



Aircraft loading occurrences

July 2003 to June 2010

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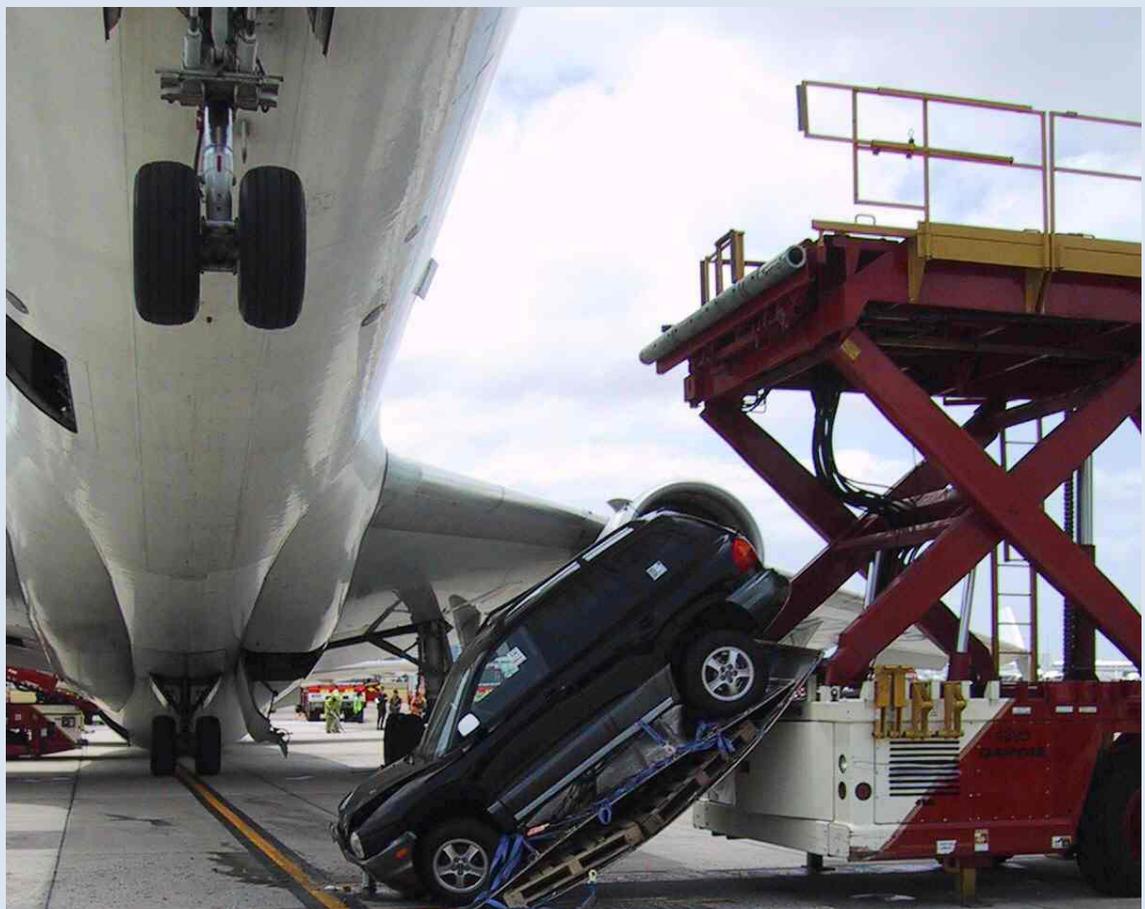
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Abstract

This report documents the number and types of safety occurrences involving loading of high capacity aircraft across a 7-year period to raise awareness within the aviation industry of the associated issues. Incorrect loading of containers, pallets or bags into aircraft can result in them being outside of weight or centre of gravity operating limits, and this may influence aircraft controllability. Most high capacity aircraft loading occurrences are relatively minor, with cargo locks not being raised being the most common. More serious occurrences have involved shifting cargo and unlisted cargo being loaded onto aircraft. Aircraft performance has been affected in a small number of cases, and the result has been rejected takeoff, extra stabiliser trim, or aircraft control difficulties.

Weight and balance event during unloading



BACKGROUND

The aircraft loading process starts in the airline flight operations department before passengers start boarding; it examines the number of passengers booked on the flight, distance to be covered, the amount of fuel required for the flight, freight and baggage, the aircraft centre of gravity and trim settings, along with carriage of dangerous goods and animals. A provisional Load Instruction Report (LIR) is produced and loading begins. A final record of the number of passengers, and the amount of freight and fuel is produced in hard copy or electronically sent to the aircraft prior to takeoff.

