



Report 97-018

Various Boeing 767 and 747 aircraft

unrestrained cargo

17 October 1997 to 12 January 1998

Abstract

Between 17 October 1997 and 12 January 1998 various Boeing 767 and 747 aircraft were flown with unrestrained unit load devices or pallets. In four cases the cargo was able to move freely along the adjacent empty spaces in the cargo hold of the aircraft.

An investigation of the first incident was initiated in Sydney, at the Commission's request, by the Australian Bureau of Air Safety Investigation. While that investigation was in progress four further incidents occurred.

As a result the Commission decided to investigate the general area of the company's aircraft loading process by a detailed investigation of the second incident, and to utilise the findings of the investigations into the other four incidents by other parties, as a guide for the emphasis on the various causal factors involved. Other personnel who were not involved in any of the incidents were interviewed to obtain their understanding of the individual tasks which related to the aircraft loading, and thus give a greater breadth to the appraisal of the company's procedures.

The safety issues identified related to:

- the consultation associated with the modification of company aircraft,
- the process for amending company manuals,
- the supervision of aircraft pre-departure procedures,
- the aircraft loader's awareness of loading hazards,
- the co-ordination on the ramp,
- the training and qualification of personnel,
- the pressures on ramp personnel,
- the checking of individual competence,
- the incident notification procedures, and
- unauthorised interference with the aircraft equipment.

These matters have been addressed in the safety recommendations and actions proposed by the operator which are referred to in this report.

Transport Accident Investigation Commission

Aircraft Incident Report 97-018

Aircraft types and registrations:	Boeing 767-200, ZK-NBC, Boeing 767-300, ZK-NCF and ZK-NCL and Boeing 747-200, ZK-NZX
Dates:	17 October 1997 to 12 January 1998 ¹
Location:	During international flights
Type of flight:	Air Transport Scheduled Passenger Services (except ZK-NBC)
Injuries:	Nil
Nature of damage:	Substantial to Unit Load Devices
Investigator-in-Charge:	R Chippindale

¹ The times in this report are in Australian Eastern Standard Time (EST) or New Zealand daylight saving time (NZDT) as applicable. Australian EST is 10 hours and NZDT 13 hours ahead of UTC respectively

1. History of the loading incidents (see also Appendix A)

- 1.1 At 0440 hours on Friday 17 October 1997, an Air New Zealand Boeing 767 arrived in Christchurch after a flight from Sydney. When the rear cargo hold was opened the cargo loaders found an unrestrained unit load device (ULD) weighing 1530 kg had been free to move a distance of some 9 m during the flight.
- 1.2 At 1630 hours on Sunday 16 November 1997, an Air New Zealand Boeing 767 arrived in Sydney after a scheduled passenger flight from Christchurch. When the forward cargo hold was opened the cargo loaders found two unrestrained ULDs weighing 2015 kg had been free to move a distance of some 3 m during the flight.
- 1.3 At 1100 hours on Saturday 13 December 1997, an Air New Zealand Boeing 747 arrived in Auckland after a scheduled passenger flight from Rarotonga. When the forward cargo hold was opened the cargo loaders found the locks in front of a cargo pallet weighing 878 kg in compartment 24 had not been raised. In this case there was a baggage ULD in front of the container which limited its movement.
- 1.4 At 1100 hours on Wednesday 7 January 1998, an Air New Zealand Boeing 767 arrived in Brisbane after a scheduled passenger flight from Wellington. When the rear cargo hold was opened the cargo loaders found three unrestrained ULDs had been free to move a distance of some 2 metres during the flight.
- 1.5 At 0640 hours on Saturday 10 January 1998, an Air New Zealand Boeing 767 arrived in Auckland after a scheduled passenger flight from Honolulu. When the rear cargo hold was opened the cargo loaders found a JT-8 engine on a pallet weighing 2268 kg had been free to move a distance of some 2 metres during the flight.

2. Detail of incident involving Air New Zealand Boeing 767-300, ZK-NCL, flight NZ 183 on 16 November 1997 at Christchurch Airport

- 2.1 As a result of the incidents described in section one, and detailed in Appendix "A" to this report, the loading system of the operator as it applied to the incident on 16 November 1997, was investigated to examine the loading process involved in detail.

Captains notification

- 2.2 The crew of ZK-NCL (referred to in 1.2) heard "loud rumblings and bangs from the cargo hold" on the descent into Sydney. In Sydney the loaders found two ULDs in the forward hold, with a total weight of 2015 kg, had not been restrained. The relevant Engineering report stated:

Found nil lateral guides or centre ball mat area locks in locked positions. Nil hold damage found. One cargo container punctured by contact with pallet.

Positioning of the aircraft

- 2.3 On 16 November 1997 Air New Zealand Boeing 767-300, ZK-NCL, arrived in Christchurch from Melbourne at 0022 hours as flight NZ 198. After the passengers and cargo were unloaded it was parked on Gate 30 as it was not due to depart until 1315 hours that day for Sydney as scheduled passenger service NZ 183.

- 2.4 Parking at Gate 30 was in accordance with the gate plan. The gate plan was prepared on the previous day by the personnel in the Airline Operation Centre (AOC) at Christchurch. This plan depicted the allocation of gates to aircraft against time on a chart. The gate plan for 16 October started at 0500 hours and depicted gate 15 as occupied until 0645 hours after which it was clear until flight NZ 183 (ZK-NCL) was to be positioned there by Christchurch Line Maintenance during a quiet period between 0800 hours and 1100 hours. Gate 30 was not intended to be in use again until 1400 hours. The only scheduled movement between 0800 and 1100 hours, a Boeing 747, flight NZ 98 from Osaka, was allocated to Gate 28. NZ 98 arrived at 0736 and departed at 0920 hours, five minutes after its scheduled time of departure.
- 2.5 The normal procedure for personnel in the AOC was to check on their television monitors that each aircraft was positioned on the correct gate at least 60 minutes before its scheduled time of departure. They could see gate 15 on a television monitor. Gate 30 was not visible and did not have a television monitor.
- 2.6 The engineers, who were responsible for towing the aircraft into position, were advised of the gate allocation, and time of arrival and departure for each aircraft, via a visual display unit which displayed specific information for each flight entered by the AOC personnel into the Air New Zealand Carina Departure Control System (Carina) computer network.

Loading of the aircraft

- 2.7 ZK-NCL was not moved into position on Gate 15 as expected by the AOC personnel, either during the quiet period or by 60 minutes prior to the standard departure time. Therefore the loading team assembled the cargo and baggage for loading onto flight NZ 183 at gate 30. At 1215 hours, one hour before the scheduled departure time, two loaders arrived to commence loading the aircraft.
- 2.8 Someone from Line Maintenance instructed the loaders not to start the loading because the aircraft had to be moved to another gate. At 1250 hours the aircraft was positioned on Gate 15 and the two loaders started the loading.
- 2.9 Only part of the loading team was available for loading NZ 183, as three of its members were helping dispatch a Boeing 747, flight NZ 34, due to depart at 1320 hours. The loading foreman joined the loading team after ZK-NCL was moved to gate 15, but he was advised soon after his arrival that late baggage needed to be collected for flight NZ 34, so he left on a tractor to locate and load the baggage. To avoid delaying flight NZ 34 the loading foreman left the loading of the forward hold of Flight 183 to the two available loaders.
- 2.10 After they loaded the forward hold the JCPL (jumbo container and pallet loader) driver repositioned the JCPL at the door of the rear cargo hold to continue the loading of the aircraft while his assistant closed the door on the front hold. The JCPL driver was responsible for loading the containers and pallets allocated to each main hold in the correct locations and ensuring they were properly secured.

Certification of security of the load

- 2.11 The loading foreman's overall responsibility was to ensure each item of cargo and baggage in the holds of the aircraft was correctly located and secured. As was normal, he trusted the JCPL driver to do this on his behalf in the main cargo holds. This delegation was necessary as the foreman's duties involved him in supervising the loading of more than one aircraft in addition to working as a loader.
- 2.12 In accordance with the company's practice the load controller, as well as the loading foreman and each of his loaders, had a copy of the loading instruction form (LIR) for this flight.

- 2.13 On the LIRs were three parallel schematic diagrams each of which showed the positions in the forward and aft holds of the aircraft in which the containers and pallets could be stowed. In sequence they depicted:
- where the incoming containers and pallets should be stowed
 - where the outgoing pallets and containers were intended to be stowed, and
 - where the outgoing pallets and containers were actually stowed prior to departure.
- 2.14 The upper and centre diagrams i.e. arrival and loading instructions were to be completed by the load planning officer. Completion of the arrival diagram was not required at the originating station (on this occasion Christchurch). The lower diagram was intended to be completed by the loading foreman supervising the aircraft loading if any changes to the intended load distribution occurred.
- 2.15 Only the centre diagram was completed for flight NZ 183. On the JCPL driver's copy, only the location of the pallet and three ULDs was shown originally. The identifying numbers of four additional baggage ULDs were added later. Empty compartments (no fits) were shown by the letter "N" to either side of the pallet. These empty compartments were the rearmost and doorway compartments in the forward hold.
- 2.16 On the LIR for this flight the certification for the loading of the individual holds had not been signed or initialled by the JCPL driver nor by anyone else. Although the JCPL driver did not sign the LIR in respect of either the forward or aft cargo hold on this occasion, he believed he had and stated he had no reason not to sign it in respect of either hold.
- 2.17 The loading foreman had certified in the space "Load Foreman sign" that "containers and pallets have been checked for serviceability and have been loaded and secured in CPTS [compartments] 1,2,3, & 4 according to the distribution . . . and in accordance with Air New Zealand's written instructions, and deviations advised to load control prior to departure." After the loading foreman had certified that he was satisfied the aircraft was correctly loaded in accordance with the LIR (see figure 1), he handed the LIR to the load controller, with whom he confirmed there were no last minute changes.
- 2.18 The load controller was expected to check that the LIR was properly certified before completing the load sheet for the aircraft captain.

