing of Airlink 223 direct to TULMI, or reacted to the STCA *conflict alert* that would also have been displayed on their radar screen. In other words, the third controller would have provided an additional defence against separation of the 2 aircraft being lost.

2.13 The loss of required separation occurred when the controller re-cleared Airlink 223 "direct TULMI". Prior to issuing this clearance the controller should have checked the proposed route for any possible conflictions. That neither the controller nor the planner identified ZK-FGZ as being a likely hazard was concerning, especially since the controller had only 2 minutes previously cleared ZK-FGZ to operate in the Mercer PDA. What may have influenced the controller at this time was earlier seeing the radar target representing ZK-FGZ positioned west of Mercer and heading further west as it was climbing and before he cleared it to operate within the PDA.

2.14 The basic principle or tenet of safe air traffic management was to separate aircraft from aircraft. This principle was described in various aeronautical publications and controllers were trained with this objective in mind. This could be a reason for the controller clearing

Airlink 223 direct to TULMI. At that time ZK-FGZ was more than 3 nm from the proposed track for Airlink 223 and diverging further away. It would therefore not have been seen as a threat to Airlink 223. This was reinforced by the muted colour of the Mercer PDA on the controllers' screens, which gave minimal emphasis to the need to keep aircraft away from the PDA boundary.

2.15 However, it was not uncommon in other locations for controllers to have to provide separation under Civil Aviation Rules between aircraft and active special-use airspace, for example danger areas (CAA, 2008c). Therefore it should not have been unusual for the controller in this situation to do likewise. The way that the Mercer PDA was being operated, and the way that the MOU was written, meant that a controller needed to keep transiting aircraft at least 3 nm away from the PDA boundary when it was active, regardless of the location of the aircraft operating in the area. Lateral separation between aircraft could therefore be as much as 6 nm. It also allowed a controller to clear an aircraft into the PDA and turn their attention to the other aircraft being controlled. In this incident the controller may have cleared ZK-FGZ into the PDA and simply forgotten about it, knowing that the pilot would call when exiting.

2.16 For the PDA to be operated safely in this manner, the area needed to be more prominently displayed on controllers' screen to ensure it attracted the controllers' attention. Air traffic routes through that portion of controlled airspace could also be re-routed to ensure at least 3 nm separation from the boundary of the PDA. The PDA display could also have been selected "on" each time an aircraft was cleared to operate inside the PDA as an active reminder, rather than leaving it on for the whole day. Conversely, were the aircraft-from-aircraft separation principle to be used, aircraft operating in the PDA needed to be more tightly controlled, including a requirement for additional radio calls, for example clearance to drop.

2.17 The controllers were adamant that their casual talk had not been a contributing factor in the lead-up to the incident. Casual talk, other unexpected noises and even work-related communications can all distract a controller from performing their primary duties. Short of enforcing a full "sterile environment", where only specific work-related activities are allowed to occur, distractions will continue to occur and controllers need to manage these, which is why defences such as additional controllers to manage workload and technological features such as STCA*s* have been built into the system. A total sterile environment would be difficult to achieve given the length of time controllers are at their stations and the varying periods of both high and low workloads. Controllers therefore need to employ good TEM/TRM techniques to ensure full situational awareness is maintained and be given guidelines on when and under what circumstances the sterile environment would be appropriate.

2.18 Based on the information available, the inquiry could not establish whether non-work related communications or distractions were contributing factors in this incident. Controller-station local area audio recordings may have enabled the inquiry to conclusively eliminate distractions as a factor. The installation of local area recorders on the flight decks of aircraft and on the bridges of ships has not been without controversy, but the ICAO and the IMO (International Maritime Organization) have recognised the benefit of such recordings and mandated their use.

2.19 Efficient and safe air traffic control services are critical to the safe operation of aircraft. The Commission appreciates the sensitivity surround the installation of workplace recorders and the possibility that appropriate legislation protecting the data might be required. ICAO Annex 13 Aircraft Accident and Incident Investigation, directs states to not make certain "recordings available for purposes other than accident or incident investigation", including "recordings and transcripts of recordings from air traffic control units". Airways could use

other means of routinely ensuring workplace practises were in compliance with expected norms, but controller station recordings would also provide a useful tool for data collection and auditing to fulfil the future requirements of safety management systems in air traffic services.