Aircraft hold loading starts with items of baggage and freight that are transported to the aircraft from the passenger or freight terminal and either packed as individual items, or placed into bins, containers (called unit load devices) and onto pallets, then positioned in the aircraft hold. These loads are lifted into the aircraft hold using a conveyor belt or scissor lift, and individual items are secured with netting. Containers and pallets are positioned in the hold using a series of electronically controlled rollers. Containers and pallets are locked into place using retractable latches, integrated into the floor or wall of the aircraft. These latches, called cargo locks, stop containers and pallets from moving, while the aircraft is in flight or moving on the ground. The Leading Hand checks that the loads are recorded correctly on the LIR. At the destination, passengers and freight are unloaded from the aircraft.

Safety occurrences relating to loading and unloading of high capacity aircraft are varied in nature. Events reported to the Australian Transport Safety Bureau (ATSB) in recent years have included:

- The flight crew of an Airbus A330 were surprised to find the aircraft nose heavy during takeoff.
- A dog escaped from the cargo door of a taxiing Boeing 737 and was seen by the flight crew running next to the aircraft as it approached the aerobridge after landing.
- During pushback, a loud thumping noise was heard coming from the cargo hold by aircraft crew. A subsequent inspection of the aircraft hold revealed the presence of a baggage handler, who had fallen asleep while waiting for late baggage.
- The front wheel of an aircraft was noted by ground staff to be almost off the ground during loading, because of a tail-heavy aircraft.

Loading occurrences are safety incidents and accidents relating to aircraft weight and balance, type of load, and restraint of cargo within an aircraft. They also relate to documentation about loads and their distribution in an aircraft. A number of different people and systems are used to support the loading process, including port controllers, flight operations planners, and flight, cabin and ground crew. Most loading occurrences are discovered at the destination post, but sometimes they are discovered before an aircraft taxis for takeoff, or while the aircraft is in the air. An aircraft might exhibit a high fuel burn rate or need extra stabiliser trim to maintain stable flight. Sometimes flight and cabin crews hear bumps and thumps in the cargo hold when unrestrained cargo moves, particularly at top of descent.

Most loading occurrences have minimal impact on the safety of operations and there are people, processes, procedures, and engineering equipment used by aircraft and ground operators to control the risks to an aircraft from a loading perspective.

The process of loading, flying, and then unloading an aircraft is quite complex and time sensitive from an airline perspective. Airlines are under internal and external pressures to meet timeframes; the internal pressures relate to operating costs, and external pressures relate to reputation and customer choice.

Sometimes the complex coordination involved in loading high capacity aircraft breaks down. This has led, on occasions, to disastrous outcomes overseas, but not in Australia. Australia's most memorable loading event to date involved an attempted robbery on Trans Australian Airlines Flight 454 in 1982, where criminals stowed away in cargo and attempted to steal reserve bank money.

A number of international accidents have been the result of loading issues. For example:

- In 2009, a Bulgarian-registered Airbus A320 suffered a tailstrike during takeoff from Verona, Italy. The aircraft was on a two-sector trip with Verona the first stop before continuing to Rome. The Italian National Agency for Aviation Safety investigation found that the entire luggage for passengers alighting at Verona was in the forward hold, while the luggage for passengers continuing to Rome was in the rear hold. Therefore, when taking-off from Verona, the forward hold was empty.¹
- In 1999 in the United Kingdom, a tail-heavy Fokker F27 aircraft pitched up significantly as the wing flaps were applied on final approach to Guernsey Airport in the Channel Islands, resulting in the left wing dropping and the aircraft stalling. The pilots lost control and the aircraft collided with terrain and the two flight crew were killed. The investigation team believed that cargo shifted during taxiing or flight and this aggravated the aircraft loss of control.²

In Australia, loading occurrences have been the subject of a number of ATSB occurrence investigation reports and safety deficiency investigations to industry. These investigations relate to the 1990's and have dealt with:

- scorch marks (possible fire) on aircraft cargo hold pallets
- cargo restraint and locks
- aircraft weight and balance
- inadequate load summary documentation, computerised load systems
- reductions in the number of loading gang members and cost cutting
- training of loading gang members
- communication between the load offices, loading gang members, and flight crew.