Aircraft cargo and baggage restraint system

- 2.19 There are three cargo compartments in the lower deck of the Boeing 767-300. These are the forward containerised cargo compartment (forward cargo hold), the aft containerised cargo compartment (aft cargo hold) and the bulk cargo compartment. An electro-mechanical cargo handling system loads and unloads containers in the containerised cargo compartments. The forward containerised cargo compartment has a large cargo door and additional cargo handling components for pallets. The cargo handling system is controlled from the cargo handling control panels by the JCPL driver.

AIR NEW ZEALAND B767-319 LOADING INSTRUCTION	FROM CHC	TO SYD	DATE 16/11/97	DISTRIBUTION PLANNED BY F. JWE
	FLT NZ183	R ZK NCL	CONFIG 0/9/1	TRAIL TRIM 710

Loaded By: _____
 CPTS 1 & 2 SIGNED _____
 CPTS 3 & 4 SIGNED _____
 CPTS 5 SIGNED _____
 Lead Foreman Sign: _____

Loading foreman's initials

AT ARRIVAL

51	43	42	41	34	33	32	31

Aft Cargo hold

REPOSITION

51	43	42	41	34	33	32	31
Bulk hold	B	S	B	9701	9283	41035	X
				C	X		
				1360			
				150219	9750		

Bulk hold

LOADING INSTRUCTION

← 2450kg → ← 7500kg → ← 12100kg → ← 10000kg →

Forward cargo hold

Two ULDs which were not secured

11	12	13	14	21	22	23	24	27	28	29	30	31	32	33	34
				21P		22P									

Forward cargo hold doorway

Pallet load

15300kg

Forward cargo hold doorway

15300kg

No-fit bays

Forward cargo hold

11	12	13	14	21	22	23	24	27	28	29	30	31	32	33	34
				21P		22P									

Forward cargo hold doorway

15300kg

Forward cargo hold doorway

15300kg

REPORT

NOTES

Figure 1
Copy of LIR used by JCPL Driver

- 2.20 The forward compartments are divided into 8 bays each of which can hold two half width containers or unit load devices (ULD) or one full width ULD. When required, four pallets can be carried in the hold. Cargo handling system components are installed in the floor of the compartment and ULDs or pallets are loaded and unloaded using the cargo handling system. The cargo door is on the right side of the aircraft and the control panel is on the fuselage at sill level to the right of the door.
- 2.21 The containerised compartments are equipped with restraints for guiding ULDs into and within each compartment and for securing the ULDs in flight. These restraints include lateral guides and partial load stops.
- 2.22 To restrain the two ULDs in the forward hold the JCPL driver needed to raise the lateral guides and partial load stops adjacent to the hold door manually, before closing the door. He did not position either the guides or the stops.
- 2.23 The lateral guides (see figure 2) were devices designed to keep the ULDs aligned as they moved into the hold and to re-erect automatically after the load had passed over them. The re-erection was particularly important when, as in this case, there was a “no-fit” in the aircraft compartment(s) immediately inside the door.
- 2.24 The guides in each hold were in two rows of three, one forward and one in the centre of the forward hold doorway compartments and one row on either side of the rear hold doorway compartment. When electrically operated the guides automatically raised when a load was being transferred into the aircraft from the JCPL. When the loader selected the direction in which he wanted to drive the cargo from the doorway the lateral guides, which would otherwise obstruct the movement, were automatically retracted. At the completion of the loading the lateral guides returned to the raised position.
- 2.25 Most Boeing 767 aircraft, including two QANTAS aircraft which these loaders had dispatched earlier in the shift, had electrically operated lateral guides. As the Air New Zealand Boeing 767 aircraft did not have electrically operated lateral guides the guides had to be operated manually. As they could not be reached once a load was inside the doorway, they could not be raised to guide the load in on occasions when they would subsequently obstruct the progress of the pallet or ULD in the required direction. The lateral guides were required to be raised and locked by hand after the pallet or ULD had passed over them.

Modification of the lateral guides

- 2.26 In common with other airlines, Air New Zealand had difficulty in maintaining the original version of the electrically operated lateral guides in a serviceable condition. The early version of the guides was prone to failure due to tension loads which could be applied to an erected guide if impacted by off-loading containers, and compression loads which could be applied to partially erected guides if impacted by an onloading container. On 10 November 1986, the company decided by Engineering Authorisation EO 25-2044 to remove the actuators from these guides and require the guides to be manually operated:
- ... till such time [as] the new stops will be available, at which point the actuators will be reinstalled.
- 2.27 Prior to such decisions being made, the company’s Engineering Services management normally circulated an Engineering Proposal to Flight Operations for their acceptance “with respect to flight operations procedures”. In this case the section of the proposal relating to flight operations was marked “n/a”. The technical assessment on the form stated:

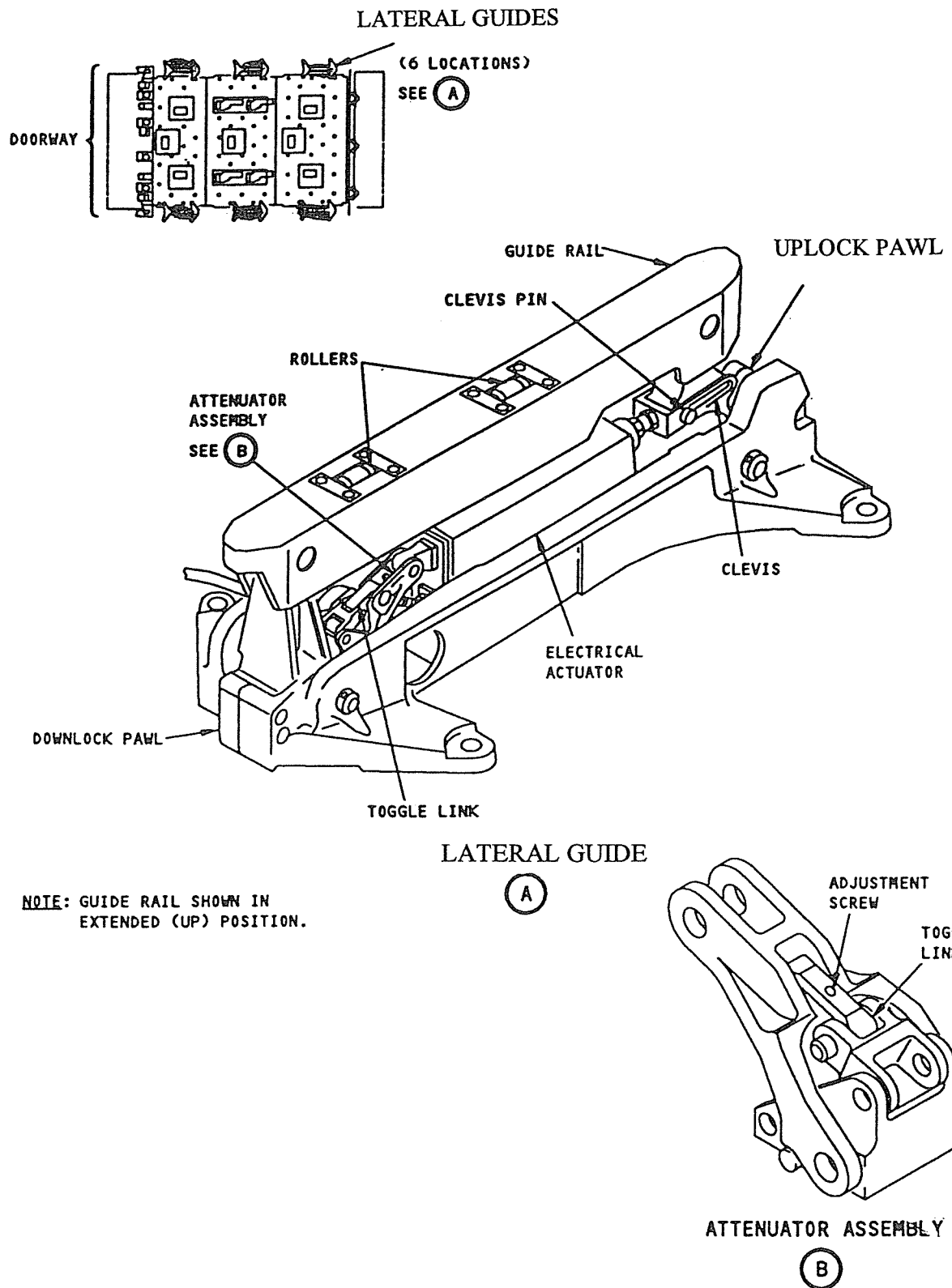


Figure 2
Lateral guides

The removal of the lateral guide actuators will not affect the operation of the aircraft. Manual operation is standard to aircraft.

