Report 97-010

RNZAF Hercules and Eagle Air Metroliner III

HER 7002 and EAG 105

loss of radar separation

Bay Area Sector (Hamilton - Taumarunui Track)

2 June 1997

Abstract

At about 1735 hours on Monday 2 June 1997 a loss of separation occurred between an RNZAF Hercules and an Eagle Air Metroliner proceeding in opposite directions on the Hamilton - Taumarunui track. The aircraft were under radar control and the Area Controller had cleared the northbound Hercules to descend from flight level 170 to 10 000 feet after the crew reported a pressurisation difficulty. The aircraft passed approximately 0.7 nm horizontally and 600 feet vertically apart.

No deficiencies were identified in relation to established standard procedures for radar control. However the incident underlined the safety benefit likely to ensue from the installation of a system software modification to provide an on-screen alert to controllers of an impending loss of separation and the importance of appropriate track and profile monitoring to ensure separation standards are maintained.

Transport Accident Investigation Commission

Aircraft Incident Report 97-010

Aircraft types & flight numbers:	Lockheed Hercules C130H, HER 7002 Fairchild SA227 Metroliner III, EAG 105
Date and time:	2 June 1997, 1735 hours[1]
Location:	About 40 nm south of Hamilton on the Hamilton - Taumarunui track
Type of flight:	RNZAF Air Movements task Eagle Air scheduled air transport
Persons on board:	Crew: HER 7002: 6 EAG 105: 2 Passengers: HER 7002: 10 EAG 105: 5
Injuries:	Nil
Nature of damage:	Nil
Investigator-in-Charge:	D G Graham

[1] All times in this report are in NZST (UTC + 12)

1. Factual Information

1.1 On Monday 2 June 1997 an Eagle Airways Limited Metroliner departed from Hamilton at 1722 hours for Palmerston North. The flight, identified as EAG 105, was cleared at Flight Level (FL) 140 via Taumarunui. EAG 105 reported routinely to Auckland Area Control at 1726 hours, climbing to FL 140.

1.2 An RNZAF Hercules aircraft, HER 7002, departed from Ohakea at 1715 hours for Whenuapai. The flight was cleared at FL 170 via Taumarunui and Hamilton.

1.3 HER 7002 climbed uneventfully to FL 170. However, in the cruise the crew became aware of an unusual noise coming from the aircraft wing root area. The noise appeared to be associated with the pressurisation system. As a result the crew requested clearance from Ohakea Control to descend to 10 000 feet for the remainder of the flight.

1.4 HER 7002 was about to be released from Ohakea Control to Auckland Area Control, a routine transfer which took place when an aircraft crossed the airspace boundary at Taumarunui Reporting Point. The Ohakea Controller advised HER 7002 that contact with Auckland was required to co-ordinate the requested descent, then telephoned the Auckland Area Controller and in a brief exchange informed her that the crew had requested descent to 10 000 feet "due pressurisation".

1.5 EAG 105 at FL 140 was opposing traffic for HER 7002. Accordingly the Auckland Area Controller responded that HER 7002 could be cleared to FL 150 initially. The Ohakea Controller agreed with this restriction and confirmed release of HER 7002 to the Auckland Area Controller.

1.6 The Auckland Area Controller was obliged to handle other airline traffic over the next 30 seconds but at the first opportunity she instructed EAG 105 to turn left twenty degrees explaining that this was to keep their aircraft clear of ". . . northbound Hercules traffic through Taumarunui requiring emergency descent due to pressurisation failure". The crew of EAG 105 complied without delay and advised the controller of their new heading.

1.7 Approximately one minute after HER 7002 had been released by Ohakea to Auckland Area Control the crew established contact with the Auckland Area Controller. Their transmission partially crossed the controller's most recent transmission to EAG 105. They informed the controller ". . . we just have trouble maintaining cabin altitude so just requesting descent to one zero thousand when available."

1.8 EAG 105 and HER 7002 were approximately 40 nm apart at this time. The controller replied immediately clearing HER 7002 to 10 000 feet. The Hercules crew read back the clearance correctly. In their response the crew queried whether the controller understood that their descent was not an emergency. The controller confirmed this. Nevertheless, she anticipated that having received the descent clearance the crew would still want to reach 10 000 feet with a minimum of delay.

1.9 The controller then directed her attention to the Raglan area of the sector. Over the next three minutes she became absorbed in the communications and monitoring necessary to ensure expeditious sequencing and separation of three aircraft in that vicinity. Having resolved the situation satisfactorily she returned to HER 7002 and EAG 105. She recognised immediately that HER 7002 had not descended as rapidly as she expected, and there was about to be a loss of separation between the two aircraft.