2.20 As discussed above, another factor in the controllers not identifying the potential for conflict when clearing Airlink 223 direct to TULMI may have been the colour of the PDA – the same colour as the airspace boundary lines around it. The colour of the Mercer PDA had been selected in an attempt to provide a balance between the area being able to be readily identified, but not dominate a controller's view of the radar display. Therefore, any proposed change to the PDA display colour would need to be carefully reviewed against other PDAs and the low utilisation of the Mercer PDA, which is located within a very congested area of controlled airspace.

2.21 The presence of PDAs and other areas around New Zealand containing concentrated adventure flying activities reflected public demand for such activities and the need to manage them safely. The establishment of D222 and subsequently the Mercer PDA is a good example. With only 2 recorded "loss of separation" type incidents, and none since the MOU became effective, the location of the Mercer PDA, while possibly not ideal, did show that parachuting activities could be safely managed from the aerodrome. However, the seriousness of this incident suggested that a risk and standardisation review of PDAs generally, and the Mercer PDA specifically, may be warranted to ensure these areas continue to operate as safely as possible. Refer to sections 4 and 5, Safety Actions and Safety Recommendations.

2.22 There was no audio evidence to support the comment by the planner that the controller had instructed the pilot of ZK-FGZ "do not drop". Had such an instruction been given, the planner could then understandably have thought the controller was aware of a possible conflict and was monitoring the progress of the 2 aircraft. The planner would then have been able to focus on his other duties. However, an instruction not to drop would still not have prevented a loss of separation, as the pilot of ZK-FGZ could still have climbed or descended within the PDA as he wished. The use of effective TRM practices, which address assumption-making and communication breakdowns, should have encouraged the planner to at least identify the risk, ensure all team members were aware of it then eliminate the risk.

2.23 The activation of the STCA indicating a potential conflict between Airlink 223 and ZK-FGZ, and the lack of response by the 2 controllers for about 30 seconds before the 2 aircraft crossed, were significant because these were important defences for preventing loss of separation and collision. The *conflict alert* had been preceded by 2 "nuisance alerts" in 8 minutes and the controller and planner may have dismissed this latest alert without first identifying the aircraft and checking the circumstances. The planner's attention may also have been diverted away from the screen during this time as he undertook other duties, such as making telephone calls and coordinating traffic with other agencies.

2.24 There was no evidence to suggest the 2 controllers normally, or controllers generally, would automatically dismiss these warnings without first determining the situation. However, with no means of recording false or genuine STCA activations and controller responses, it was not possible to determine if this was actually the case.

2.25 There should have been enough cues, both visual and audible, to attract the controller's and planner's attention to the situation developing near Mercer. The *conflict alert* and *proximity alert* were a controller's last 2 lines of defence against a mid-air collision and were not to be relied on as a normal means of controlling aircraft. That neither the controller nor the

planner reacted to the *conflict alert* during the time it was active suggests that the activation criteria and means of alerting a controller should be reviewed.

2.26 The STCA and TCAS functioned as designed and together provided appropriate and timely alerts. The lack of an STCA *proximity alert* was because the manoeuvre of ZK-FGZ, when it entered a rapid and tight descending turn, exceeded the limitations of the STCA equipment. The manoeuvre did not give sufficient time for a *proximity alert* to be calculated and displayed before the 2 aircraft had passed. This type of manoeuvre was not common in controlled airspace and was regarded as an acceptable limitation on the system, and emphasised the need for controllers to act on the first level of warning – the *conflict alert*.