- 2.28 On 24 October 1991 the manufacturer notified Air New Zealand that an improved lateral guide was available which protected the actuator from the compression and tension loads which had been damaging the guides. Air New Zealand elected not to reinstall the actuators, “to reduce maintenance costs”. Further they decided to maintain the commonality of the fleet by removing the actuators from the modified lateral guides in any aircraft which were added to their Boeing 767 fleet.
- 2.29 As the Passenger Services Department (now Airport Service Delivery) was not consulted they did not have the opportunity to draw the attention of the engineers to the drawbacks of their proposal. One of these drawbacks was the imposition on the loading crews, in New Zealand and overseas, who had to make a special effort to raise and secure the guides manually. This was an extra task which was not required on Boeing 767 aircraft operated by other companies.
- 2.30 Experience showed that some of Air New Zealand’s Boeing 767 aircraft were arriving for routine maintenance with all of the manually operated lateral guides unserviceable due to a distortion of the latch which was intended to keep them in the raised position. Examination of the damage to the latches indicated it was unlikely to have occurred in normal usage. The bending of the component to disable the lateral guides was effected in a position which was not vulnerable to damage by cargo passing over the guides.
- 2.31 The Passenger Services Department became aware that the actuators had been removed from the lateral guides immediately after the action was taken but did not amend the relevant manuals, nor promulgate new procedures to their loaders to recognise the effect of the modification. At the time of the incidents discussed in this report, the relevant manuals referred to the lateral guides as being electrically operated.

Supervisory structure

- 2.32 Airport terminal services were the responsibility of the Manager of Airport Service Delivery. The manager of Airport Service Delivery also had a staff officer who was responsible for auditing the performance of terminal service units in New Zealand and overseas to ensure they were able to deliver the services required to the standard specified in the company’s manuals. He was responsible for ensuring the contracts with the providing companies prescribed the necessary standards and that the companies met those standards.
- 2.33 Air New Zealand had an airport manager at each of the airports in New Zealand involved in their international services who was responsible for the overall supervision of the loading of international aircraft.
- 2.34 The incident involving flight NZ 183 occurred on a Sunday. During the weekend the overall supervision of the loading of international aircraft was the responsibility of the Duty Manager. Irrespective of the day of the week the co-ordination of the activities on the ramp was the responsibility of the AOC personnel and the loading of the aircraft was planned by a Load Controller. The loading of the aircraft to the Load Controller’s plan was the responsibility of one or more loading gangs of five, each under the control of a Loading Foreman. The Loading Foreman also worked in the gang as a loader.

Auditing and investigation

- 2.35 The Air New Zealand procedures and documentation relating to aircraft loading had not been the subject of a Civil Aviation Authority (CAA), audit.
- 2.36 The company had its own internal audit teams which had investigated each of the incidents involved in this report and made specific recommendations with the aim of preventing the recurrence of similar events. These teams were also responsible for proactive auditing but were still in their formative stage and were committed to the production of the relevant documentation for obtaining CAA approval under Part 119 of the Civil Aviation Rules. As an independent business unit within Air New Zealand the Terminal Services Department was expected to be audited in a similar manner to those units supplying ramp services at overseas stations.
- 2.37 The company also had a Group Safety and Security Department which was able to conduct reactive and proactive investigations on the health of any department of the company. They had been involved in the reactive investigation of the series of incidents as a whole but, due to a lack of effective incident notification, they had not detected a need for the ramp area to receive special attention prior to this series of incidents.
- 2.38 The Manager of Airport Service Delivery required that she be advised of all incidents and accidents involving Terminal Services personnel (or their overseas equivalents) so that she would be aware of the health of the operation for which she was responsible, and be able to correct any trends which had the potential to reduce the safety of the operation.

Ramp co-ordination

- 2.39 Air New Zealand AOC's were established to:
- monitor and co-ordinate all airport processes,
 - adjust priorities to meet changing circumstances and ensure operation integrity,
 - integrate local airport resources to meet the network plans,
 - maintain close communications and liaison with all airport functions,
 - input all relevant local information into the network control centre,
 - ensure a high standard of safety and regularity,
 - provide operation support to airport management, and
 - provide a flexible, pro-active and responsive attitude to customer service and service recovery.
- 2.40 One function of the AOC was to check that each aircraft was on the correct gate and that, in the case of international aircraft which were to be repositioned by Line Maintenance, the aircraft were on the correct gate at least 60 minutes prior to departure.
- 2.41 The transmission of information between the AOC and Line Maintenance depended primarily on the entry of the arrival and departure times of each flight, and the gates at which the aircraft were to be positioned, into the Carina network computer system.
- 2.42 In this case Line Maintenance knew, from their Carina visual display unit, that ZK-NCL was expected to be repositioned from gate 30 to gate 15 by 1215 hours. This did not happen. When the deadline for the aircraft to start loading came Line Maintenance did not move the aircraft. Why the aircraft had not been moved in a window of time between 0800 and 1100 hours, when there were no other aircraft being serviced, was not established nor was it established why

AOC had not detected the delay on their monitors, nor why the engineers declined to allow the loaders to load the pallet and ULDs which they had taken to gate 30. The reasons were not established because the late notification of the incident led to lapses in the memories of the individuals concerned before they were interviewed

- 2.43 The loaders did not draw the loading foreman's attention to the delay imposed by Line Maintenance nor did the Line Maintenance foreman advise the AOC that there would be a delay with the re-location of ZK-NCL.

Circumstances creating pressure on the loading team

- 2.44 There were two teams of loaders involved on the Christchurch ramp on the day of the incident. The first team, which reported for duty at 0400 hours, was involved in the loading of flight NZ 183. The second team arrived in time to load NZ 27 which was scheduled to depart at 1235 hours.
- 2.45 When flight NZ 183 was due to be loaded, flight NZ 27, a Boeing 767 which arrived 50 minutes ahead of schedule at 1025 hours and had been unloaded by the first team of loaders, was being prepared by the second team for a 1235 hours departure. A Boeing 747, flight NZ 34, which had arrived at 1200 hours, was also being prepared for departure at 1320 hours by the first team in conjunction with members of the second team.
- 2.46 The loading foreman was often required to supervise the loading of more than one aircraft at a time and/or to share the responsibility of loading an aircraft with another loading gang. An aircraft was often unloaded by one gang and loaded by another.
- 2.47 Line Maintenance was involved in the investigation and rectification of a problem with the ignition on number four engine of the Boeing 747, flight NZ 34, and were also waiting to push back flight NZ 27 from gate 29. These activities prevented Line Maintenance from relocating NZ 183 on to gate 15 until 25 minutes before its scheduled departure time.
- 2.48 As a result of the late movement of NZ 183 the loading team had 35 minutes less than normal to load the aircraft. The loading foreman was responsible for supervising the completion of the loading of both NZ 183 and, with the assistance of the foreman and some members of the second team, flight NZ 34.

Loading staff

- 2.49 The loaders involved in loading flight NZ 183 each had more than 20 years continuous experience in the ramp environment and were fully conversant with the procedures required to load an Air New Zealand Boeing 767 aircraft safely.
- 2.50 Few of the loading staff interviewed implied that any shortcomings were due to a reduction in the size of the loading gangs, however the loading gangs were only able to meet the task because the foremen worked as loaders, the time spent on formal awareness training was reduced and the foreman delegated his responsibility for the supervision of the loading.
- 2.51 The training for loaders was a combination of introductory class room training and on-the-job training reinforced by supervised experience. Recurrent training, called "awareness training", was undertaken in respect of dangerous goods but formal recurrent training in other aspects of the loaders' ramp duties had been discontinued. The records of the training which did take place were incomplete.
- 2.52 The requirements for appointment as a loading foreman were not specified or standard within the company.

2.53 The airport managers were appointed on the basis of their experience but, although a formal job description had been issued during an introductory discussion period in September 1997, no formal training had been given to them in respect of their duties. The policy and procedures of the airport managers were not consistent throughout the company.

Factors affecting the loaders

2.54 The JCPL driver stated that he had no concerns which might have distracted him but he was conscious of the short time available to achieve an on-time departure for NZ 183. On-time departures were the aim of the loaders and they prided themselves on achieving them for a high percentage of the aircraft leaving Christchurch.

