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Aircraft loading event involving Boeing 737, ZK-TLK

Sydney Airport, New South Wales, 17 December 2016

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Addendum

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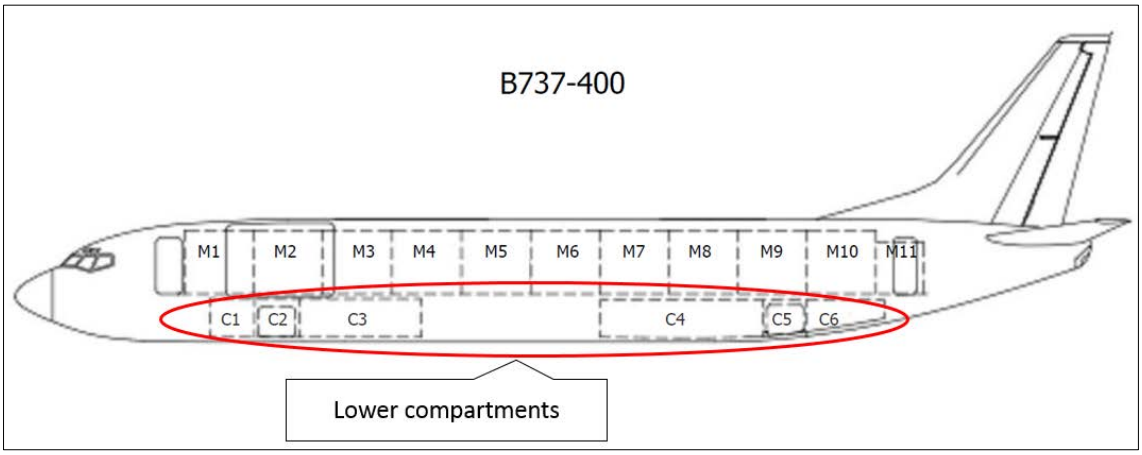
Aircraft loading event involving Boeing 737, ZK-TLK

What happened

On 15 December 2016, a Boeing 737-476SF (Special Freighter) aircraft, registered ZK-TLK (TLK), conducted a night freight flight from Sydney, New South Wales, to Melbourne, Victoria. On approach to Melbourne Airport the captain noted the aircraft nose attitude appeared to be too high and airspeed appeared to be too low for that phase of flight. After landing at Melbourne Airport, the captain was notified that a loading error occurred at Sydney Airport.

On the evening of the incident, two 737 freighter aircraft, operated by the same freight company, with the same paint scheme, were conducting freight flights into and out of Sydney Airport. The loading supervisor received loading instructions for the two aircraft shortly after they[1] started their shift at 1600 Eastern Daylight-savings Time (EDT). The loading instructions included changes to the scheduled lower compartment loads for the two 737 freighter aircraft, TLK and ZK-JTQ (JTQ) (Figure 1).

Figure 1: Boeing 737-476SF lower compartments



Source: Operator, annotated by ATSB

At about 1945, the loading supervisor completed their ramp report, which included the planned aircraft parking bays. At 2015, they travelled to the parking bays to prepare the tarmac for the aircraft arrivals and confirm the freight was prepared for loading. At 2030, they briefed their leading hand, who was responsible for directing the transfer of the road freight to the respective aircraft parking bays.

The planned loads for TLK and JTQ were distributed into containerised and non-containerised freight. Containerised freight is loaded into the upper compartments of the 737 freighter aircraft and non-containerised freight is loaded into the lower compartment. The freight was prepared on the international side of the airport and then delivered to aircraft parking bays 5 and 6 on the domestic side of the airport.

At about 2040, the loading supervisor received a phone call from their manager that there would be an aircraft swap at Sydney Airport (see *aircraft swap*). Therefore, the freight planned for TLK and JTQ, needed to be exchanged between the two aircraft. The supervisor was at the tarmac at the time of the phone call and did not have access to a computer, so they manually changed their ramp report and briefed the tarmac loaders about the change. However, they only swapped the

[1] Gender-free plural pronouns: may be used throughout the report to refer to an individual (i.e. they, them and their).

aircraft registration, flight number and inbound port on their ramp report, they did not change the parking bay numbers. According to the supervisor's ramp report, TLK was scheduled to park on bay 6 and JTQ on bay 5. However, when the two aircraft arrived at their parking bays, at about 2136 and 2138 respectively, TLK parked on bay 5 and JTQ parked on bay 6.