One of the most serious loading occurrences in Australia occurred in the early 1990s, where 60 additional golf bags were loaded into a Fokker F28 aircraft. The pilot landed with the stabiliser trim at the maximum setting, and the aircraft was very nose heavy.

More recently, the ATSB has been investigating two incidents, one involving an aircraft which was 1 tonne over its maximum take-off weight (investigation report AO-2009-011), and another with about 700 kg of unlisted cargo (investigation report AO-2009-034).

Data sources

Loading occurrences were included in this report if they were reported to the ATSB between 1 July 2003 and 30 June 2010 and categorised as a transport safety matter by the ATSB. The current report covers both VH- and foreign registered high capacity aircraft³, arriving or departing from Australia. Although dangerous goods are related to aircraft loading, they are considered separately to this report. Cargo in this report is considered to be any containers, pallets, bags or pets placed under the aircraft for carriage during flight.

Different weight and balance conditions can lead to the same outcome. For example, an error in calculating stabiliser trim or loading of unlisted freight on an aircraft can lead to a nose heavy aircraft. Loading reports sent to the ATSB do not always contain sufficient information to provide context to

1 Accident: *BH Air A320 at Verona on Sep 1st 2009, tail strike on takeoff*. The Aviation Herald (www.avherald.com).

2 Air Accidents Investigation Branch (2000) Aircraft accident report 2/2000 (Fokker F27-600 Friendship, G-CHNL).

3 A high capacity aircraft refers to an aircraft that is certified as having a maximum capacity exceeding 38 seats or a maximum payload exceeding 4,200 kg.

prior events, only that the event occurred. Therefore, the approach taken to coding loading occurrences has been to assign a single primary code to each occurrence, based on what was reported to the ATSB.

Aircraft loading



Source: Thinkstock 93981919

Exclusions

A number of related occurrences were excluded from the analysis in this report including:

- pilot-related data calculation and flight management computer data entry errors⁴
- false cargo fire warnings
- cargo door occurrences
- battery-related occurrences where batteries were part of aircraft systems
- smoke and fumes occurrences not related to cargo, including passengers smoking, or failure of aircraft components (such as fans)
- ground operations occurrences⁵.

A number of other occurrences that were potentially related to loading could not be included in this report as there was not enough information reported to the ATSB to determine whether loading contributed to the occurrence. These included some aircraft weight and balance or performance conditions, bumps and thumps felt by flight or cabin crew and passengers, and fumes.

4 Occurrences related to pilot data calculation and data entry errors have been documented in a recent ATSB report *Take-off performance calculation and entry errors: A global perspective* (Aviation Research and Analysis Report – AR-2009-052)

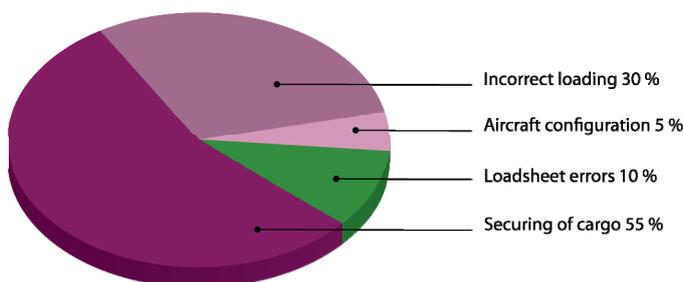
5 Ground operations related occurrences have been documented in a recent ATSB report *Ground operations occurrences at Australian airports 1998 to 2008* (Aviation Research and Analysis Report –AR-2009-042).

SUMMARY OF OCCURRENCES

Between 1 July 2003 and 30 June 2010, there were 260 loading occurrences reported to the ATSB involving high capacity aircraft operations. Nearly all (98 per cent) of these occurrences involved passenger carrying operations.

Of the 260 loading occurrences, about 55 per cent related to securing of cargo, 30 per cent related to incorrect loading, about 10 per cent to loadsheet errors and 5 per cent to aircraft configuration (Figure 1). Since 2006, reported incorrect loading and securing of cargo occurrences have increased, while configuration and loadsheet errors have remained relatively static.

Figure 1: Loading occurrences



Securing of cargo

There were 145 occurrences relating to securing of cargo over the reporting period. Cargo locks not raised was the most frequently reported occurrence, followed by unsecured cargo, shifting cargo and cargo webbing occurrences. The majority of securing of cargo occurrences took place on domestic services; where the securing of cargo occurrences occurred on international flights, about 40 per cent were leaving Australia, and 60 per cent were arriving in Australia.