2.55 The loading team's tasks after they arrived at 0400 hours were:

- to unload and reload a QANTAS Boeing 767 aircraft which arrived from Melbourne at 0432 hours, 23 minutes ahead of schedule. (The aircraft was scheduled to depart at 0615 hours and departed 5 minutes ahead of schedule.),
- to load another QANTAS Boeing 767 aircraft, which had been at Christchurch overnight, for an 0640 hours departure. (The aircraft departed on time.),
- to load another overnight Air New Zealand Boeing 767 aircraft to dispatch by 0700 hours. (The aircraft departed four minutes ahead of schedule.),
- to unload and reload an Air New Zealand Boeing 747 which arrived 24 minutes ahead of schedule at 0736 hours. (The aircraft was dispatched five minutes late, due to the late arrival of a passenger.),
- to unload and reload an Air New Zealand Boeing 767 which arrived 50 minutes ahead of schedule at 1025. (The aircraft departed three minutes late at 1238 hours.),
- to unload and reload an Air New Zealand Boeing 747 which arrived five minutes late at 1205. (The aircraft departed four minutes late at 1324 hours.), and
- to reload ZK-NCL, the aircraft involved in this incident, which had been at Christchurch overnight, for an 1315 hours departure.

2.56 The assistance of the loading gang, which started at midday and had finished loading a Boeing 767 to depart at 1235 hours, was obtained to finish loading the Boeing 747, NZ 34, which was to depart at 1320 hours.

Manuals

In-hold equipment

2.57 The information in the Weight and Balance Manual B767-319 was not up to date in relation to the in-hold equipment in the Boeing 767 or its use. The manual described the system as being electrically actuated and detailed instructions for the equipment as if the equipment were so operated.

2.58 The ramp staff were aware of the difference between the actual situation and that described in the manuals in relation to both the equipment and the method in which it should be used.

Load certification

2.59 The company Ground Handling Manual had a page of instructions on load certification.

Page, C 1-1 issued on 28 August 1997, stated:

... The "Person-in-Charge" may be either traffic or loading staff but in all instances must be able to physically observe the correct loading of the aircraft, including the setting of the applicable restraint locks on B747/B767 aircraft and the fitting of restraint nets on all aircraft.

A Person-in-Charge is responsible for the correct observance of physical handling and loading procedures and may also delegate work but not responsibility to individual loaders.

Responsibility for the correct application of these duties will be indicated by signing the certification on the Loading Instruction [LIR].

Note:

Responsibilities for Cargo Loading-Passenger Services, Airport Management, and Engineering.

1. Company policy relating to loading, securing, and documentation of cargo is established by Passenger Services
2. Responsibility for compliance with Company policy rests with Airport Management.
3. Certifying Engineers may, however, require loads to be re-secured or off-loaded if they consider any item of cargo could cause an unsafe or hazardous condition.

2.60 The load control check sheet for NZ 183 (see Figure 3) had some significant errors. The use of the load control check sheet was intended to confirm that the difference between the actual weights on the aircraft and those standard weights used to estimate the aircraft loading, was accounted for correctly in the computer generated load plan. On the check sheet for this flight there was a difference of 857 kg between the totals entered for the estimated passenger/baggage weight and the actual passenger/baggage weight. When the load controller subtracted the actual passenger/baggage weight entered from the estimated passenger/baggage weight entered he obtained a difference of 584 kg. As none of the other variables in the aircraft load had changed the difference between the estimated and actual passenger/baggage weights should have equalled the difference between the estimated zero fuel weight and the actual zero fuel weight which he had calculated as 597 kg. According to his calculation the difference was only 13 kg so the load controller accepted the difference as a minor matter which he could correct later. However he had also entered incorrect figures for the actual zero fuel weight and the actual passenger/baggage weight.

2.61 Another error not detected by the load controller involved incorrect entries on a load advice message to Sydney due to confusion over the difference between the hold layout of the Boeing 767-200 series and that of the Boeing 767-300.

2.62 The load controller who was supervising the loading of flight NZ 183 was an experienced person whom the company utilised as an instructor to train other load controllers.

LOAD CONTROL CHECKSHEET

FLIGHT NZ183 DATE 16/11 ETD 1315 REGN NZL CONFIG 24/212 GATE _____

- DI REGN/CONFIG/PANTRY & CREW CODES
- FI GATE/PW/ETD
- DW PANTRY C CREW 2/8 DOW (1)
- SW SVC WT ADJUSTMENTS _____
- PC ADJUST FOR ROUTE AS NECESSARY
- CO CARGO OFFER
- ME MAIL EST MAIL ACT
- CE CARGO EST CARGO ACT
- LR
- BP (CHECK CAPACITY) P _____ J _____ Y _____
..... CHECK UPGRADES/CATERING -----) (2)
- QS (FOR T/S FLT'S) CHECK AGAINST SOM
- CK70 (FOR T/S FLT'S) CHECK AGAINST LDM _____)
- TR (FOR T/S FLT'S)
- IF CHECK SYSTEM EST SFW AGAINST MANUAL
- EP PROFILE JOINING LOADS (BY HOLD)
- CK61 JOINING BAGGAGE ULDS (BY HOLD) (3)
- MC START MONITOR ACT 3 (MC/S/3)
- DH HARD COPY & CHECK AGAINST LOADPLAN
SYSTEM LIZFW _____ PLAN LISFW _____
- PR SP...ML/AUTO...PR... TO RE-PLAN
- FP ENTER FUEL FIGURES
RESTRICTION? _____ (4)
- MC START MONITOR ACT 4 (MC/S/4)
- FC TIME _____
- MO OR ONLOADS AS REQUIRED
- MS RESTART MONITOR
- FF TIME _____
- LS ESTIMATE/ACTUAL ZFW RECONCILIATION)
SS...ML/AUTO...PR...LS TO RE-RUN
- PW LMC'S DONE?
- PL/LG* ENTER CPM ON LOADMESSAGE
- UCM
- MC START MONITOR ACT 5 (MS/S/5)
- MC START MONITOR ACT 6 (MC/S/6)
- NN ALL CLEAR?..... THEN BY

DEST.	CARGO (GROSS)		MAIL (GROSS)		CKG1
	ESTIMATE	ACTUAL	ESTIMATE	ACTUAL	
<u>GVA</u>		<u>4915</u>			
		<u>530</u>			
TOTAL					

MAIL		<u>0</u> KG
CARGO (GROSS)	+	<u>4915</u> KG
BAGGAGE ULDS (BY/105, ALE=140)	+	<u>530</u> KG
EST PAX TTL <u>(19176)</u> PAX/BAG WT= <u>95</u>	+	<u>18525</u> KG
JOINING LOAD	=	KG
T/S PAX: A _____ C _____ I _____	+	KG
T/S DEADLOAD	+	KG
MISC WEIGHTS (SPCL LOADS)	+	KG
TOTAL TRAFFIC LOAD	=	KG
DRY OPERATING WEIGHT	+	<u>90853</u> KG
EST ZERO FUEL WEIGHT	=	<u>114823</u> KG
ZFW PASSED (M.ZZ) & TIME		KG

PW RESULT	
P BAGS	KG
J BAGS	+
Y BAGS	+
PAX WEIGHT	+
PW TOTAL	=

RECONCILIATION	
(2) EST PAX/BAG WT	= <u>18525</u> KG
(4) PW TOTAL	= <u>11668</u> KG
DIFFERENCE =	+
CARGO ESTIMATE/ACTUAL	+/-
MAIL ESTIMATE/ACTUAL	+/-
MISC/CK61 ADJUSTMENTS	+/-
QP (T/S PAX) ADJUSTMENTS	+/-
CK70 (T/S DEADLOAD) ADJUSTMENTS	+/-
TOTAL OF DIFFERENCES =	+/-
(3) EST ZERO FUEL WEIGHT	= <u>114823</u> KG
ACTUAL ZERO FUEL WEIGHT	= <u>114326</u> KG
DIFFERENCE =	+

Figure 3
Load Control Check Sheet for Flight 183

Loading instruction

- 2.63 The instructions on the LIR did not explain the certification block on the form but emphasised that the person responsible for planning the load distribution in the hold must prepare the Loading Instruction Form [LIR] and verbal instructions were not acceptable as the form was part of the weight and balance certification of the flight. The Ground Handling Manual advised that completed examples were available in the appropriate aircraft Weight and Balance Manual. Although the B767-319 Weight and Balance Manual contained a blank LIR, and explained how it should be completed, no “completed example” was provided. There was no explanation in either manual of the instruction on the LIR as to the “Air New Zealand’s written instructions” with which the signatory was expected to comply.
- 2.64 When questioned none of the loaders spoken to had a clear idea of which “Air New Zealand’s written instructions” the form referred to or where to seek clarification. Most were of the opinion that the LIR itself constituted the written instructions to which the LIR referred. Whatever their opinion it was clear that none of the loaders spoken to referred to either the Weight and Balance Manual or the Passenger Services Manual and few knew where those documents could be found.

Incident notification

- 2.65 Although the Ground Handling Manual emphasised the notification action to be taken in the case of an incident involving dangerous goods (a hazardous incident) and discrepancies between the actual load in an aircraft and the aircraft’s loadsheet, there was no similar direct guidance for notification of other types of incidents associated with the loading of aircraft. The Ground Handling Manual in its reference to Incident/Accident Reporting² stated simply on page B 3-6, dated 5 July 1996:

Depending on the nature of any accident/incident, the reporting procedures are covered in:

- The Emergency Response Manual and
- The Administration Manual Part 3, Section 28.

