FINAL REPORT

BOEING 737-900, REGISTRATION PK-LHQ
WIND INCIDENT, CHANGI AIRPORT
26 MAY 2013

AIB/AAI/CAS.093

Air Accident Investigation Bureau of Singapore
Ministry of Transport
Singapore

1 August 2014

The Air Accident Investigation Bureau of Singapore

The Air Accident Investigation Bureau (AAIB) is the air accidents and incidents investigation authority in Singapore responsible to the Ministry of Transport. Its mission is to promote aviation safety through the conduct of independent and objective investigations into air accidents and incidents.

The AAIB conducts the investigations in accordance with the Singapore Air Navigation (Investigation of Accidents and Incidents) Order 2003 and Annex 13 to the Convention on International Civil Aviation, which governs how member States of the International Civil Aviation Organisation (ICAO) conduct aircraft accident investigations internationally.

In carrying out the investigations, the AAIB will adhere to ICAO's stated objective, which is as follows:

> *"The sole objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability."*

Accordingly, it is inappropriate that AAIB reports should be used to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

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SYNOPSIS

On 26 May 2013 at about 1342 hours, a Boeing 737-900 aircraft taxied to Bay C17 after landing at Changi Airport. At about 1405 hours, after all the passengers had disembarked, a wind of about 26 knots during a tropical rain caused the aircraft nose to swing to the right. This resulted in damages of varying degree to the aircraft, the passenger loading bridge that was docked to the aircraft, and a baggage loading equipment.

The Air Accident Investigation Bureau of Singapore classified this occurrence as an incident. The investigation revealed contributing factors related to the way the baggage was loaded, the wheels were chocked, and the early insertion of the nose landing gear steering bypass pin.

AIRCRAFT DETAILS

Aircraft type	: Boeing 737-900
Operator	: Lion Air
Registration	: PK-LHQ
Number and type of engines	: 2 x CFM56-7B26/3
Type of flight	: Scheduled Passenger Flight

1 FACTUAL INFORMATION

All times used in this report are Singapore times. Singapore time is eight hours ahead of UTC (Coordinated Universal Time).

1.1 History of the flight

1.1.1 At about 1342 hours on 26 May 2013, a Boeing 737-900 aircraft taxied to its designated gate at Bay C17 after landing at Changi Airport. The aircraft was scheduled to depart at 1450 hours. There was no aircraft parked on adjacent bays.

1.1.2 The aircraft was serviced by a team from the ground handling agent (GHA) of the operator. The team comprised, among others, a team leader and five flight handlers. The team leader was responsible for supervising the unloading/loading of baggage and cargo by the flight handlers.

1.1.3 Wheel chocks were inserted when the aircraft had come to a complete stop at the bay. The GHA team leader inserted the nose landing gear (NLG) steering bypass pin. The PLB was docked to the front left door (Door 1L) of the aircraft. After the passengers had disembarked, the PLB remained docked to Door 1L.

1.1.4 Two baggage loaders were parked on the right side of the aircraft, one each at the front and rear baggage compartments, for the loading of the baggage. After the arrival baggage had been offloaded, the GHA commenced the uploading of 50 pieces of departure baggage into the rear baggage compartment. The front baggage compartment was empty at that time and remained empty until the incident. Refueling was also being conducted simultaneously. The refueling truck was parked beside the No.2 (i.e. right) engine. The positions of the aircraft, PLB, baggage loaders and refueling truck before the incident are as shown in **Figure 1**.

