



## Airline's Five Unrestrained-cargo Incidents in Four Months Reveal Loading-procedure Deficiencies

*The official investigation found factors that breached Air New Zealand's defenses against errors in cargo loading. One incident investigated in detail involved reduced time available for loading, a modification to the automatic loading equipment, a loading team reduced in number and a busy loading foreman who delegated his oversight duties.*

FSF Editorial Staff

On Nov. 16, 1997, Air New Zealand Flight 183, a Boeing 767-300, landed at Sydney, Australia, after a scheduled passenger flight from Christchurch, New Zealand. During the descent, the crew had heard "loud rumblings and bangs from the cargo hold." When cargo handlers at Sydney opened the forward cargo hold, they found two containers, known as unit load devices (ULDs), weighing 2,015 kilograms (kg; 4,442 pounds) total, that had been unrestrained and free to move about three meters (9.8 feet) during the flight. There were no injuries or damage to the aircraft, but the ULDs were damaged substantially.

The incident was one of five between Oct. 17, 1997, and Jan. 10, 1998, in which Air New Zealand Boeing 767 or Boeing 747 aircraft were flown with unrestrained ULDs or pallets. In four of the incidents, the cargo shifted during flight.

The other incidents included the following:

- On Oct. 17, 1997, a ULD was found to have been unrestrained on a B-767 flight from Sydney to Christchurch. The ULD weighed 1,530 kg (3,373 pounds) and had been free to travel nine meters (30 feet);
- On Dec. 13, 1997, a B-747 arrived at Sydney after a flight from Rarotonga, New Zealand. The cargo crew discovered that the locks in front of an 878-kg (1,936-pound) cargo



pallet had not been raised, although an adjacent ULD limited the unrestrained pallet's movement;

- On Jan. 7, 1998, the cargo hold of a B-767 was opened after the aircraft arrived at Brisbane, Australia, following a flight from Wellington, New Zealand. Cargo handlers discovered three ULDs that had been free to move two meters (4.4 feet) during the flight; and,
- On Jan. 10, 1998, a B-767 arriving in Auckland after a flight from Honolulu, Hawaii, U.S., was found to contain a jet engine on a pallet, weighing a total of 2,268 kg (5,000 pounds), that had been free to move two meters during the flight.

The New Zealand Transport Accident Investigation Commission (TAIC) examined Air New Zealand's aircraft-loading procedures and conducted a detailed investigation of the Nov. 16 incident.

The incident aircraft arrived at Christchurch after a flight from Melbourne, Australia, at 0022 hours local time. After the passengers disembarked and the cargo was unloaded, the aircraft was parked at Gate 30. Although the B-767 was scheduled to depart as Flight 183 from Gate 15 at 1315, Gate 15 was occupied by another aircraft until 0645, according to the gate plan prepared the previous day by the Airline Operation Centre (AOC).

The gate plan specified that the incident aircraft was to be positioned at Gate 15 during a period of minimal activity between 0800 and 1100. But the line maintenance personnel who were responsible for towing the aircraft did not move it during the 0800–1100 period.

At 1215, two loaders arrived to load the cargo and baggage onto Flight 183 at Gate 30.

“Someone from Line Maintenance instructed the loaders not to start the loading because the aircraft had to be moved to another gate,” said the TAIC report.

Repositioning the aircraft was delayed while line maintenance personnel attended to a problem with the ignition on an engine of a B-747 and the push-back of a flight from Gate 29. At 1250, 25 minutes before the scheduled departure, the aircraft was positioned at Gate 15. The loading team had 35 fewer minutes than they would normally have had in which to load the aircraft.

“Why the aircraft had not been moved in a window of time between 0800 and 1100 ... , when there were no other aircraft being serviced, was not established, nor was it established why AOC had not detected the delay on their [television] monitors, nor why the [line maintenance] engineers declined to allow the loaders to load the pallet and ULDs which they had taken to Gate 30,” said the report.