2.27 There was nothing in the history of the 2 controllers to raise concerns about their ability to control aircraft. The circumstances indicate this was not a single, isolated error; rather there were a number of contributing factors, including:

- the controllers accepting the absence of the third controller
- the duty manager accepting the absence of the third controller
- the controllers not fully assessing the route before clearing Airlink 223 to TULMI
- the controllers not detecting an impending loss of separation
- the controllers not reacting to the STCA warning
- the possibility that a non-sterile environment might have led to unnecessary distractions.

While the reasons for each of the above points can be separately explained, collectively they indicate a wider or deeper systemic issue, with the Auckland Terminal sector at least. With this in mind the Commission examined the results of the NOSS.

The NOSS

2.28 The CAA audit of Airways was a compliance-orientated audit that focused on documented procedures, not individual controllers. By comparison the NOSS, while identifying general trends, observed individual controllers and their ability to manage everyday threats and challenges to determine those trends.

2.29 The NOSS identified that most errors generated by controllers were communication errors, usually procedural or instruction errors. While this was typical of an air traffic centre, the Christchurch Centre generated a higher percentage of communication errors. This was considered by some senior controllers to be due possibly to a more casual or easygoing attitude to radio communications by both pilots and controllers. Encouragingly, while threats and errors were more common, controllers showed they were able to prevent these developing into something potentially more dangerous.

2.30 Of direct relevance to this incident was the greater percentage of instruction errors generated by Auckland Terminal sector controllers. This could be due to either the higher traffic densities in the Auckland sector compared with other sectors or Auckland terminal sector controllers being possibly more casual in their work ethic, or a combination of both. If the former, it again reinforces the need to have the approach controller position occupied during the times prescribed. However, the circumstances of this incident, in particular the list of individual failures, could suggest the latter.

2.31 The main trunk ATC set-up, with the 3 terminal sectors being managed independently of each other, placed a greater reliance on the controllers to self-monitor their performance.

The Airways duty manager's job was not to supervise individual controllers, but to manage the resources to meet the needs of the centre at the time. The duty manager's role was to facilitate and not critique individual controllers. Therefore, controllers' ability to work unsupervised was premised on their high skill levels and professionalism. However, annual competency checks may not be sufficient to identify lapses in performance or non-adherence to procedures and practices. If duty managers are not to be involved in critiquing or assessing workplace performance, some other means of doing so, such as installing area microphones, might be needed, with the added benefit of recordings being available for incident and accident investigation.

2.32 The centralisation of internal audit and safety functions was recognition by Airways that there needed to be greater standardisation and accountability across each of the sectors. It should also help defuse the potential for any insular attitude to develop where a sector may become too inwardly focused and hardened to external criticism. Centralisation may also help ensure that agreed work practices are adhered to and MOUs are standardised.

3 Findings

Findings are listed in order of development and not in order of priority.

3.1 The 2 aircraft were being flown in accordance with their ATC clearances, which caused a loss of required separation and subsequently a near collision.

3.2 The positive actions of the crew of Airlink 223 following the TCAS alert and advisory prevented a potential collision.

3.3 The controller and the planner collectively did not recognise a conflict had developed because:

- the controller did not adequately check the route before clearing Airlink 223 direct to TULMI at 12 000 feet
- the controller either initially attempted to separate Airlink 223 from ZK-FGZ, rather than from the boundary of the Mercer PDA, or forgot about the presence of ZK-FGZ along the route
- there was ineffective monitoring of the progress of Airlink 223 and ZK-FGZ
- the STCA warning did not alert the controllers to the situation because they had most likely become desensitised to the warning by 2 previous activations of the system.

3.4 The absence of the third controller in the control room was either an isolated example of non-compliance with documented procedures or an indication of widespread risk-taking.

3.5 The Commission was not able to conclusively eliminate non-work related activities as a contributing factor in this incident due to the lack of work station audio recordings.

3.6 Although the Auckland Terminal sector was overrepresented in generating "clearance instruction errors", this incident was not a communication instruction-related error. However, the performance of the controllers during this incident could partially be attributed to the ATC organisational set-up, where the individual management of each terminal sector provided the potential for controllers to act in isolation and develop unsatisfactory work habits. The low level of supervision of controllers to ensure workplace standards were maintained and procedures adhered to may have contributed to the incident.