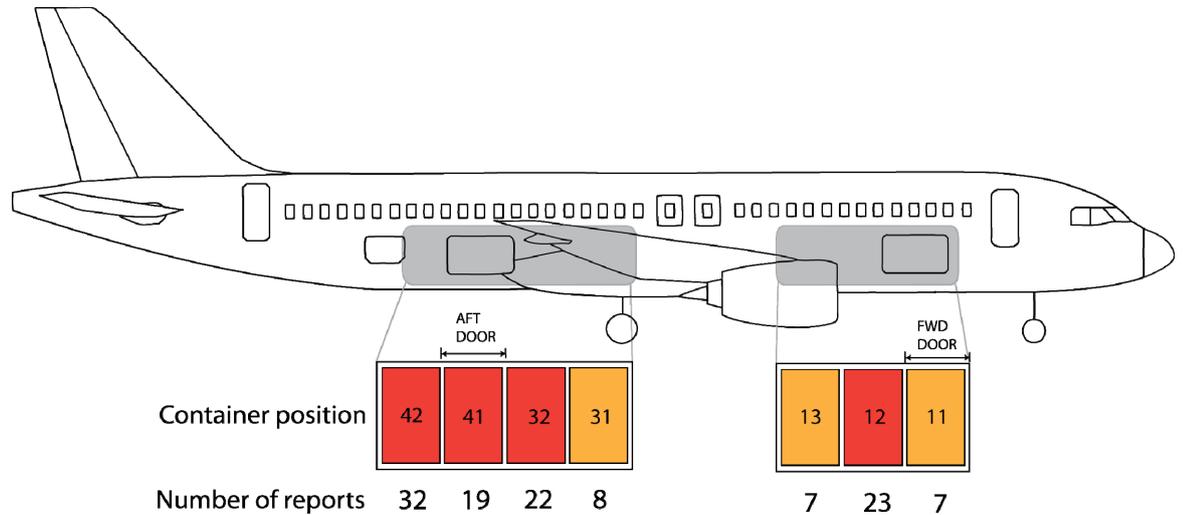
Occurrences with cargo that was not secured involved aircraft departing from 26 different aerodromes. The data shows that the number of reported occurrences is consistent with the number of movements at each aerodrome annually, with the exception of the Gold Coast. The number of departures at Gold Coast aerodrome more than doubled from 2007 to 2008; this may in part account for the spike in the number of Gold Coast securing of cargo occurrences.

Cargo locks not raised

The most frequently reported loading occurrence was cargo locks not being raised (127 occurrences), accounting for about 90 per cent of securing of cargo occurrences. The hazard associated with cargo locks not being raised is that cargo can potentially move in flight and this in turn affects the aircraft's centre of gravity and controllability. About 80 per cent of these occurrences took place among Airbus A320-200 series aircraft, with the remaining 20 per cent divided between Airbus A330-200, Boeing 767-300, 747-400, and 737-800 series aircraft. Most other high capacity aircraft operated in Australia do not regularly use container or unit load devices (ULD). The majority of domestic carriers in Australia don't use cargo containers.

The distribution of cargo positions in the Airbus A320-200 (A320) aircraft are shown in Figure 2. The aircraft has forward and aft cargo compartments, with the three forward cargo compartments being in positions 11, 12, and 13, while the aft compartment usually has four positions - 31, 32, 41, 42 (depending on how the aircraft is configured). The red labels in Figure 2 highlight positions where cargo locks are most frequently not raised - these are positions 12, 32, 41 and 42.

Figure 2: Airbus A320 Cargo locks not raised



The number of reported A320 cargo locks occurrences has diminished since the major portion of the Australian fleet was introduced in late 2005 and early 2006. This seems to suggest that operational experience has improved use of cargo locks by ground staff. The vast majority of occurrences involving cargo locks not being raised were discovered when the aircraft was being unloaded, but occasionally a bump or bang was heard in flight, and inspection of the hold, at the request of the flight crew, found a lock in the lowered position. Not all occurrence notifications specifically mentioned cargo lock serviceability, but where they did, the locks were found to be serviceable. This suggests that these occurrences are related to loading procedures, rather than cargo lock wear and tear.