Three members of the loading team were not available for duty on Flight 183, because they were working on Flight 34, a B-747 scheduled to depart at 1320. The loading foreman arrived at Gate 15 but left to load late-arriving baggage onto Flight 34, leaving two members of the loading team at Gate 15.

After the two loaders finished placing cargo in the forward hold of Flight 183, the jumbo container and pallet loader (JCPL) driver repositioned the vehicle at the aft cargo-hold door.

“The JCPL driver was responsible for loading the containers and pallets allocated to each main hold in the correct locations and ensuring that they were properly secured,” said the report. “The loading foreman’s overall responsibility was to ensure [that] 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.”

The loading foreman reported to the load controller, who was responsible for ensuring that the weight and balance were correct when the load was placed aboard the aircraft according to the loading instruction form (LIR). Everyone involved in the loading of Flight 183 had a copy of the LIR.

The report said, “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 [that is, those to be unloaded from an arriving flight] and pallets should be stowed;
- “Where the outgoing pallets and containers [that is, those to be loaded onto the departing flight] were intended to be stowed; and,
- “Where the outgoing pallets and containers were actually stowed prior to departure.”

Air New Zealand procedures required the upper and center diagrams to be completed by the load planning officer; the lower diagram was to be completed by the loading foreman if there were any changes to the planned loading distribution. For Flight 183, only the center diagram was completed.

“On the LIR for this flight the certification for the loading of the individual holds had not been signed or initialed by the JCPL driver [or] by anyone else,” said the report. “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 [compartments] 1, 2, 3 and 4 according to the distribution ... and in accordance with Air New Zealand’s written instructions, and deviations advised to load control prior to departure.”

The loading foreman handed the certification to the load controller, who was responsible for checking the certification and completing the load sheet for the aircraft captain.

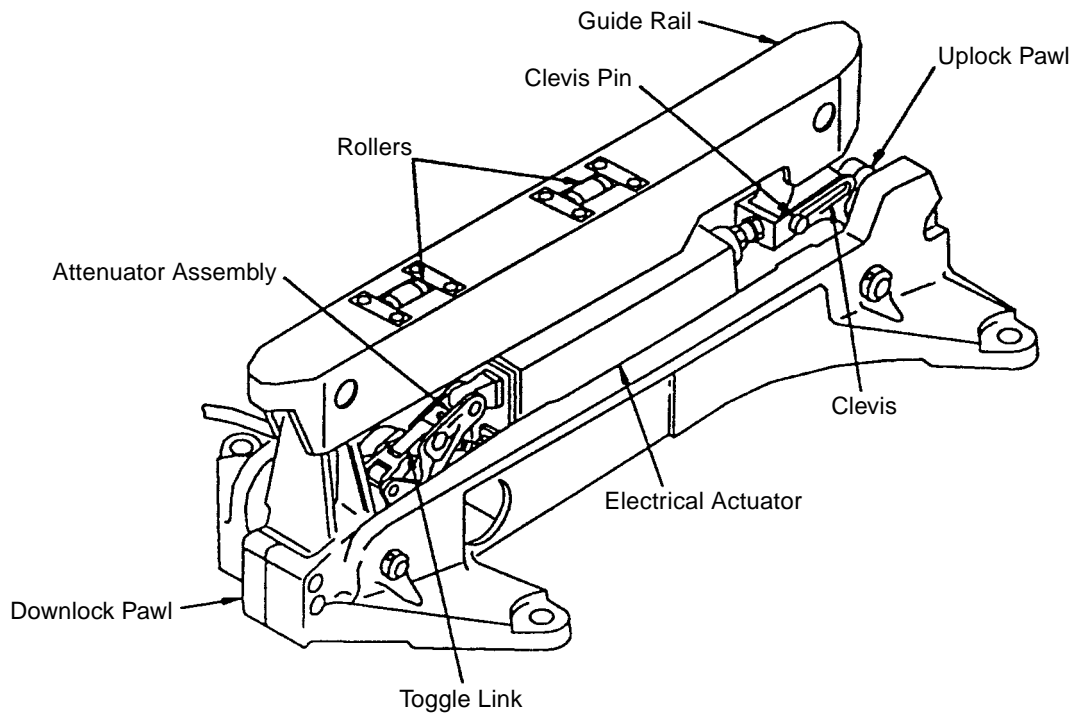
The B-767 cargo-handling system includes components mounted in the floor of the aircraft’s three cargo compartments (forward, aft and bulk cargo). The system is controlled by the JCPL driver via a fuselage-mounted control panel.