The staff responsible for loading the containerised freight into the upper compartments of the aircraft loaded the aircraft with reference to their copy of the load instruction report.[2] However, the non-containerised lower compartment freight was allocated to the aircraft by the loading supervisor with reference to their ramp report parking bay numbers, which were incorrect. Consequently, TLK was loaded with JTQs lower compartment freight and JTQ was loaded with TLKs lower compartment freight. The flight crew were then issued with the load instruction reports with their planned freight, which were correct for their upper compartments, but incorrect for their lower compartments. The aircraft taxied for departure at 2247 and 2253, and departed at 2300 and 2302 respectively.

Airport curfew

While the loading supervisor was supervising the distribution of freight for the aircraft, they were also mindful of the airport curfew time of 2300. The priority for the loading supervisor in this situation is to ensure that the aircraft can depart on time. Therefore, they were required to closely monitor and assess the progress of the loading in order to be prepared to make a decision to stop the loading of freight if it posed a risk of delay past curfew.

Aircraft swap

The normal schedule for the two 737 freighter aircraft were as follows:

Flight TFR 21 from Brisbane to Sydney would depart outbound from Sydney as TFR 22 for Melbourne.

Flight TFR 34 from Adelaide to Sydney, would depart outbound from Sydney as TFR 41 for Brisbane.

On the night of the incident, JTQ operated as TFR 21 from Brisbane to Sydney and TLK operated as TFR 34 from Adelaide to Sydney. The aircraft swap in Sydney required JTQ to depart from Sydney as TFR 41 for Brisbane and TLK to depart from Sydney as TFR 22 for Melbourne.

Weight and balance

The two 737 freighter aircraft had a maximum take-off weight of 68,039 kg. The centre-of-gravity limits for the aircraft, represented as an 'index',[3] varied with respect to the weight of the aircraft in a non-linear manner. Table 1 depicts the planned and actual data for TLK and Table 2 depicts the planned and actual data for JTQ. The actual weight and balance for TLK was within limits, but while the weight for JTQ was within limits, the centre of gravity was marginally forward of the forward centre-of-gravity limit.[4] The weight and balance calculation is used to provide the aircraft horizontal stabiliser adjustment setting for take-off. The difference between the planned and the actual required stabiliser settings was minimal for both aircraft.

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[2] The load instruction report (LIR) includes the aircraft registration, flight number, destination and description of planned load with reference to the respective aircraft upper and lower compartments. The LIR is issued by the load control centre and therefore incorporated all the changes which were communicated to the loading supervisor.

[3] 'Index' is a number calculated from aircraft weight and centre of gravity position to represent the aircraft moment. The aircraft index is referenced from a point near the centre of gravity and permits simplified centre of gravity calculations when loading the aircraft.

[4] A centre of gravity forward of the limits can adversely affect the stability and control of the aircraft.

Table 1: ZK-TLK weight and balance

Planned taxi weight	58,178 kg	Index	35.1
Actual taxi weight	59,937 kg	Index	35.7
Planned landing weight	54,217 kg	Index	33.4
Actual landing weight	55,976 kg	Index	34.0
Stabiliser adjustment figures:			
Planned flaps 1 & 5	4.4	Planned flaps 15	3.6
Actual flaps 1 & 5	4.3	Actual flaps 15	3.6

Table 2: ZK-JTQ weight and balance

Planned taxi weight	58,629 kg	Index	23.3
Actual taxi weight	56,875 kg	Index	**22.6**
Planned landing weight	54,533 kg	Index	23.1
Actual landing weight	52,779 kg	Index	**22.4**
Stabiliser adjustment figures:			
Planned flaps 1 & 5	5.0	Planned flaps 15	4.3
Actual flaps 1 & 5	5.1	Actual flaps 15	4.4

Safety analysis

Several changes to the planned loading of the aircraft were communicated to the loading supervisor on the afternoon and evening of the incident. The loading supervisor incorporated the initial change to the lower compartment freight into their ramp report and communicated the plan to the staff. When the loading supervisor was notified that an aircraft swap would occur in Sydney, they were on the tarmac and performed a manual update to their ramp report. However, their manual update did not include the change in parking bay numbers.