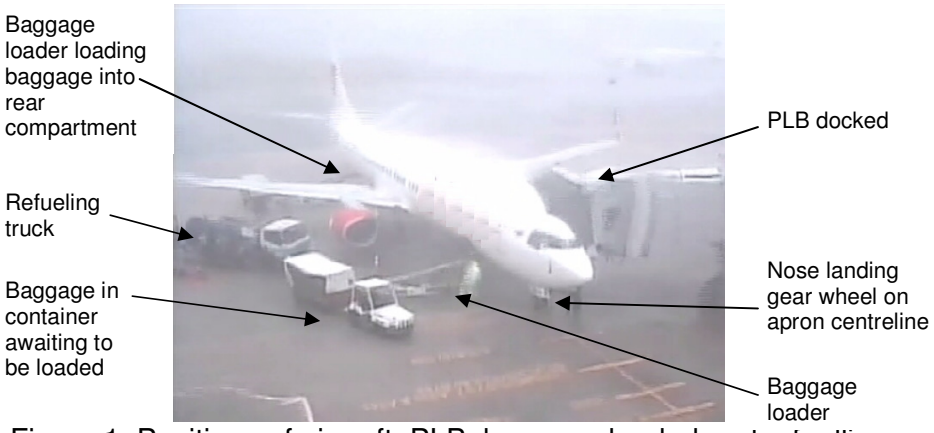

Figure 1: Positions of aircraft, PLB, baggage loaded and refuelling truck

1.1.5 At 1400 hours, it started to rain heavily. The rain was accompanied by winds up to about 26 knots. At about 1405 hours, the wind caused the aircraft nose to swing to the right (i.e. away from the PLB), with the aircraft pivoting about the right main landing gear (MLG). The aircraft nose swung through a distance of about 3.5 m from the apron centerline (see **Figure 2**). The NLG also rotated about 30° to the right about its own axis (see **Figure 3**). At the time of the incident, the parking brakes were not set[1].

Figure 2: Resting position of the aircraft

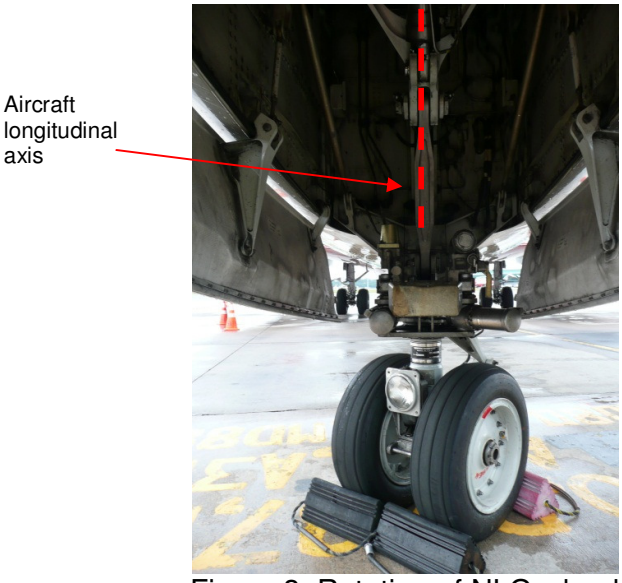

Figure 3: Rotation of NLG wheel
(viewed from nose towards aft)

1.2 Injuries

1.2.1 There was no injury in this incident.

[1] The non-setting of the parking brakes facilitates the cooling of the wheel brakes through ventilation.

1.3 Damage to aircraft

1.3.1 The swinging of the aircraft nose caused Door 1L to hit the PLB canopy. A door hinge was damaged and the door could not be closed. The PLB sustained minor damage.

1.3.2 The aircraft also hit the baggage loader at the front baggage compartment. The baggage loader went under the aircraft fuselage and caused a 90-cm scratch and dent at the bottom of the fuselage. The baggage loader sustained minor damage.

1.4 Meteorological information

1.4.1 At about the time of the incident, the wind speed recorded by a sensor located about 250 m from Bay C17 was 26.4 knots.

1.4.2 The Meteorological Service Singapore (MSS) had issued to air traffic control at 1346 hours a meteorological warning of thunderstorm over the aerodrome. The thunderstorm was expected between 1400 and 1445 hours.

1.4.3 At 1400 hours, the MSS issued a weather forecast, also to air traffic control, indicating that between 1400 and 1445 hours, the visibility in the airport was forecasted to be 3 km and thunderstorm with moderate rain was expected. The wind speed was forecasted to be 10 knots with gusting up to 20 knots.