1.10 The controller instructed EAG 105 to turn left on to a heading of 090°, and HER 7002 to turn left on to a heading of 280°, and provided each aircraft with the relevant essential traffic information. Both aircraft complied promptly with the controller's instructions. The aircraft passed in instrument meteorological conditions shortly after 1735 hours, with less than the required separation. Once the aircraft were clear of the potential conflict the controller cleared them back on track.

1.11 The controller immediately reported the occurrence to her supervisor. At 1737 hours another controller took over her position in accordance with routine action following such an event.

1.12 The controller was on the first day of a four day spell of duty. She had been off duty for the previous two days. The afternoon shift was from 1345 hours to 2115 hours. The controller took a break at 1530 hours and again at 1705 hours. (A requirement of the radar controller's position was that not more than two hours should elapse between breaks). The loss of separation occurred about thirty minutes after the last break.

1.13 The controller had commenced air traffic service training ten years earlier and had been a qualified controller for seven years. She had qualified as an Area Radar Controller in December 1993 and as an Approach Radar Controller in March 1994. She had worked at Ohakea until July 1996. In August 1996 she had been validated on the Bay Area sector, the sector being worked at the time of the occurrence. Her most recent proficiency assessment had taken place at the time of her validation.

1.14 The controller considered that traffic volume at the time of the occurrence was average. Of direct relevance was the necessity for the Bay Area Controller to monitor and sequence traffic in the Raglan area in order to release these aircraft to Auckland Terminal sector appropriately. The Bay Area sector also included responsibility for aircraft north of Auckland. Two aircraft were operating in this area but did not require the controller's close attention at the time.

1.15 The Hamilton - Taumarunui track involved two way traffic. At busy periods this could lead to a complex control situation requiring vectoring and clearing of aircraft off track. In contrast, some other routes provided separated tracks for northbound and southbound aircraft, this facilitated a "circular" traffic flow which simplified and reduced the extent of monitoring and control required.

1.16 The relevant radar recordings showed that EAG 105 and HER 7002 passed each other with a separation of approximately 0.7 nm horizontally and 600 feet vertically. Standard radar separation was 5 nm and 1000 feet. The loss of separation occurred approximately 40 nm south of Hamilton. The radar data indicated that HER 7002 had descended at about 1000 feet per minute.

1.17 Neither of the aircraft involved in this incident was fitted with a traffic alert and collision avoidance system (TCAS). Installation of this equipment was not a requirement for aircraft operating within New Zealand airspace.

1.18 The radar equipment in use did not provide a controller with any warning of an impending loss of separation. Purchase of a suitable system modification (short term conflict alert (STCA)) was approved by Airways Corporation in April 1997, prior to this incident, and the software installation project has commenced. Implementation is expected in 1998. The modification will alert a controller by an on-screen flashing indication.

2. Analysis

2.1 Although HER 7002 and EAG 105 were flying opposing headings on the same track, no conflict existed initially as HER 7002 was cruising at FL 170 and EAG 105 at FL 140 thus maintaining ample vertical separation.

2.2 The crew of HER 7002 requested clearance to leave FL 170 and descend to 10 000 feet as a precaution because of their concern regarding the pressurisation of the aircraft. From the crew's perspective it was not an emergency. Consequently, once cleared to descend, the crew employed a standard procedure producing a rate of descent of approximately 1000 feet per minute as confirmed by the radar data.

2.3 On the part of the controller, however, the indication of a pressurisation problem introduced an expectation that a descent clearance was needed as soon as practicable, and that when cleared the aircraft would descend rapidly.

2.4 This expectation was founded in the controller's training and conditioning with regard to a pressurisation system failure or sudden decompression. An event of this nature implied a necessity to reach an appropriate altitude with a minimum of delay, normally requiring the crew to adopt specific operational procedures to obtain a high rate of descent.

2.5 While the crew of HER 7002 in their transmissions to Auckland Area Control sought to minimise the problem they had identified, and confirmed with the controller that it was not an emergency, the aircraft's rate of descent was not mentioned by the crew nor queried by the controller. The controller still expected a reasonably high rate of descent by the aircraft.

2.6 An option existed for the controller not to permit HER 7002 to descend below FL 150 until the opposing traffic had passed. This would have preserved the required minimum vertical separation between the two aircraft unequivocally but would have delayed the authorisation of further descent by HER 7002 to 10 000 feet.

2.7 The controller followed the alternative of directing the crew of EAG 105 to make a heading change, and issuing the descent clearance to HER 7002 without delay. The distance apart of the aircraft at the time, and the anticipated rate of descent of HER 7002, suggested that standard separation would be maintained without difficulty.