Shifting and unsecured cargo

There were only 18 reported occurrences of actual shifting cargo. Most of these occurrences related to securing of containers and pallets, but some also related to bags not being secured with webbing. These shifts of cargo were often associated with changes in momentum at takeoff, climb, or top of descent. They were heard by a range of flight crew, cabin crew and passengers.

Hungry dog chews aircraft wires

Immediately after takeoff, a dog in the cargo bay escaped from its cage and chewed through the wiring loom for the Auxiliary Power Unit controls.

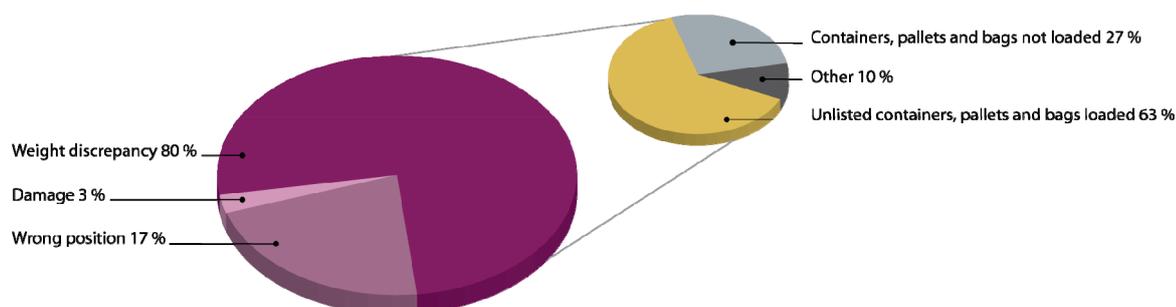
Examples of shifting and unsecured load occurrences include:

- On an international flight, a pallet weighing 2,500 kg moved forward and jammed in the aircraft hold.
- On another international flight, the cargo container moved forward and pierced the fabric bulkhead.
- On one domestic flight, a ULD expanded in flight and could not be unloaded through the forward cargo door. Soft bags had been placed at the bottom of the ULD, and hard bags were placed on top - with changes in momentum, the ULD expanded in flight.
- On another domestic flight, cargo webbing was jammed in the cargo door as it was being closed. This was not discovered before a master caution annunciation during the climb to cruise - the aircraft landed safely.

Incorrect loading

Seventy-eight incorrect loading occurrences were reported to the ATSB over the period 1 July 2003 to 30 June 2010. These related to three main occurrence types: aircraft weight discrepancies; wrong position of containers, pallets or bags in the aircraft; and damage to the aircraft hold (Figure 3). The hazard associated with this type of occurrence is the potential for an aircraft to be out-of-balance.

Figure 3: Incorrect loading occurrences



Many airlines continue to use standard passenger and baggage weights to plan and administer aircraft loading. This is combined with fuel, aircraft cargo and empty aircraft weight to calculate total aircraft weight. Most aircraft currently in service in Australia do not have systems installed to perform on-board measurement of weight on wheels using scales or pressure on landing gear struts. There are systems available for automatic weight and mean aerodynamic cord measurement for several larger aircraft types (such as Boeing 747-400, Airbus A320 and A330/340). However, at present these are not used as the primary means of calculating weight and balance due to concerns about the reliability of such systems.⁶

Aircraft weight discrepancy

Weight discrepancy occurrences were mostly a result of either unlisted containers, pallets or bags being loaded, or containers, pallets or bags not being loaded (Figure 3).

Unlisted containers, pallets and bags loaded

Most occurrences involving aircraft with unlisted containers, pallets or bags had less than 1,000 kg of extra weight on the aircraft. The highest amount of extra weight recorded was 3,400 kg on a Boeing 747-400. Some of the unlisted cargo was related to empty containers, but the vast majority related to the wrong container or pallet being loaded on the aircraft. In a small number of occurrences, the cargo from a previous flight was not unloaded, or containers were unloaded from the aircraft and then returned to the aircraft full, but the cargo card recorded the container as empty. About two-thirds of the unlisted container, pallet or bag occurrences were among smaller narrow-body Boeing 737 or Airbus A320 aircraft, and the remainder were larger wide-body Boeing 747, 767 or Airbus A330 aircraft. For the narrow-body aircraft, only one Boeing 737 had more than 1,000 kg extra weight, and this was a foreign registered international flight departing from Australia.