The loading supervisor referred to their ramp report to direct the loading of the lower compartment freight planned for TLK and JTQ. The staff loading the upper compartments referred to their load instruction reports, which had the correct parking bays. At this time, the supervisor's attention was divided between the freight loading activities and the overall progress of the loading of both aircraft against the approaching airport curfew time. Consequently, the supervisor directed the planned lower compartment freight for TLK to JTQ, and the planned lower compartment freight for JTQ to TLK.

The pilot of TLK reported that the aircraft's flight management computer determines the airspeed to be flown on final approach based on aircraft weight. They entered a zero fuel weight into the flight management computer based on the planned load, which was less than the actual load. Therefore the target airspeed flown was slower than required for the actual weight of the aircraft and the aircraft nose attitude increased in order to produce sufficient lift to maintain the approach flight path.

Findings

These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- The loading supervisor made a manual change to their ramp report, but did not include a change to the aircraft parking bay numbers; this resulted in them directing the lower compartment freight for TLK to JTQ, and the lower compartment freight for JTQ to TLK.
- JTQ was operated with a centre of gravity marginally forward of the limit.

Safety action

Whether or not the ATSB identifies safety issues in the course of an investigation, relevant organisations may proactively initiate safety action in order to reduce their safety risk. The ATSB has been advised of the following proactive safety action in response to this occurrence.

Loading supervisor

As a result of this occurrence, the loading supervisor has advised the ATSB that they have taken the following safety actions:

Cross-check

During loading of the aircraft lower compartment freight, an independent cross-check will be made of the freight destination against the load instruction report.

Safety message

This incident highlights the risk associated with a single source of error propagating through a safety critical process. Following this incident, the loading supervisor reported that the lesson they learned was to have their work cross-checked whenever feasible.

General details

Occurrence details

Date and time:	17 December 2016 – 2220 EDT	
Occurrence category:	Incident	
Primary occurrence type:	Loading related	
Location:	Sydney Airport, New South Wales	
	Latitude: 33° 56.77’ S	Longitude: 151° 10.63’ E

Aircraft details

Manufacturer and model:	The Boeing Company 737-476SF	
Registration:	ZK-TLK	
Serial number:	24434	
Type of operation:	Air transport high capacity – Freight	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

Aircraft details

Manufacturer and model:	The Boeing Company 737-476SF	
Registration:	ZK-JTQ	
Serial number:	24442	
Type of operation:	Air transport high capacity – Freight	
Persons on board:	Crew – 2	Passengers – 0
Injuries:	Crew – 0	Passengers – 0
Aircraft damage:	Nil	

About the ATSB

The Australian Transport Safety Bureau (ATSB) is an independent Commonwealth Government statutory agency. The ATSB is governed by a Commission and is entirely separate from transport regulators, policy makers and service providers. The ATSB's function is to improve safety and public confidence in the aviation, marine and rail modes of transport through excellence in: independent investigation of transport accidents and other safety occurrences; safety data recording, analysis and research; and fostering safety awareness, knowledge and action.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to operations involving the travelling public.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and Regulations and, where applicable, relevant international agreements.

The object of a safety investigation is to identify and reduce safety-related risk. ATSB investigations determine and communicate the safety factors related to the transport safety matter being investigated.

It is not a function of the ATSB to apportion blame or determine liability. At the same time, an investigation report must include factual material of sufficient weight to support the analysis and findings. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

About this report

Decisions regarding whether to conduct an investigation, and the scope of an investigation, are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, a limited-scope, fact-gathering investigation was conducted in order to produce a short summary report, and allow for greater industry awareness of potential safety issues and possible safety actions.