3.7 The nearly completed re-organisation of the Christchurch Centre by Airways should help promote greater standardisation and safer work practices.

3.8 The colour of the Mercer PDA on the radar display being less prominent to the controller, and the MOU between Airways and the Mercer Skydiving Centre that allowed ZK-FGZ to fly within the PDA for up to 15 minutes without communication with the controller, were 2 factors that probably contributed to his losing awareness of ZK-FGZ and the requirement to provide appropriate separation.

3.9 Failure to follow the principles of TRM within the Airways terminal sector control room was a lost opportunity to avert a near collision.

4 Safety Actions

Safety actions are listed in order of development and not in order of priority.

4.1 In October 2009, the parachuting operator installed a TCAS in ZK-FGZ. Initial reports from the pilot confirmed it was providing valuable traffic information to support his normal lookout.

4.2 Airways advised that following an internal investigation it had initiated several safety actions, including: the radar map display for the Mercer PDA would include cross-hatching to ensure the area was more visible when active, and the map display would be activated and deactivated for each parachute drop sortie. Also, the practicality of using a voice tag as part of the STCA activation prompts to replace the 2 audible beeps was being considered. Further, as a result of the NOSS report, a "Strategic Safety Plan" was being implemented that "specifically targets Casual Communications".

Other possible actions considered but not currently being acted upon included providing STCA protection around special-use areas, including PDAs, changing the colour of PDAs displayed on the radar screen, providing alternative routing for aircraft flying from Auckland to Tauranga or further south and amending the MOU to include the requirement for a pre-drop call by pilot of a parachuting aircraft. This may also include restrictions on parachuting aircraft descents.

5 Safety Recommendations

5.1 On 21 July 2010, the Commission recommended to the Director of Civil Aviation that he address the following safety issues:

5.1.1 The Mercer PDA is near a busy international and domestic airport and close to the tracks flown by aircraft flying from Auckland to Tauranga, which alone elevates the risk of midair collisions if air traffic controllers lose awareness of aircraft operating in and around the PDA, or if aircraft deviate outside the PDA. The MOU between the Mercer Skydiving Centre and Airways allows for special communication procedures that mean an aircraft could be operating within the PDA for up to 15 minutes without communicating with air traffic controllers, which together with the poor definition of the PDA on controllers' screens could contribute to controllers losing situational awareness of aircraft operating in and around the PDA and increase the risk of the required separation of aircraft being breached.

The Commission believes these are safety issues that the Director needs to address with Airways and recommends that the Director work with Airways to review the

management of the Mercer PDA, including a general risk assessment of the operation, and consider whether these safety issues extend to other PDAs and associated memoranda of understanding. (021/10)

5.1.2 Air traffic control is a highly safety-critical function of the aviation system, yet the process by which Airways ensured that workplace practices were in accordance with documented procedures was not effective, as shown by the non-compliance with written and agreed roster requirements.

The Commission believes this is a safety issue that the Director needs to address with Airways and recommends that Airways be required to implement an effective and auditable means of capturing the performance of individual controllers in a systematic way, as will be expected under the principles of safety management systems. (022/10)

5.1.3 The NOSS showed that the number of communication errors by both controllers and pilots, particularly for the Auckland Terminal sector, was unusually high by international standards. This increases the risk of communication errors contributing to a breakdown in safety standards.

The Commission believes this is a safety issue that the Director needs to address with Airways and recommends that he satisfies himself that Airways' planned Strategic Safety Plan will reduce communication errors and the consequent risk. (023/10)

5.1.4 The controllers were unaware of the activation of the STCA, which remained illuminated for about 30 seconds before the 2 aircraft crossed. The STCA is potentially a controller's last defence for averting a collision and needs to be acknowledged in every case. The lack of response in this incident may indicate that either the STCA activation indications were not effective or controllers had become desensitised to the indications due to a high number of "nuisance" alerts, or a combination of both.