In relation to the type of service (international or domestic), about 25 per cent of unlisted cargo occurrences were on international flights. Where recorded, all these international flights had extra weight of at least 1,000 kg or more. This probably reflects the size of the ULD carried by larger aircraft. In addition, larger aircraft are manufactured with a greater airframe capacity to accommodate extra weight, because of the relative size of the containers, pallets and bags, compared with the maximum

⁶ van Es., G. W. H. (2007). *Analysis of aircraft weight and balance related safety occurrences*. (Report NLR-TP-2007-153). National Aerospace Laboratory NLR: Amsterdam. (Available through Skybrary bookshelf (www.skybrary.aero/bookshelf/content/index.php)).

take-off weight of the aircraft. A search of all electronic records at the ATSB between 1969 and 2010 shows two extremes in terms of overloading for small and large aircraft.

The highest additional load figure reported in Australian data was in 1976 and involved a foreign-registered Boeing 747 aircraft weighing about 342,000 kg. It was overloaded by 32,000 kg at takeoff in terms of the runway length available, climatic conditions and aircraft configuration. It overran the end of runway 27 at Melbourne Airport by 46 metres, but managed to get airborne without any damage.⁷

Compared with this event, overloading occurrences among large aircraft in the current report are relatively minor. Smaller aircraft have a smaller margin for loading and weight and balance error. For example:

In 1993, the flight crew of an Australian-registered Fokker F28 aircraft on final approach to Launceston aerodrome reported that they were not able to apply adequate trim to the nose-heavy aircraft even with maximum nose-up stabiliser trim. After landing, 60 golf bags weighing about 1,300 kg, but not listed on the Load Instruction Report, were found in the forward cargo compartments. The maximum take-off weight of the aircraft was about 33,000 kg. In this circumstance, control difficulties were experienced.

Cargo container being loaded into an aircraft hold



Source: Thinkstock 98990270

Aircraft loading occurrences involving extra weight from unlisted containers, pallets and bags during the period of study for this report generally had little or no consequences. Although aircraft involved in this report may have been heavier than recorded on the LIR, it is probable that most operated within their allowable weight and balance limits. However, there is always the potential that the additional unlisted weight loaded will place an aircraft beyond what is safe.

Other less common reasons why unlisted cargo was loaded into aircraft include incorrect cargo cards being attached to containers, and time pressure where late arriving inbound aircraft left little time for loading.

7 Aviation Safety Digest, 104:16-17

There were 20 aerodromes in Australia and internationally where unlisted cargo was loaded onto aircraft. Melbourne, Sydney and Perth aerodromes recorded the highest number of unlisted cargo occurrences. Relative to the number of aircraft movements, the rate of unlisted cargo occurrences is very low.

Containers, pallets and bags not loaded

Occurrences where cargo was not loaded onto an aircraft involved containers, pallets and bags (often mail). Most occurrences involving cargo not being loaded were discovered at the destination port, but some were discovered at the departure port when loading staff noticed cargo containers at the gate, after the aircraft had departed. One aircraft had about 4,200 kg less than the LIR, but most were between 300 and 800 kg under the weight recorded on the LIR.

Other weight discrepancies

The majority of occurrences involving the *Other* category (Figure 3) related to incorrect fuel loads. These were either because too much fuel was loaded on the aircraft, unusable fuel was factored into the fuel uplift, or fuel tanks assumed to be empty contained fuel. One international flight involved a calculation error when pounds were not converted into kilograms. This resulted in the aircraft being lighter by 2,250 kg than the figure recorded on the LIR.

Wrong position and aircraft damage

There were only 20 incorrect loading occurrences involving wrong positions or aircraft damage. For incorrect position occurrences, more containers were in the wrong position than bags. No particular pattern emerged in relation to the type of load, aircraft, type of service, or position. Two occurrences involving internal damage to the aircraft hold were reported to the ATSB. One involved a metal bar from the top of a baggage container being driven into the ceiling panel, and another had damage to the freight compartment floor from an undetermined source. Both damaging occurrences involved international flights.

Pallets being loaded into an aircraft hold



Source: Thinkstock 200313470

Loadsheets occurrences

A small number of loadsheet related occurrences have been reported to the ATSB (10 per cent of all loading occurrences). These have involved errors in the number of passengers recorded on the aircraft loadsheet, the loadsheet being sent to the flight crew while the aircraft was still being loaded, and other loadsheet errors.