2.8 In the event, the twenty degree 'split' given to EAG 105 did not provide horizontal separation as intended, and the aircraft remained on potentially conflicting headings. As a result, compliance with the required minimum standard became dependent on the vertical separation maintained between the two aircraft.

2.9 Radar data indicated that had HER 7002 descended, when cleared, at approximately 2000 feet per minute (i.e. about twice the aircraft's actual rate of descent) normal separation would have been maintained.

2.10 If the controller had known that the crew of HER 7002 would employ a standard descent procedure, she had the option of directing a greater 'split' by EAG 105, or requesting a turn by both aircraft, to ensure adequate horizontal separation. In either case, however, it was essential that appropriate track and profile monitoring took place subsequently to ensure that the intended separation was achieved.

2.11 The controller was trained, experienced, and under no undue stress. In her estimation the workload was average. On occasion, however, considerable time and attention was required on the Bay Area sector to monitor and sequence the aircraft in one particular area of the sector. In this incident the controller's absorption with the Raglan traffic situation prevented her from assessing the adequacy of the twenty degree 'split' given to EAG 105, and monitoring HER 7002's track and rate of descent in a timely manner.

2.12 Airways Corporation had assessed the staffing requirements of the Bay sector prior to the incident, and subsequently carried out a further review. Their studies concluded that the overall workload did not warrant the addition of a planner position and that, in the circumstances, a planner would not have assisted significantly in preventing the occurrence. Implementation of new software to effect a single integrated radar and flight data processing system in late 1997 was also expected to decrease the workload on the Bay sector and other sectors.

2.13 The radar recordings indicated that the aircraft were about six nautical miles apart when the controller recognised the potential for a loss of separation and instructed each crew to turn their aircraft to the left. The controller's decisive and immediate action substantially reduced the risk of any conflict between the aircraft. The circumstances illustrated the need to make the appropriate allowance for closing speeds when issuing avoidance instructions to opposing traffic.

2.14 Aircraft on the Hamilton - Taumarunui track frequently required particular attention from a controller as a result of the two-way traffic flow but in this occurrence it was only the unusual circumstance of the request by HER 7002 that introduced potential for a loss of separation.

2.15 Control could be simplified over a number of busy routes by defining separated tracks for northbound and southbound traffic. However the benefits of a 'circular flow' depended, among other factors, on overall traffic volume and the availability of alternative routes and suitably located reporting points. Any change to existing routes was likely to affect airline operating economics and would require detailed analysis and consultation on a cost versus safety basis.

3. Findings

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

3.1 The controller was properly qualified and fit for duty.

3.2 The aircraft involved were being flown in accordance with the air traffic control clearances issued.

3.3 Advice of the pressurisation difficulty experienced by the crew of HER 7002 created an expectation on the part of the controller that the aircraft would require a descent clearance as soon as practicable, and would descend rapidly.

3.4 The controller's decision to turn the opposing traffic, EAG 105, and issue a descent clearance to HER 7002 was appropriate, but timely monitoring of the tracks of both aircraft and HER 7002's rate of descent was essential to ensure that adequate horizontal or vertical separation was maintained subsequently.

3.5 Had HER 7002 descended at the rate anticipated by the controller from the time the descent clearance was issued, adequate separation between the aircraft would have resulted.

3.6 The advice from the aircraft's crew that no emergency was involved did not remove the controller's expectation that HER 7002's rate of descent would be higher than normal.

3.7 The controller's absorption with monitoring and sequencing traffic in another area of the sector delayed her assessment of the developing situation and prevented timely intervention to avoid the loss of separation.

3.8 The controller's decisive and immediate action on recognising an impending loss of separation was in accordance with standard procedure and reduced the risk of any conflict between the aircraft substantially.

4. Safety Recommendations

4.1 It was recommended to the Chief Executive of the Airways Corporation of New Zealand that he:

4.1.1 Assign appropriate priority to the installation of a system software modification STCA, already purchased, which will provide radar controllers with an on-screen warning of an impending loss of separation between aircraft under radar control in the sectors for which they are responsible. (076/97)

4.1.2 Without identifying individuals use the incident involving EAG 105 and HER 7002 in controller education and training as an example of unusual circumstances concerning a 'pressurisation' event, emphasising the importance of appropriate track and descent profile monitoring to ensure separation standards are maintained. (078/97)

4.2 The Chief Executive of the Airways Corporation of New Zealand responded as follows:

4.2.1 **076/97** Airways Board of Directors approved the purchase of Short Term Conflict Alert software on 29 April, which was prior to this incident, and the installation project has commenced. The project is planned to be completed without delay, however, due to the complexity of the project implementation is not expected to be complete until November 1998.