The report said, “The containerized 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 [Figure 1, page 3] and partial load stops.

“The lateral guides were devices to keep the ULDs aligned as they moved into the hold and to re-erect automatically after the load had passed over them. ... The guides in each hold were in two rows of three, one forward and one in the center 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,

## Lateral Guide, Cargo Hold, Boeing 767



Note: Guide rail is shown in extended (up) position.

Source: New Zealand Transportation Accident Investigation Commission

**Figure 1**

which would otherwise obstruct the movement, were automatically retracted. At the completion of the loading, the lateral guides returned to the raised position.”

On most B-767s, the lateral guides are raised and lowered electrically. But because Air New Zealand had experienced difficulties with the original version of the lateral guides, the airline had elected in 1986 to remove the actuators from the lateral guides and required the guides to be manually operated until a modification was available, at which time the actuators would be reinstalled.

In 1991, the lateral-guide manufacturer notified Air New Zealand that an improved version was available. Nevertheless, Air New Zealand did not reinstall the actuators. The report said that this decision was made “to reduce maintenance costs.” For the sake of fleetwide commonality, the airline removed the actuators from newly delivered B-767s.

“The purpose of the in-hold lateral guides in the B-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,” said the report. “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 defense provided by the automatic

raising of the guides, after the load had passed in the required direction, ensured [that] their locking function was available [prior to the modification] 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 defense in the system against insecure loads.”

Although Passenger Services Department of Air New Zealand was not consulted before the action was taken, the department learned of the actuators’ removal immediately afterward. But neither the relevant manuals nor loading procedures were changed to reflect the modification. At the time of the incident, the manuals still described the lateral guides as electrically operated.

Routine maintenance revealed that on some Air New Zealand B-767s, all of the manually operated lateral guides were unserviceable because of distortions in the latches that were intended to retain them in the raised position.

“Examination of the damage to the latches indicated [that] it was unlikely to have occurred in normal usage,” said the report. “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.”

There investigation also revealed a discrepancy in the documentation for Flight 183.

The report said, “On the [load-control] check sheet for this flight, there was a difference of 857 kilograms [1,889 pounds] 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 kilograms [1,287 pounds].

“As none of the other variables in the aircraft load had changed, the difference between the estimated and actual passenger/baggage weights should have equaled the difference between the estimated zero-fuel weight and the actual zero-fuel weight, which he had calculated as 597 kilograms [1,316 pounds]. According to his calculation, the difference was only 13 kilograms [29 pounds], 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.”

The TAIC also found ambiguities in Air New Zealand’s instructions to its personnel concerning loading and incident notification.

The report said, “The instructions on the LIR did not explain the certification block on the form but emphasized that the person responsible for planning the load distribution in the hold must prepare the [LIR], and [that] 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.”

Loaders who were questioned were unable to interpret the form, did not know where they could obtain clarification and did not refer to the weight-and-balance manual or the passenger-services manual. Few of the loaders questioned knew where the manuals were located.

The ground-handling manual discussed procedures for notifying higher authority of incidents involving dangerous goods and discrepancies between the actual load and the aircraft’s load sheet, but there was no direct explanation of what other types of loading incidents required notification.

“The ramp staff spoken to were unaware of what constituted a notifiable incident, or to whom it should be notified,” said the report. “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.”

Investigators found that the training given by Air New Zealand to loaders had been reduced in scope.

“The training for loaders was a combination of introductory classroom training and on-the-job training, reinforced by supervised experience,” said the report. “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.”

In its analysis, the TAIC referred primarily to information gathered in its investigation of the Nov. 16 incident, but at times included practices or policies that appeared to have a bearing on all five unrestrained-cargo incidents that occurred between Oct. 17, 1997, and Jan. 10, 1998.