Incorrect number of passengers

On one flight, the cabin manager realised that there were 25 extra passengers on the aircraft not recorded on the final load sheet, while on another flight, a group of children was not included on the final load sheet. Three other occurrences recorded small discrepancies such as one or two passengers not being on the aircraft; these minor occurrences are probably more of a security risk than a safety risk.

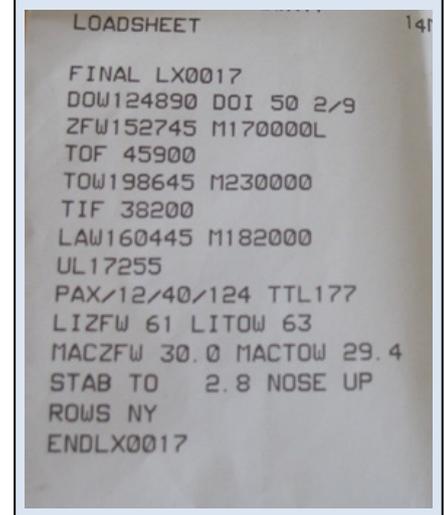
Aircraft is still being loaded

Several occurrence reports stated that the loadsheet was received with the aircraft holds still open, the cargo doors were reopened to accommodate further cargo, or baggage was loaded after the loadsheet was received.

Loadsheets errors

The loadsheet errors have involved incorrect zero fuel weights, receipt of a new loadsheet after takeoff, documentation in relation to rafts and over-water operations not included on the loadsheet, incorrectly recorded weights of cargo and freight items, incorrect aircraft registrations, and calculation of the weight of passengers where there are groups of small children.

Example of a loadsheet printout



Aircraft configuration

Aircraft configuration occurrences included in this section specifically related to loading, rather than configuration errors by the flight crew. Often they were identified through a cockpit warning at takeoff or during the climb, where the aircraft pitched up or was nose heavy, or exhibited an increase change in aircraft control responsiveness. These occurrences are closely related to other occurrences involving cargo not loaded or unlisted cargo being loaded (discussed on page 7), but with the addition of resultant aircraft handling difficulties. Occurrences classified as involving aircraft configuration were considered consequential events – where some other event, such as an error in the loadsheet, or incorrect loading leads to an out-of-balance aircraft.

One of the curious things about aircraft centre of gravity is that it is easier to detect an out-of-balance aircraft in the air than it is on the ground. Aircraft loading configuration problems are not always apparent until takeoff occurs; for example, until full thrust is applied, a configuration problem may not necessarily be apparent. Rather, a number of conditions must be met for a cockpit warning horn to sound or error message to be generated. Commonly this includes a combination of stabiliser trim settings, engine thrust and flap settings.

There were 12 occurrences with documented aircraft centre of gravity problems. This represents about 5 per cent of all loading occurrences. Seven occurrences involved an aft heavy aircraft and five involved a forward heavy aircraft. Two occurred during disembarkation and 10 while the aircraft was preparing for flight or departing the aerodrome.

The two disembarkation occurrences involved tail-heavy Boeing 737 aircraft developing nose high attitudes when passengers and cargo were being unloaded. These disembarkation occurrences were identified by ground staff. In the first occurrence, passengers were asked to be seated while the aft cargo holds were emptied. In the second occurrence when the nose of the aircraft rose, the cabin door made contact with stairs.

Incorrect unloading can cause an aircraft to pitch up



Of the remaining 10 occurrences, two were technical in nature:

- A flight planning computer system did not calculate the correct pitch trim setting. The flight crew received a pitch trim cockpit warning as the aircraft was taxiing for takeoff. After examining the layout of the load in the hold, and consulting the mean aerodynamic chord (MAC) stabiliser trim setting chart, the flight crew used the stabiliser trim setting from the aircraft flight manual, rather than from the computer system. The aircraft departed normally with no undue forces on the control column. Unlike the Airbus A320, the A330 MAC and pitch trim settings are not positioned adjacent to each other, making a reasonableness test of MAC and pitch trim more difficult.
- A discrepancy between the two flight management computers (FMC) meant that one computer was not updated, resulting in inaccurate weight and performance data in that FMC. This led to a weight and balance error which was picked up at top of descent.