The Commission believes this is a safety issue that the Director needs to address with Airways and recommends that Airways be required to review the operation of the STCA to ensure it is effective in reducing the risk of a collision and that controllers are sufficiently aware of the risk of ignoring what might be perceived as nuisance alerts. (024/10)

5.1.5 This incident highlighted a number of individual failures in the system for managing aircraft separation within the Auckland Terminal sector, the busiest sector within the New Zealand air traffic control system. Together with the findings of the NOSS, this indicates that a deeper systemic issue within the overall management of the sector may exist.

The Commission believes this is a safety issue that the Director needs to address with Airways and recommends that a review of Airways' operations be undertaken to confirm that the proposed re-organisation, including the centralisation of auditing and safety functions, will identify and remedy any systemic safety issues with the management and performance of the Auckland Terminal sector. (025/10)

5.2 On 26th August 2010 the Director of Civil Aviation replied:

Recommendation 021/10

I accept this recommendation. The CAA will be conducting an Audit of the Auckland Terminal Sector in September 2010. The audit will include review of the MoU and any actions taken by Airways Corporation.

Recommendation 022/10

I accept this recommendation.

A Safety Management System (SMS) is a formal organisational framework to manage safety. Under an SMS, organisations will need to have systems for hazard identification and risk management, safety targets and reporting processes, procedures for audit, investigations, remedial actions, and safety education.

The CAA has adopted a policy of implementing SMS requirements for a wide range of certificated organisations in the civil aviation system, including Civil Aviation Rule (CAR) Part 172 certificate holders such as Airways. The SMS policy is to be implemented through a series of amendments to CARs.

However many CARs already include a number of elements of a modern SMS. CAR Part 172 currently includes requirements for Airways to have procedures in place to establish the competence of its staff providing air traffic services, and an internal management system addressing, inter alia, the need for an internal quality assurance system to ensure compliance with, and the adequacy of, the procedures required by the rule.

These matters will be the subject of ongoing audit activity and air traffic controller performance systems (including training and competency) are to be included in the scope of the Auckland Terminal Sector audit in September 2010.

Recommendation 023/10

This recommendation will be addressed by the actions to be taken in response to 022/10.

Recommendation 024/10

I accept the recommendation. CAA staff will engage with Airways to specifically address the issue.

Recommendation 025/10

This recommendation will be addressed as part of the audit of the Auckland Terminal Sector, scheduled for September 2010.

5.3 On 18th August 2010, the Commission recommended to the Director of Civil Aviation Authority that he address the following safety issue:

5.3.1 Inquiries into this and previous incidents involving air traffic controllers have relied on radar and radiotelephone recordings, and the statements made by the air traffic controllers. However, verbal communications between controllers in the same work space is critical and integral element of the process for controlling aircraft but are currently not recorded. Without controller-station local area recordings, investigations will not always be able to identify all the contributing factors to an incident or accident and therefore valuable learnings might be lost.

The Commission believes this is a safety issue that the Director needs to address by initiating discussions with industry with a view to mandating the installation of air traffic controller station local-area recordings and providing the appropriate level of protection for such recordings as intended by ICAO for the purposes of assisting any future safety investigations. (036/10)

5.4 On 3 November 2010 the Director of Civil Aviation Authority replied in part:

> I appreciate the thrust of the Commission's recommendation. As previously advised, I am prepared to engage with civil aviation participants (in particular the Airways Corporation) with a view to encouraging voluntary introduction of air-traffic controller station local area recording.
>
> As you may be aware, mandating installation of local area recording systems is likely to require Civil Aviation Rule and legislative development/changes. In either case, a well developed safety case will be necessary to progress the work. While I appreciate that the Commission is seeking that I initiate discussions with industry to help facilitate a safety case being developed, the Commission may also be well positioned to assist in the development of a safety case that would eventually lead to Civil Aviation Rule or legislative change. I would welcome any assistance the Commission can lend on this front, and would invite your officers to engage with my staff to help clarify the requirements of a safety case.

Approved on 21 July 2010 for Publication

Mr John Marshall QC
Chief Commissioner

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