Among the report’s observations were the following:

- “The history of the event demonstrates that there was a depth of defensive measures in place to prevent incidents of [this] type ... ;
- “The common result of the failure or removal of these defenses 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 [incident], the loaders knew that the requirement existed and they were familiar with the operation of the locks involved;
- “One common factor in the incidents was the occurrence of one or more unusual events during or prior to the loading process [for example, a delay in the departure of another aircraft, requiring the loading foreman to supervise two loading operations simultaneously, or the late positioning of an aircraft at the gate];
- “In each case a remedy was available without recourse to any involved procedure. ... 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;
- “The witnesses interviewed did not reflect a culture of conformance with the [passenger-services and weight-and-balance] 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. ... An example of the unreliability of the manuals was the outstanding amendment required to the Boeing 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;

- “While few of the loading staff interviewed implied that any shortcomings were due to a reduction in the size of the loading [crews], 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 [interest] 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;

- “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 20 years or more.

“Nevertheless, the foreman was appointed to provide an independent check of the loaders, and [was] 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 [had] been able to check the security after the load was stowed;

- “Although the computer load sheet [for Flight 183] was correct, the load sheet had no value as a defense against any errors the computer load sheet might contain, because the load controller rationalized 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 defenses against the incorrect loading and insecurity of the aircraft load;
- “The failure of the AOC personnel to ensure [that] the aircraft was in its allocated position on time, together with the [line maintenance engineers’] refusal to allow the aircraft to be loaded in part at Gate 30, invalidated the defense against exerting unnecessary pressure on the loading [crew]. The existence of unusual pressure during the completion of a task is recognized as a dominant factor in errors made by personnel working in such environments;
- “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 defense against insecure loads provided by one set of locks ... [and] indicated an uncritical approach to the serviceability of in-hold equipment by loading [crews] and engineers alike;

- “The act of loading a series of similar aircraft with similar loads on a regular basis had the advantage of [creating] 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;
- “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; [and,]
- “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.”

On Jan. 27, 1998, the TAIC made the following recommendations to Air New Zealand:

- “Conduct a precontract 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;
- “Review the capabilities of each of the personnel involved in the loading process to ensure [that] they meet the required standards, are cognizant of their duties, and have sufficient resources and training to distribute and secure the load correctly;
- “Ensure that load controllers check that the loading foreman’s load-instruction form is completed correctly and signed;
- “Emphasize the need for loading foremen to be particularly vigilant while loading is taking place in an environment of disruptions or other factors which minimize the time available for loading or require the supervision of the loading of more than one aircraft at a time;

- “Consider recommissioning the actuators in the lateral load guides on the B-767 in-hold loading equipment;
- “Amend all company manuals which refer to the operation of the actuators in the lateral load guides on the B-767 in-hold loading equipment to ensure [that] 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;
- “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 [that] any consequential amendments in the standard operating procedures are detailed in writing as soon as the modifications are embodied; and,
- “Consider introducing more frequent inspections of the lateral load guides on the B-767 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.”

On Sept. 1, 1998, the managing director of Air New Zealand provided details of actions the airline had taken in response to each of the TAIC safety recommendations. Responses included the following, among others:

- “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;

- “[Air New Zealand has ensured] that (a) the load controller is required to meet the person responsible for the loading (postflight closure and preflight departure) to confirm [that] 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 [his] own name; and (c) the load controller then proceeds to the flight deck with the load sheet;
- “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 program now under development;
- “Air New Zealand are reinstalling the automatic B-767 lateral-guide actuators, with a fleet completion date of March 1999; [and,]
- “The Air New Zealand B-767 maintenance manual has been changed to reflect the actual lateral-load [guide’s] mode of operation, and will be amended to reflect the changes as they are effected.”♦

Editorial note: This article is based on New Zealand Transport Accident Investigation Commission Aviation Occurrence Report 97-018, *Various Boeing 767 and 747 Aircraft, Unrestrained Cargo, 17 October 1997 to 12 January 1998*.

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