The remaining eight occurrences involved aircraft with forward or aft centre of gravity discrepancies. Two occurrences involving Boeing 737 aircraft resulted in a rejected takeoff followed by adjustments to the stabiliser trim. One involved a forward centre of gravity and the other was at the aft limit. A third occurrence involving an Airbus A330 aircraft was detected at the gate, when the flight crew performed a cross-check of the flight planning computer final load sheet, and found that no stabiliser trim was annotated on the load sheet. Without stabiliser trim, the aircraft would have been outside the forward centre of gravity envelope. The aircraft was delayed while cargo was redistributed. The flight crew expressed concerns about how an out-of-limits load sheet could be raised in the first instance – given modern database logic and rules.

Two occurrences involved nose heavy aircraft, where excessive back pressure was required by pilots on the control column to rotate the aircraft. Three occurrences involved an aft heavy aircraft, where the aircraft nose unexpectedly pitched up during takeoff on rotation. These occurrences are described below.

Nose heavy occurrences

The first nose heavy occurrence involved an A330 on an international flight.⁸ The aircraft operator had two load control systems, one for domestic and another for international flights. When the international load control profile was created for the aircraft, the profile was corrupt, and take-off performance charts from the departure point were not available. The flight crew extracted the aircraft weight and parameters from a fleet weight and balance folder at the departure port, but did not check this data against the aircraft configuration. This data was given to the port load controller, who did not cross-check the data, and an erroneous load sheet was generated. Effectively, a domestic weight and aircraft index was applied to an international weight and aircraft index. This latent condition was not detected in the intervening months because the aircraft had performed domestic flights only. The aircraft flew two sectors before the error was discovered.

In relation to the second nose heavy occurrence, the aircraft was a Boeing 767 on a domestic flight. Few details were provided to the ATSB, except to say that the stabiliser trim was set in accordance with normal procedures.

Aft heavy occurrences

Three occurrences involved aircraft with reported aft heavy aircraft conditions. Two of the three aircraft were performing domestic services. The first nose heavy aircraft was a Boeing 767, which exhibited a rapid nose pitch up on rotation. Adjustments were required to the stabiliser trim setting. No further details were available. The second occurrence involved a Boeing 747 on an international flight, when the nose pitched up and forward control inputs arrested the climb angle. The flight crew queried the load controller who stated that the aircraft was at the aft end of the flight envelope, but within limits. During the climb, the aircraft was somewhat difficult to control, and required manual flight. At the cruise altitude of 29,000 feet, pitch and speed became unstable. The pilot considered early transfer of the tail tank fuel to stabilise the aircraft, but decided against this course of action. No further details about this occurrence were available. The third occurrence involved nose pitch up in an Airbus A320. The crew noted that the aircraft centre of gravity was in the aft section of the envelope, but within limits. During flight, 16 passengers were re-seated in the forward cabin, placing approximately 1,300 kg further forward in the aircraft.

⁸ ATSB occurrence investigation 200405064.

CONTROL STRATEGIES

A number of different people contribute to and oversee aircraft loading, including port controllers, load controllers and load gangs, flight planners, freight terminal staff, and flight crew. In the last 2 years, major RPT airline operators have all upgraded their load control computer software, to make sure they have efficient, accurate and safe flight planning and loading systems. In Australia, in the past few years, cargo loading and ground handling companies have emerged from airlines and airports, and less loading staff work within airlines.

The types of errors found in these data are largely individual actions, but some systemic issues also arise. The following practices can help to guard against common loading errors:

- Perform cross-checks between the mean aerodynamic chord and stabiliser trim setting, for all LIRs.
- Perform a cross-check of the aircraft weight, as recorded in the aircraft manual - with the load report weight, and ensure the aircraft registration details are correct on the loadsheet.
- Flight crew should not accept a loadsheet while the aircraft is being loaded.
- incorporate rules within load control software that stop incorrectly configured aircraft loadsheets from being generated.
- Remove off-loaded/rejected containers or loads from next to the aircraft where they can potentially get reloaded in error.
- Use on-board aircraft weight sensors as a cross-check against weight and centre of gravity calculations.

SUMMARY

This report has examined loading occurrence for high capacity aircraft operating in Australia. It shows that the most frequently reported problem is cargo locks not being raised. Aircraft performance has been affected in a small number of reported cases. Generally, there are a small number of loading occurrences per million movements, but there is no room for complacency. Methods for ensuring that aircraft are correctly loaded revolve around a system of cross-checks by load personnel, load controllers and their computer software, and flight crew. These systems and procedures must be adhered to so that continued airline safety can be assured to all passengers.