- 2.66 The Aircraft Emergency Response Manual detailed the assessment and response processes and procedures for an aircraft emergency or accident. There was no specific reference to loading matters or the investigation of loading incidents in the manual, only a universal requirement for aircraft incidents to be assessed for seriousness, then emergency response procedures to be activated if warranted. Page 1-04 of the manual stated:

The purpose of this manual is to outline the company’s policies and procedures for the handling of major aircraft emergencies.

- 2.67 The Administration Manual Part 3 Section 28 referred to accidents and incidents involving death, injury or damage to company property.
- 2.68 The ramp staff spoken to were unaware of what constituted a notifiable incident, or to whom it should be notified. They were clear however that if something unusual did occur, which they considered a threat to the safety of the operation, they would draw it to the attention of someone in authority.
- 2.69 The loading staff were not encouraged to submit suggestions for the improvement of the safety and efficiency of their routine tasks nor were they aware of the channels for making such suggestions.

² The word “Reporting” is often used incorrectly as a synonym for “notification”.

Notification of the incidents

- 2.70 Notification of the incident involving the aircraft which departed on 16 October 1997 was received by the Transport Accident Investigation Commission (TAIC) from CAA at 1211 hours on 31 October 1997. The incident had been registered by CAA on 24 October.
- 2.71 Notification of this incident involving flight NZ 183, which occurred on 16 November 1997 was received by TAIC from CAA at 1346 hours on 3 December 1997. This incident had been registered by CAA on 1 December. (A note on this notification from CAA apologised for the late notification due to staff illness).
- 2.72 Notification of the incident, which occurred on 13 December 1997 was received by TAIC from CAA at 1028 hours on 23 January 1998. This incident had been registered by CAA on 9 January 1998.
- 2.73 Notification of the incident, which occurred on 7 January 1998 was received by TAIC from CAA at 1440 hours on 5 February 1998. This incident had been registered by CAA on 5 February.
- 2.74 Notification of the incident, which occurred on 10 January 1998 was received by TAIC from CAA at 1114 hours on 10 February 1998. This incident had been registered by CAA on 10 February.
- 2.75 Civil Aviation Rule 12 requires:

12.55 Notification of incident

- (a) Where an incident is a serious incident or an immediate hazard to the safety of aircraft operations, each holder of a certificate issued under-
- (1) for an aircraft incident or dangerous goods incident, Part 119 or 129:
- shall, if the certificate holder is involved in the incident, notify the Authority [CAA] of the incident as soon as practicable.
- (d) The notification of an incident required by paragraphs (a), (b) and (c) shall be conveyed by a means acceptable to the authority and contain, where ascertainable, the information listed in-
- (4) for aircraft incidents, Appendix A(d):

Appendix A(d) stated:

- (d) **Aircraft incident** - The following information is required for notification under 12.55 (d)(4):
- (1) date and time of the incident
- (2) brief description of events
- (3) aircraft nationality, registration, radio call sign, flight number, and type
- (4) name of the aircraft operator and owner
- (5) aircraft position and altitude
- (6) phase of flight
- (7) if applicable name of aerodrome and runway used
- (8) effect on the flight
- (9) name of the pilot-in-command

- (10) type of operation being conducted
- (11) number of persons on board the aircraft
- (12) name, organisation and contact details of the person notifying the incident.

12.57 Details of the incident

- (a) Notwithstanding 12.55, each -
 - (1) certificate holder referred to in 12.55(a) that is involved in an incident:

shall provide the Authority with occurrence details under paragraph(b).

- (b) Each person required to provide occurrence details under paragraph (a) shall provide the details requested on form CA 005 within 10 days of the incident-
 - (1) on form CA 005 or
 - (2) by a means acceptable to the Authority.

12.59 Investigating and reporting

Each certificate holder who submits occurrence details under 12.57(a)(1), unless otherwise notified by the Authority shall-

- (1) subject to section 14 of the Transport Accident Investigation Commission Act 1990, conduct an investigation to identify the facts relating to its involvement in the incident and establish, so far as those facts will allow, the cause or causes of the incident: and

2.76 Of the information required by 12.55.(d)(4) TAIC was advised for each incident:

- the date and time
- a brief description of events
- aircraft nationality
- name of the operator but not the owner
- phase of flight
- the aerodrome
- the effect on the flight
- name and contact details of the person notifying the incident.

2.77 The operator commenced investigations in each case before notifying the incident to the CAA.

2.78 CAA is required by S27 of the Civil Aviation Act 1990 to notify TAIC, as soon as practicable after any accident or incident is notified to the Authority, that it has been notified of the accident or incident if it isa serious incident in accordance with the provisions of the International Convention on Civil Aviation.

2.79 CAA categorised incidents as critical, major and minor and notified TAIC of all those categorised as critical or major. In the case of these incidents each was categorised as major.

3. Analysis

- 3.1 The history of the event demonstrates that there was a depth of defensive measures in place to prevent incidents of the type referred to in this report. Although a different station was involved in each incident the same or similar defences existed at each location and in each case the defences failed to prevent an incident.
- 3.2 The common result of the failure or removal of these defences was an insecure load as a result of the appropriate locks not being set as required by the LIR and the relevant Weight and Balance Manual for the aircraft type. In each case the loaders knew that the requirement existed and they were familiar with the operation of the locks involved.
- 3.3 In each case the members of the loading gang involved were experienced in their task. Each gang had a loading foreman who was responsible for ensuring that the locks were set correctly and who certified that the load had been loaded and secured correctly.
- 3.4 The standard procedure of the load controller consulting with the loading foreman was followed and neither saw any reason to doubt the security of the load.
- 3.5 One common factor in the incidents was the occurrence of one or more unusual events during or prior to the loading process, for example:
- an unserviceable aircraft being towed away for maintenance before the loading team had completed the transfer of the load,
 - the departure of the aircraft from the engineering base instead of the normal passenger loading ramp,
 - a distorted pallet which required improvised loading procedures to locate it in the hold,
 - a delay in the departure of a previous aircraft requiring the loading foreman to supervise loading of two aircraft concurrently,
 - a decision to restow an incoming load,
 - the late positioning of an aircraft on the gate, and
 - a refusal by Line Maintenance services to allow the loaders to load the aircraft before they moved it to the correct gate.
- 3.6 Although the events were unusual they had each been encountered previously by the loaders involved. In each case a remedy was available without recourse to any involved procedure. The make-up of the ramp party from the loaders through the loading foreman to the load controller, AOC or Line Maintenance services and the duty manager, was designed to identify and rectify problems as they occurred. The breakdown in these incidents resulted from a failure to communicate a problem to the appropriate level. All that was required was for the loading foreman to be brought into the picture or, where he was already involved, for him to seek assistance from the load controller, the AOC or the duty manager (or equivalents). This did not happen.
- 3.7 From the manager of Airport Service Delivery to the individual loaders there were defences established to minimise the risk of such occurrences.

- 3.8 The manager of Airport Service Delivery's requirement that she be advised of all incidents and accidents involving Terminal Services personnel (or their overseas equivalents) required a notification system with a high degree of reliability to be effective. Staff needed encouragement to notify to the company every incident which they considered had the potential to endanger the operation; they had to be aware of what constituted a risk to the operation; they had to have immunity from censure for such reporting and they had to be familiar with the steps necessary to make an accurate notification.
- 3.9 The manager was confident that the notification system was detailed in the appropriate manuals. On closer inspection the notification procedure lacked the elements referred to in the previous paragraph. Loading personnel were not aware of any opportunities to make suggestions to improve the safety and efficiency of their task, nor were they aware of a requirement to report incidents which had the potential to cause serious harm, nor were they clear on a procedure for notifying an incident other than one involving dangerous goods or a mismatch between the aircraft load and the documentation relating to that load. With the cessation of their awareness training they were not reminded of the consequences of a failure to comply with the established procedures.
- 3.10 The company had been approved by the Director of Civil Aviation (DCA) to conduct its airline business on the basis of transitional arrangements for companies in good standing at the time of the introduction of new legislation, which required specific auditing of new companies prior to such approval. At the time of the incidents the company was involved in preparing the necessary manuals and procedures for formal approval by DCA at the expiry of the transitional arrangements.
- 3.11 Routine auditing by the CAA followed its established sampling process but, at the time of the incidents, the procedures and documentation relating to aircraft loading had not been the subject of a CAA audit. In the absence of the CAA audit, the slow drift away from the letter of the procedures prescribed in the manuals and the lapse of currency of the manuals pending the rewrite which was in progress was not detected by the CAA.
- 3.12 The company's internal audit teams which had investigated each of the incidents involved in this report had made specific recommendations with the aim of preventing the recurrence of similar events. This team was also responsible for proactive auditing but was still in its formative stage and fully committed in the production of the relevant documentation for obtaining CAA approval under Part 119 of the Civil Aviation Rules. Thus the intended defence provided by this unit, its potential to detect unsatisfactory trends in the ramp procedures, had still to become effective.
- 3.13 Prior to the occurrence of the series of incidents which is the subject of this report the company's Group Safety and Security Department which was able to conduct proactive investigations to maintain the health of any department of the company had not detected a need for the ramp area to receive special attention due to the lack of an effective incident notification system.
- 3.14 The Manager of Airport Service Delivery's staff officer who was responsible for auditing the performance of terminal service units in New Zealand and overseas to ensure they were able to deliver the services required to the standard specified in the company's manuals could have been more effective had he the benefit of a data base built on the results of an effective notification system.