4.2.2 **078/97** Airways accepts the general principle that lessons learnt in incidents should be used as educational material as well as material useful in guiding process change designed to avoid repeats of similar incidents. The lessons learnt from the type of deficiencies identified in this incident have already been incorporated into some of our cyclical training programs. Due to this recommendation being more in the nature of a principle or philosophy, rather than an action item, a proposed time for implementation is not relevant.

15 October 1997

Hon. W P Jeffries
Chief Commissioner

Glossary of aviation abbreviations

AD	Airworthiness Directive
ADF	automatic direction-finding equipment
agl	above ground level
AI	attitude indicator
AIC	Aeronautical Information Circular
AIP	Aeronautical Information Publication
amsl	above mean sea level
AOD	aft of datum
ASI	airspeed indicator
ATA	actual time of arrival
ATC	Air Traffic Control
ATD	actual time of departure
ATPL (A *or* H)	Airline Transport Pilot Licence (Aeroplane *or* Helicopter)
AUW	all-up weight
^{o}C	degrees Celsius
CAA	Civil Aviation Authority
CASO	Civil Aviation Safety Order
CDI	course deviation indicator
CFI	Chief Flying Instructor
C of A	Certificate of Airworthiness
C of G (*or* CG)	centre of gravity
CPL (A *or* H)	Commercial Pilot Licence (Aeroplane *or* Helicopter)
DME	distance measuring equipment
E	east
ELT	emergency location transmitter
ERC	Enroute Chart
ETA	estimated time of arrival
ETD	estimated time of departure
^{o}F	degrees Fahrenheit
FAA	Federal Aviation Administration (United States)
FL	flight level
ft	foot/feet
g	acceleration due to gravity
GPS	Global Positioning System
h	hour
HF	high frequency
hPa	hectopascals
hrs	hours
HSI	horizontal situation indicator
HT	high tension
IAS	indicated airspeed
IFR	Instrument Flight Rules
IGE	in ground effect
ILS	instrument landing system

IMC	instrument meteorological conditions
in	inch(es)
ins Hg	inches of mercury
kg	kilogram(s)
kHz	kilohertz
KIAS	knots indicated airspeed
km	kilometre(s)
kt	knot(s)
LAME	Licensed Aircraft Maintenance Engineer
lb	pound(s)
LF	low frequency
LLZ	localiser
Ltd	Limited
m	metre(s)
M	Mach number (e.g. M1.2)
^{o}M	degrees Magnetic
MAANZ	Microlight Aircraft Association of New Zealand
MAP	manifold absolute pressure (measured in inches of mercury)
MAUW	maximum all-up weight
METAR	aviation routine weather report (in aeronautical meteorological code)
MF	medium frequency
MHz	megahertz
mm	millimetre(s)
mph	miles per hour
N	north
NDB	non-directional radio beacon
nm	nautical mile
NOTAM	Notice to Airmen
NTSB	National Transportation Safety Board (United States)
NZAACA	New Zealand Amateur Aircraft Constructors Association
NZDT	New Zealand Daylight Time (UTC + 13 hours)
NZGA	New Zealand Gliding Association
NZHGPA	New Zealand Hang Gliding and Paragliding Association
NZMS	New Zealand Mapping Service map series number
NZST	New Zealand Standard Time (UTC + 12 hours)
OGE	out of ground effect
okta	eighths of sky cloud cover (e.g. 4 oktas = 4/8 of cloud cover)
PAR	precision approach radar
PIC	pilot in command
PPL (A *or* H)	Private Pilot Licence (Aeroplane *or* Helicopter)
psi	pounds per square inch
QFE	an altimeter subscale setting to obtain height above aerodrome
QNH	an altimeter subscale setting to obtain elevation above mean sea level
RNZAC	Royal New Zealand Aero Club
RNZAF	Royal New Zealand Air Force
r.p.m.	revolutions per minute
RTF	radio telephone or radio telephony

s	second(s)
S	south
SAR	Search and Rescue
SSR	secondary surveillance radar
°T	degrees true
TACAN	Tactical Air Navigation aid
TAF	aerodrome forecast
TAS	true airspeed
UHF	ultra high frequency
UTC	Coordinated Universal Time
VASIS	visual approach slope indicator system
VFG	Visual Flight Guide
VFR	visual flight rules
VHF	very high frequency
VMC	visual meteorological conditions
VOR	VHF omnidirectional radio range
VORTAC	VOR and TACAN combined
VTC	Visual Terminal Chart
W	west