1.4.4 Routine weather and aerodrome warnings were updated on a website managed by MSS. Subscribers to this website, for example ground handling agents and aircraft operators, can gain access to such weather information, which included wind speed. At the time of the incident, the aerodrome operator, aircraft operator and the GHA did not subscribe to this service. Neither did they make use of other sources to obtain wind information.

1.5 Additional information

1.5.1 Refuelling

1.5.1.1 According to the operator's engineer who monitored the refuelling, at the time of incident, both the wing tanks were full (with 3,915 kg of fuel each) and the centre tank contained about 3,000 kg of fuel.

1.5.2 Baggage loading procedures

1.5.2.1 The aircraft manufacturer recommended loading the front baggage compartment before loading the rear baggage compartment. This was

to achieve a forward centre of gravity (CG) of the aircraft, thus increasing the aircraft's resistance to any tendency to pivot about an MLG as a result of wind. The operator also required that baggage be loaded into the front baggage compartment first. However, there was no evidence that this procedure had been conveyed to the GHA.

1.5.2.2 The loading instruction report which contained the load distribution of the aircraft was prepared by a load control officer of the GHA. The load control officer was responsible for briefing the GHA staff concerned on the loading requirements before the loading commenced. There was no evidence that the load control officer had emphasised the need to load the front baggage compartment first to the GHA staff concerned about. The loading instruction report also did not specify whether the front or the rear baggage compartment should be loaded first.

1.5.3 Wheel chocks

1.5.3.1 Wheel chocks are placed either at the front or back of, or at both the front and back of, the aircraft's wheels to prevent inadvertent aircraft movement.

1.5.3.2 When the aircraft taxied into Bay C17, the GHA placed four chocks against the wheels; one each at the front and back of the NLG, and one at the back of each MLG (see **Figure 4**). It was GHA's default configuration for the wheel chock positions for narrow body aircraft such as the incident aircraft[2], unless otherwise instructed by the operator.

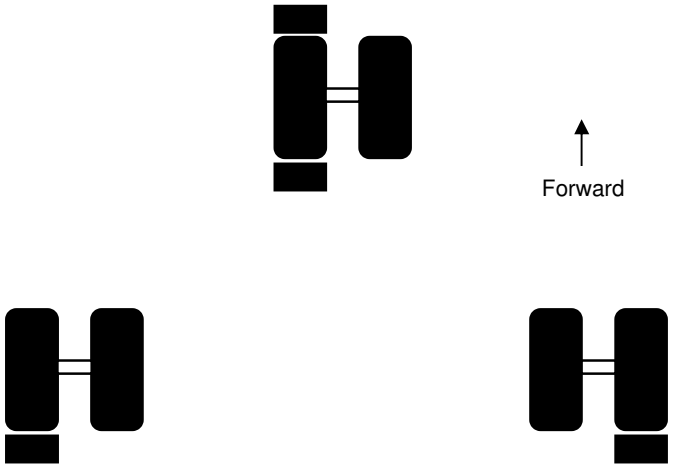

Figure 4: Actual wheel chock positions on incident aircraft

[2] The GHA handled only narrow body aircraft.

1.5.3.3 According to the aircraft manufacturer, the minimum wheel chock configuration comprises one chock each at the forward and aft of one tyre (either inboard or outboard) of each main landing gear (i.e. total of four wheel chocks).

1.5.3.4 According to the station manager of the operator, the operator required six wheel chocks to be inserted (one each at the front and back of each landing gear) instead of four. This requirement was apparently not conveyed to the GHA.

1.5.3.5 Arising from past incidents where aircraft were inadvertently moved during adverse weather, the operator issued a Quality Assurance Notice dated 21 March 2013 to require eight chocks to be inserted for transit aircraft parked in less than 35 knots wind velocity[3] (see **Figure 5**). This requirement was apparently not conveyed to the GHA.