- 3.15 The company placed significant reliance on compliance with the Passenger Service Manual and Weight and Balance Manuals for each aircraft type, to achieve the safe loading of aircraft. At the time of the incidents new manuals were being drafted but the existing manuals were considerably out of date in relation to procedures and nomenclature. The basis for this form of control of standards as far as the ramp services were concerned was suspect as the loaders professed an almost complete ignorance of the contents and location of the manuals.
- 3.16 The witnesses interviewed did not reflect a culture of conformance with the manuals. The loaders relied on the daily association with evolving procedures and their depth of experience with the task, following their initial on-the-job training, to ensure that they did the required task properly. Conformance was more by the reality that the manuals reflected the good practice which had evolved by on-the-job-training than vice versa. An example of the unreliability of the manuals was the outstanding amendment required to the Boeing 767 Weight and Balance manuals to reflect the consequences of the removal of the lateral guide actuators, in the company's Boeing 767 fleet, some six years prior to the incident. In placing significant reliance on the manuals to promulgate approved procedures the company displayed a lack of awareness of the existing situation vis a vis the loaders on the ramp.
- 3.17 While few of the loading staff interviewed implied that any shortcomings were due to a reduction in the size of the loading gangs, it was evident that they were only able to meet the task by using the foremen as working members, reducing the time spent on formal awareness training and delegating responsibility to less qualified members of the team. This led to a determination to get the job done by adaptation (or shortcuts) and an acceptance of incidents, such as insecure loads, in the interests of a prompt turnaround of the aircraft. There was little evidence of any awareness of the consequences of insecure loads or any sincere belief that it was worth reporting instances of such unsatisfactory incidents.
- 3.18 The loading staff took pride in their work. They gave an assurance of competence based on long service with the company in the same role and a desire to be respected for the speed and efficiency of their unit. In particular they spoke of the satisfaction of being able to increase their efficiency to the extent necessary to do the same job with fewer people. This "efficiency" however was not soundly based and the observance of those checks which were in place to detect any errors was all the more important to ensure the safety of the operation. In this respect the former awareness training could have:
- a) played a major part in drawing to the attention of the loaders the consequences of any mistakes,
 - b) identified the need for a reliable notification scheme so that the causal factors in such incidents could be identified and remedial measures initiated promptly.
- Although training officers at each domestic airport were developing training syllabi, they were doing this independently and there was no co-ordination between them. As each terminal service unit in New Zealand was a part of the Air New Zealand Terminal Services this lack of standardisation in training was counterproductive as was the decision to let the awareness programme lapse.
- 3.19 The loading foreman's delegation of his duties to the JCPL driver was a considered action and in accordance with the common practice born of a long-standing trust in the JCPL drivers to complete this task in accordance with the requirements. Most of the JCPL drivers knew the duties of the loading foremen intimately and had earned their trust through an association which in many cases spanned twenty years or more. Nevertheless the foreman was appointed to provide an independent check of the loaders and remunerated to take the responsibility for the security of the load. In a matter of such importance the foreman could only certify that the load was correctly stowed and secured in the correct location if he had observed the loading

personally or been able to check the security after the load was stowed. The LIR provided a signature space to be filled in by the JCPL driver to certify that he had loaded and secured the load correctly. When this was not completed the matter deserved close questioning of the JCPL driver irrespective of his experience. On this occasion these defences failed when no loading foreman was present to check that the JCPL driver had secured the load correctly before the hold door was closed. The need for the loading foreman to delegate this duty came about with the reduction in the size of loading teams and the emphasis on on-time departures. This omission by the loading foreman was common and accepted practice but removed another of the existing defences against insecure loads.

- 3.20 The absence of a specific guide as to the qualities and minimum skills required for a loader to be promoted to a loading foreman, and the lack of standardisation in this process between New Zealand bases, was undesirable as it led to a variation in standards of loading and supervision.
- 3.21 Air New Zealand's practice of nominating loaders as acting loading foremen to overcome the problem of supervision, when one foreman's team had to load more than one aircraft, jeopardised the standard of supervision exercised in this essential task, as part of the foreman's task was to carry out an independent check of the work of the loaders. The company's requirement for the loading foremen to work as loaders in the team also detracted from their objective supervision and checking of the work of the loaders. This was illustrated by the foreman having to leave one aircraft unsupervised while he went to uplift bags for another aircraft.
- 3.22 The loading foreman reported to the load controller who was responsible for the weight and balance of the aircraft being correct when the load was stowed in accordance with the LIR. The load controller had two main checks on this important aspect of loading. The loading foreman's assurance, supported by the correct certification of the LIR, and the load control check sheet which was designed to reconcile the difference between the estimated load figures and the final calculations made by the computer. In the case of flight NZ 183 neither the LIR nor the load control check sheet were completed correctly. In this case, although the computer load sheet was correct, the load sheet had no value as a defence against any errors the computer load sheet might contain because the load controller rationalised the "small" error which he did detect as insignificant whereas it was the result of other incorrectly entered information. By accepting the error in the load check sheet and the incompletely certified LIR the load controller dismantled two further defences against the incorrect loading and insecurity of the aircraft load.
- 3.23 The incorrect entries on the load advice message by another load controller, and the duty load controller's failure to detect the errors, indicated that an unacceptable situation existed. The duty load controller was an instructor in the loading process and its documentation and the other load controller was experienced at his task. The errors indicated that a degree of pressure, or over-familiarity with the task leading to a lack of critical application, existed.
- 3.24 One of the roles of the AOC, or its equivalent, was to ensure that the loading team was not put under unnecessary pressure. The personnel in the AOC were responsible for ensuring the aircraft was positioned on the appropriate gate on time and if it could not be then it was up to them to ensure the necessary compensating arrangements were made. In this case no action was taken to determine why the aircraft had not been positioned at the gate on two occasions. The AOC personnel, as the co-ordinators of the loading and turn around of all international movements at the aerodrome, did not achieve their intended purpose. The reason for this was not established due to the late notification of the incident which led to lapses in the memories of the individuals concerned before they were interviewed. Irrespective of the reasons, the failure of the AOC personnel to ensure the aircraft was in its allocated position on time, together with the engineer's refusal to allow the aircraft to be loaded in part at gate 30, invalidated the defence against exerting unnecessary pressure on the loading gang. The

existence of unusual pressure during the completion of a task is recognised as a dominant factor in errors made by personnel working in such environments.

- 3.25 The transmission of information between the AOC and Line Maintenance depended primarily on the entry of the arrival and departure times of each flight, and the gates at which the aircraft were to be positioned, into the Carina computer system. Line Maintenance acted on this information to position aircraft on the appropriate gate if they were not to be left at the arrival gate. While it was not difficult to deduce from the information displayed on the Carina screens when an aircraft could and should be moved into place it would have been easier for Line Maintenance to co-ordinate their work if they had a hard copy of the AOC's gate plan. Equally, had the AOC's relationship with Line Maintenance been such that Line Maintenance advised them immediately why they could not move the aircraft or allow it to be loaded elsewhere, the effectiveness of the AOC would have been enhanced.
- 3.26 The purpose of the in-hold lateral guides in the Boeing 767, as their name implied, was to guide the load into the aircraft squarely so that it was lined up for the movement forward or aft. When the actuators were removed, the guides could not be used for this purpose as they could not be lowered manually when the load was in the compartment adjacent to the doorway. The second disadvantage of removing the actuators was that the defence provided by the automatic raising of the guides, after the load had passed in the required direction, ensured their locking function was available without manual intervention by the loader. Thus the unilateral action by the company's engineers, in modifying the aircraft, deprived the loading process of another inherent defence in the system against insecure loads.
- 3.27 The mix of procedures that was introduced by removing the actuators from the Air New Zealand aircraft resulted in a potential for the loaders to transpose the relevant procedures, between those aircraft with electrically operated actuators and those without, as may have happened in this case when the same loader loaded two Qantas Boeing 767 aircraft before loading the Air New Zealand aircraft. The loader was aware that Air New Zealand aircraft were not fitted with electrically actuated lateral guides even though the Air New Zealand manual stated that they were still fitted. Nevertheless the defence provided by each aircraft of the same type having a common operating procedure was defeated by the modification of the Air New Zealand aircraft.
- 3.28 There was some evidence that the removal of the actuators from the lateral guides led to interference with the manual latches to prevent the guides being used. Some aircraft were found during routine maintenance to have all of the lateral guides deactivated in a similar manner. The acceptance of aircraft for loading with all of their lateral guides inoperative removed the defence against insecure loads provided by one series of locks. The acceptance of the aircraft for loading with all of its guides inoperative, as must have occurred before the aircraft was taken in for maintenance, indicated an uncritical approach to the serviceability of in-hold equipment by loading gangs and engineers alike.
- 3.29 The fact that an aircraft could arrive at the maintenance hangar with all 12 of its lateral guides unserviceable illustrated the ineffectiveness of the notification and rectification systems. The nature of the unserviceability was difficult to explain as a normal consequence of considerate use of the equipment. As the Air New Zealand aircraft were the only ones which required manual activation of the guides it was probable the guides had been deliberately deactivated by unlawful interference. This was another illustration of the need for a reliable incident notification system.
- 3.30 The act of loading a series of similar aircraft with similar loads on a regular basis had the advantage of familiarity with the task but the disadvantage of the "contempt" bred by that familiarity. There was no indication that any of the incidents was the result of deliberate inattention. On the contrary the opposite applied in that the loaders had developed a

confidence that the task could be achieved day in and day out without error with no special effort. As each member of the team had carried out the task for many years they were familiar with every detail of the job. Nevertheless their potential for error was recognised by the requirement for checks to be carried out on their work. These defences included a personal certification by the JCPL drivers that the load had been stowed and secured in the hold in accordance with the LIR and Air New Zealand written instructions. This certification was countersigned by the loading foreman that he was satisfied the load was correctly loaded and secured. Finally the load controller checked the LIR had the appropriate signatures and discussed the loading with the loading foreman before himself certifying to the aircraft captain that the loading was correct. As listed in the preceding paragraphs these defences failed.

3.31 The hiatus left by the withdrawal of the awareness training, which had formerly reviewed items of interest to loaders, deprived the loaders of the opportunity of discussing and being briefed on items such as:

- the hazards of insecure loads
- the advantages of incident notification
- the information available in the relevant manuals and where they could be referred to
- the difficulties of supervision of more than one aircraft at a time, and
- the appointment and responsibilities of acting loading foremen.

Recurrent training is an important defence against complacency and the reinstatement of such training appears warranted.

3.32 The following factors pointed to a situation in need of in-depth review:

- The acceptance of the incorrectly completed LIR by two separate supervisors on the basis of trust
- the acceptance of the small error in the check sheet without correction because it was rationalised as a small error (which it was not)
- the postponement of a correction to the check sheet (which did not occur)
- the confusion between the Boeing 767-300 and the Boeing 767-200 hold layout by an experienced load controller
- the acceptance of the engineer's refusal to allow the loading of the aircraft before it was moved to the correct gate
- the failure of the AOC to notice the non-appearance of the aircraft at the gate on time
- the acceptance of manually operated lateral guides in the aircraft without question after the undertaking by the engineers that they would be reinstated as soon as the problem was rectified
- the protracted delays in the notification of each event
- the superficial investigations of the incidents, and
- the number of incidents in a short period.

3.33 Neither the Weight and Balance Manual nor the Passenger Services Manual gave any encouragement to make reports on incidents involving unrestrained loads, nor was there a clear process known to those personnel involved. In the case of incidents or accidents involving dangerous goods and incorrect entries on aircraft loadsheets a detailed process was available in the Passenger Services Manual but for reporting other incidents a cross reference made to two other manuals was unhelpful as neither detailed an appropriate system. The importance of effective feedback from personnel in all levels involved in an operation is vital to pre-empting

unsatisfactory situations and taking effective corrective action following accidents and incidents. There is a clear opportunity for the company to improve its feedback from those most aware of the potential problems by instituting a simple, no-blame feedback process.

3.34 The failure of the defences appeared to be due to:

- the absence of a feed back system to top company management to enable them to identify the hazards and to make suggestions for improvement in efficiencies and safety
- the delegation of supervisory duties to personnel not in a position to exercise proper supervision
- a lack of recurrent training
- a pressure to achieve on-time departures, and
- the motivation of the loading teams to complete the job on time despite reduced manning levels.

4. Findings

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

- 4.1 The similarity of the incidents which occurred during a short period but each originating from a different station indicated the existence of a systemic problem.
- 4.2 The operator had in place a depth of defences to detect and remedy the factors which led to the incidents.
- 4.3 The failure of the defences confirmed a breakdown had occurred of the premises upon which the defences were based.
- 4.4 The operator's internal audit system's commitment to developing new material for the approval of the company under Rule 119 had prevented it from implementing its pro-active investigation responsibilities.
- 4.5 The reduction in size of the loading team had a significant effect on the supervision of the loading operation.
- 4.6 The expectation that loading foremen could act as loaders and supervise more than one aircraft at a time was unrealistic.
- 4.7 The delegation of the foreman's responsibilities to a JCPL driver thwarted the foreman's purpose as an independent supervisor.
- 4.8 The loaders were working within their capacity and fit for duty.
- 4.9 An unusual event featured in each incident as a triggering factor for the incident.
- 4.10 In several cases the co-ordination of the personnel on the ramp and the standard of communication between them was not adequate to ensure the reliability and efficiency of the ramp services.
- 4.11 The provisions for a feedback of perceived hazards and opportunities for improved efficiency and safety were ineffective.

- 4.12 The company's reliance on manuals as the basis for the observance of standard procedures and compliance within the loading staff was misplaced as the manuals were out of date and those staff seldom referred to a manual.
- 4.13 The company's decision to forgo recurrent awareness training for loaders decreased the safety of the loading operation.
- 4.14 The standard of safety and reliability achieved was the direct result of the motivation and experience of the loading teams and their on-the-job adaptation to changing circumstances.
- 4.15 The absence of a determination of the specific duties and qualifications for loaders and loading foreman should be addressed to clarify their responsibilities.
- 4.16 An independent check of the accuracy of documentation involved in the dispatch of international aircraft is warranted on a random and recurring basis.
- 4.17 An improvement in the communication between Line Maintenance services and the AOC is warranted.
- 4.18 The decision on the reinstatement of the actuators in the lateral guides once a suitable modification became available should have been based on the result of a discussion between all the parties involved.
- 4.19 The standard of reporting of defects involving in-hold aircraft equipment was unsatisfactory.
- 4.20 Insufficient emphasis was placed on the correct completion of the documents intended to confirm the balance and security of the load.
- 4.21 The company responded appropriately once it became aware of the unsatisfactory standard of the loading of its aircraft.
- 4.22 The excessive delay in the notification of incidents by the company made a thorough investigation of all of the incidents involved impractical.
- 4.23 The company's defences against further incidents would be enhanced by the introduction of an effective feedback system between the terminal services staff and their managers.

5. Safety Actions

- 5.1 The company recognised the need for a review of the problems behind the loading incidents immediately and, in addition to accepting the Commission's safety recommendations, they took prompt safety actions and engaged a "process re-engineering consultant" to work with Terminal Services loading staff and management to redesign their loading work to provide a system solution.
- 5.2 The Managing Director of Air New Zealand authorised a group policy on incident reporting which encouraged incident "reporting" without apportioning blame in "other than rare specific circumstances".
- 5.3 The excessive delay in notification of the incidents, and the investigations completed before the Commission had been notified of the incidents, deprived the Commission of the opportunity to commence an investigation while the witnesses' memories of the incidents were fresh and also deprived the Investigator-in-Charge of the opportunity to inspect the relevant evidence in the case of the unrestrained engine on a pallet. This situation has been addressed by the installation of on-line computer equipment which is programmed to notify the CAA as soon as the company itself becomes aware of any incident.

6. Safety Recommendations

- 6.1 On 27 January 1998 the Commission recommended that the Managing Director of Air New Zealand Limited:
- 6.1.1 Conduct a pre-contract assessment of each international handling contractor's ability to meet the requirements of the Air New Zealand load control process prior to entering into any future contract, (106/97); and
 - 6.1.2 Review the capabilities of each of the personnel involved in the loading process to ensure they meet the required standards, are cognisant of their duties, and have sufficient resources and training to distribute and secure the load correctly, (107/97); and
 - 6.1.3 Ensure that load controllers check that the loading foreman's load instruction form is completed correctly and signed, (108/97); and
 - 6.1.4 Emphasise the need for loading foremen to be particularly vigilant while loading is taking place in an environment of disruptions or other factors which minimise the time available for loading or require the supervision of the loading of more than one aircraft at a time, (109/97); and
 - 6.1.5 Consider re-commissioning the actuators in the lateral load guides on the B767 in-hold loading equipment, (110/97); and
 - 6.1.6 Amend all Company Manuals which refer to the operation of the actuators in the lateral load guides on the B767 in-hold loading equipment to ensure they describe the correct method of operation of the guides i.e. that they are operated manually instead of the automatic operation detailed at present, (111/97); and
 - 6.1.7 Review and improve the process which is intended to correlate amendments to the associated manuals when the Company makes a decision to modify equipment, to ensure any consequential amendments in the standard operating procedures are detailed in writing as soon as the modifications are embodied, (112/97); and
 - 6.1.8 Consider introducing more frequent inspections of the lateral load guides on the B767 in-hold loading equipment, or other appropriate measures, to ensure that any damage caused to these devices in the course of loading operations is detected and rectified promptly. (113/97)
- 6.2 On 1 September 1998 the Managing Director of Air New Zealand responded as follows:
- 6.2.1 **106/97**
Documented procedures for pre-contract assessment of contractors are included in the documentation being developed for Part 119 Certification. This assessment process had been previously undertaken as a matter of course, but the process had not been well documented. The Airline Management System Manual covers the contract assessment and the procedures have been in use since 30 June 1998.
 - 6.2.2 **107/97**
A full review of the aircraft loading process was initiated in December by Airport Service Delivery and Terminal Services following a loading review meeting called by the Group Safety and Security Department.