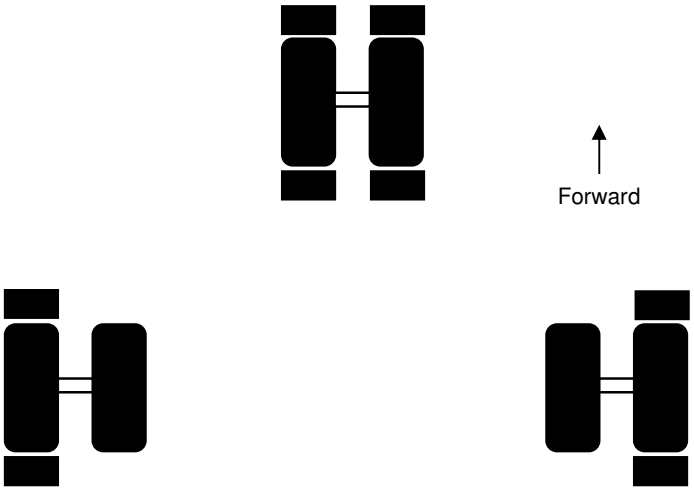

Figure 5: Wheel chock positions as per operator's Quality Assurance Notice

[3] When wind velocity was greater than 35 knots, 12 wheel chocks were to be used.

2 DISCUSSION

2.1 The GHA did not have the procedure from operator stating that the baggage loading sequence. As a result, the rear baggage compartment was loaded first instead of the front.

2.2 Based on the aircraft's weight distribution at the time of the incident, the wind speed limit, beyond which the aircraft could be vulnerable to being moved by wind, is estimated to be between 20 to 25 knots.

2.3 The wind speed recorded by a sensor located about 250 m from Bay C17 was 26.4 knots. The wind speed at Bay C17 was likely to be of about the same magnitude of 26.4 knots.

2.4 Thus, the aircraft was vulnerable to being moved by the wind. The shifting might have been preventable had the baggage been loaded in the front baggage compartment, or had wheel chocks been inserted at the front of the MLGs.

2.5 Had the NLG steering bypass pin not been inserted, the nose wheels would have remained aligned with the aircraft longitudinal axis (i.e. facing forward) and the wheels' resistance to sliding could have contributed towards countering any tendency of the aircraft nose to swing.

2.6 Although the number of wheel chocks (four) used is the same, the wheel chock configuration employed by the GHA for the aircraft involved in this incident was different from configuration recommended by the aircraft manufacturer.

2.7 While the GHA may adopt a default configuration for the wheel chock positions, it should have made its default configuration known to the operator and ascertained if the configuration was acceptable to the operator.

2.8 The aerodrome operator, aircraft operator and GHA did not have a procedure to monitor wind speed.

3 SAFETY ACTION

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the operator and the Ground Handling Agent.

3.1 The operator has informed the GHA of the following:

(a) Eight wheel chocks (configuration as per **Figure 5**) should be inserted for transit aircraft when the wind intensity is below 35 knots.

(b) Baggage should be loaded into the front baggage compartment first.

(c) The nose landing gear steering bypass pin should only be inserted when the tow bar is about to be connected with the aircraft.

3.2 The GHA has informed its staff of the above procedures through emails and notices put up on notice boards.

4 SAFETY RECOMMENDATION

A safety recommendation is for the purpose of preventive action and shall in no case create a presumption of blame or liability.

It is recommended that:

4.1 The aerodrome operator monitor wind speed forecasts and disseminate any relevant wind speed warning to the airline operators or their handling agents. [AAIB Recommendation R-2014-006]

4.2 The GHA review its apron procedures to ensure that wind speed information is monitored and timely action can be taken to stabilise or tie down its aircraft. [AAIB Recommendation R-2014-007]

4.3 The GHA review its default wheel chock configuration taking into consideration the aircraft manufacturer's recommended wheel chock configuration. [AAIB Recommendation R-2014-008]

4.4 The GHA make its default configuration for the wheel chock positions known to its airline customers and ascertain if the configuration is acceptable to them. [AAIB Recommendation R-2014-009]