The outcomes of the review are a model for Air New Zealand loading staff. For other ground handling contractors the company will prescribe loading standards, specify training standards, and monitor and audit loading processes and outcomes (both through increased oversight by our Airport Management and by centralised audit teams).

Full-time resources have been applied to a comprehensive programme of work that will require 12 months to be fully implemented around the network. The work is being undertaken in order of importance from a safety perspective, and will be implemented progressively throughout the network. Network implementation will follow once the initiatives have been tested in New Zealand airports. To support implementation and review of the improvements, approximately 10 experienced staff will be identified for operations management training and this team will then form part of a larger team focused on the load control process throughout the New Zealand network.

6.2.3

108/97

Air New Zealand have satisfied the intent of this requirement by ensuring that a) the load controller is required to meet the person responsible for the loading (post-flight closure and pre-flight departure) to confirm the aircraft physical load matches the load sheet; b) the person responsible for loading then records the names of personnel involved in the aircraft loading as well as their own name; and c) the load controller then proceeds to the flight deck with the load sheet.

The company ensure that this requirement is understood by all the relevant staff through documentation contained in the Ground Handling Manual. It has been reinforced in a separate release of an Airport Handling Notice and is part of the company's internal audit programme.

As a cross-check, Terminal Services are conducting an audit of five percent of all flights they load.

6.2.4

109/97

All loading staff throughout the network have had a briefing which stresses the procedures which must be followed to ensure that the load is correctly secured. Loading foremen have been briefed to reinforce their special responsibilities. This will be an ongoing activity as part of a refresher programme now under development.

6.2.5

110/97

Air New Zealand are reinstalling the automatic B767 lateral guide actuators, with a fleet completion date of March 1999. Advice on the reinstallation program, and a procedural reference has been communicated to all stations for the information of loading staff.

6.2.6

111/97

The Air New Zealand B767 Maintenance Manual has been changed to reflect the actual lateral load guide mode of operation, and will be amended to reflect the changes as they are effected.

6.2.7

112/97

The company has reviewed this entire process and will be introducing a new Company Document Management System. Compulsory pre-change consultation will be embedded in the system, and following an authorised change, all relevant manuals will be automatically amended.

6.2.8

113/97

Damage reporting and front-line system improvement recommendations are key components of the loading process review which have been implemented.

Approved for publication 30 September 1998

Hon. W P Jeffries
Chief Commissioner

Appendix A

A1 16 October 1997³

- A1.1 On 16 October 1997, Air New Zealand Boeing 767-200 ZK-NBC was scheduled as flight NZ 142 passenger service from Sydney to Wellington, departing at 0850 hours. The pre-flight inspection found an oil leak from the left engine at 0810 hours.
- A1.2 The Engineering investigation began at 0830 hours. After various checks had still not located the source of the oil leak the service was cancelled at 1215 hours as the flight crew then had insufficient time left to complete the flight within the crew duty time limitations.
- A1.3 As a result of the aircraft unserviceability the passengers were transferred to Air New Zealand flight NZ 102 and their baggage was off-loaded from ZK-NBC. The cargo, two unit load devices (ULD) was not unloaded and the cargo hold doors were left open. One of the ULDs which weighed 1530 kg was left unsecured in the rear hold, in position 31.
- A1.4 Rectification of the aircraft engine oil leak involved towing the aircraft from its assigned gate to the nearby maintenance area and obtaining spare parts from Melbourne. Before towing maintenance staff closed the aircraft cargo hold doors without checking that the cargo was secure or advising Ramp Control of their intentions. Ramp Control became aware that the aircraft had been towed away when one of them went to retrieve a dog from the aircraft bulk hold at 0910 hours.
- A1.5 When a change to the scheduled departure time of an aircraft occurred a delay checklist was intended to be used by the operations staff to ensure that all departments were aware of the revised estimated time of departure (ETD). Due to deficiencies in the checklist a number of departments of the ground handling company were not advised of the new departure time.
- A1.6 The load controller who was assigned to dispatch the delayed aircraft came on duty at 1330 hours. He was advised that an additional ULD, had to be loaded onto the aircraft. He completed a load instruction form (commonly known as the LIR) and advised the ramp controller that it should be loaded into position 32 as per the LIR. A copy of the LIR was sent to the ramp controller but, as no ETD had been advised to him, he assumed the aircraft would depart next day. Therefore he did not allocate a loading team to the aircraft and held the LIR pending advice of the ETD of the aircraft.
- A1.7 In the course of the rectification of the unserviceability, the Engineering staff returned the aircraft to the ramp at 2000 hours for refuelling, without opening the cargo doors or advising ramp control. For ramp control 2000 hours was in the middle of a busy period which involved two aircraft delays and two routine wide body aircraft departures.
- A1.8 The load controller who prepared the LIR was advised the aircraft had returned to the ramp and assumed the additional ULD would have been loaded at this time so he signed off the load sheet for the flight crew who were to fly the aircraft to Christchurch. The crew accepted the loadsheet and boarded the aircraft before it was towed back to the maintenance area for completion of the rectification.
- A1.9 Sydney Airport had a curfew which prevented aircraft departing after 2300 hours. The load controller was aware of this and was endeavouring to ensure that NZ 6878 could depart before the aerodrome closed.

³ All times in this section are in Australian Eastern Standard Time

- A1.10 An intrinsic part of the dispatch of an aircraft was for the load controller to sight a signed copy of the LIR to confirm that all the freight had been loaded and secured in the intended positions in the hold before signing the loadsheet. This normal dispatch process was not observed. As no loaders were assigned to the aircraft the ULD was not loaded nor was the existing load checked for security.
- A1.11 The aircraft was declared serviceable at 2230 hours and departed from the maintenance area at 2249 hours for Christchurch as NZ 6878.
- A1.12 When the aircraft arrived at Christchurch the loaders there found one of the ULDs on board, which was intended to go to Wellington, was loose in the rear hold and had been travelling between hold positions 31 and 42 in flight.
- A1.13 The Air New Zealand contract for loading aircraft at Sydney required that the load controller responsible for the flight held current Air New Zealand certification. In this case the load controller did not hold such a certificate and therefore his employment in this role did not comply with the company's procedures.
- A1.14 The captain of the aircraft was required by Air New Zealand to ensure the load controller held Air New Zealand certification.
- A1.15 The load controller was required to sight a copy of the LIR and confirm that the leading hand in charge of the loading had signed the LIR to confirm that the aircraft was correctly loaded and the load secured before he advised the captain that his aircraft was prepared for departure.

A2 16 November 1997 (this incident is discussed in detail in the body of the report)

- A2.1 On 16 November 1997 Air New Zealand Boeing 767-300 ZK-NCL departed from Christchurch at 1315 hours for Sydney as scheduled passenger service NZ 183. Ten crew and 176 passengers were on board.
- A2.2 On the descent into Sydney the crew of ZK-NCL heard "loud rumblings and bangs from the cargo hold". On arrival the loaders found two ULDs in the forward hold, weighing 2015 kg, had not been restrained.

A3 13 December 1997

- A3.1 On 13 December 1997 Air New Zealand flight NZ 17, Boeing 747-200, ZK-NZX, arrived at Rarotonga from Papeete at 0350 hours.
- A3.2 The cargo loading team decided that the aircraft was loaded incorrectly and "corrected" the situation by unloading a large pallet from position 23P, moving a transit pallet from position 11P to 24P, and reloading the pallet from 23 P into its original position. Positions 31P and 32P were no-fits.
- A3.3 ZK-NZX departed for Auckland as scheduled passenger service NZ 17 at 0550 hours. 18 crew and 415 passengers were on board.
- A3.4 On arrival in Auckland the unloading crew found two loose ULDs one in position 11P and one in 23P with no locks set behind position 24P which was a "no-fit". Also the ULD in 23P was full of baggage, not cargo as shown on the load sheet.

A4. 7 January 1998

- A4.1 On 7 January 1998 Air New Zealand Boeing 767-200, ZK-NBC, departed from Wellington at 1615 hours for Brisbane as scheduled passenger service NZ 163. Nine crew and 110 passengers were on board.
- A4.2 Just after top of descent as the aircraft pitched down the crew heard and felt a loud thump which originated from the hold area.
- A4.3 On arrival at Brisbane the ground engineers found three ULDs in hold three aft were unsecured and free to move 2 m aft of their normal position. The lateral guides between P33 and P41 were locked down. The lateral guides were found to be serviceable and there was no damage to the ULDs or the aircraft.

A5. 10 January 1998

- A5.1 On 9 January 1998 Air New Zealand Boeing 767-300, ZK-NCF, departed from Honolulu at 2345 hours for Auckland as scheduled passenger service NZ 11. Eleven crew and 219 passengers were on board.
- A5.2 Prior to departure a JT-8 engine on a pallet was loaded in position 22P by Honolulu ramp staff. They encountered difficulty in loading the engine as the pallet on which it sat was bowed upward by the engine restraints to such an extent that the combined weight of three men was required to force it under the rear bulkhead locks.
- A5.3 On arrival the cargo loaders found that the JT-8 engine on the pallet had been free to move between compartments 21 and 23, a distance of some 2 m, during the flight.