Aviation Safety Investigation Report 199503463

Boeing Co
B727

18 October 1995

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Aviation Safety Investigation Report

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Occurrence Number: 199503463 **Occurrence Type:** Incident
Location: Sydney, Aerodrome
State: NSW **Inv Category:** 3
Date: Wednesday 18 October 1995
Time: 1507 hours **Time Zone** EST
Highest Injury Level: None

Aircraft Manufacturer: Boeing Co
Aircraft Model: 727
Aircraft Registration: N805EA **Serial Number:** 22436
Type of Operation: Air Transport High Capacity International Positioning Scheduled
Damage to Aircraft: Minor
Departure Point: Auckland New Zealand
Departure Time:
Destination: Sydney NSW

Crew Details:

Role	Class of Licence	Hours on Type	Hours Total
Pilot-In-Command	ATPL	1500.0	12000
Co-Pilot/1st Officer	ATPL	1650.0	16000
Flight Engineer	Commercial	2500.0	7000

Approved for Release: Monday, May 27, 1996

1. FACTUAL INFORMATION

Sequence of events

The crew reported that the flight had been normal and that the subsequent approach, which was flown by the co-pilot, was stable. The touchdown on runway 16R was smooth. The anti-skid and auto-spoiler systems were armed prior to touchdown. However, the ground spoilers did not automatically deploy, but were manually raised by the pilot in command when the aircraft was about 150 metres beyond the touchdown point.

Coincident with the raising of the ground spoilers, the crew became aware of a thumping noise from the rear of the aircraft, and of the right wing beginning to drop. The aircraft deviated about 8 metres to the right of the runway centreline and was brought to a stop at the intersection of runways 16R and 07.

The aerodrome controller activated the crash alarm after observing excessive smoke from the right main landing gear and the shredding of the tyres. The airport RFFS attended the aircraft and confirmed that there was no fire and that the brakes were cold. The only heat present had been generated by the failed tyres. The engines were shut down and the APU was started to maintain the aircraft electrical system. After the pilot in command had confirmed that personnel were available to ensure their safety, the passengers were disembarked via the rear airstair.

On-site investigation

Inspection of the tyres and the tyre markings on the runway indicated that neither right main gear wheel rotated at touchdown. The right tyres produced heavy rubber skid marks from the touchdown point for about 120 metres, until the inboard tyre failed. The outboard tyre then failed about 20 metres further on. The aircraft travelled about 700 metres from the touchdown point. The complete tread section of the right inboard tyre had separated from the casing at some time subsequent to its failure.

Flaying tyre material had detached the landing gear outer door and damaged a trailing edge flap and flap fairing. Prior to touchdown the crew had not been aware of any abnormal technical indications. The wind was from 140 degrees, at 10 to 15 knots, gusting to 20 knots, and the runway was dry.

The aircraft was fitted with auto brakes. However, they were not used for this landing, as the operator's procedure when landing on runways such as 16R at Sydney was to use reverse thrust until the aircraft speed had reduced to below 60 knots. Normal braking would then be used.

Initial inspection of the right landing gear and braking system established that the wheels were able to rotate freely and that the fusible plugs in the wheels remained intact. Both failed tyres appeared to have been in serviceable condition prior to the landing. The inner tyre had accumulated 37 landings, while the outer tyre had accumulated four landings. The brake assemblies appeared to be serviceable.

Engineering examination

Subsequent detailed inspection of the aircraft systems found that with the anti-skid system activated and the right brake applied, the right inboard mainwheel locked. The fault was traced to switch No 480, which was found to be defective, and its mounting twisted. The switch was designed to provide locked wheel protection signaling for the anti-skid system, to ensure full brake release of the inboard pair of wheels at touchdown. The signal is cancelled when wheel speed of 60 mph is sensed and the anti-skid system is then activated.

Locked wheel protection for the outboard wheel pair is provided by the landing gear accessory unit which is switched by the squat switch on the left main gear. This unit could not be faulted on ground test. Complete testing of the anti-skid system in accordance with the maintenance manual and recommendations from the manufacturer failed to detect any reason for lockup of the outboard brake. The failure of switch No 480 is consistent with inadequate lubrication of the control cable mechanism which activates the switch. Lack of lubrication can cause binding which may lead to disruption of the control. Similar problems with this mechanism have been reported by another operator.

Testing of the auto-spoiler system did not detect any defects. The system, when armed, will automatically deploy at touchdown when wheel rotational speed of 60 mph is sensed by a wheel on each landing gear, or after a time interval of 4 seconds after the squat switch on the left gear is sensed in ground mode. Although both wheels on the right landing gear were locked, the auto-spoilers would have deployed 4 seconds after ground mode was sensed, had the pilot not manually selected them.

The aircraft maintenance manual recommended replacement of the brake metering valve when tyre scuffing was evident. Consequently, the right brake metering valve was changed as a precaution. However, apart from this recommendation, the reason for the ouboard tyre failure was not determined.

Flight recorder information

The aircraft was fitted with a Sundstrand Universal Flight Data Recorder. Twelve parameters were recorded, including vertical and horizontal acceleration, pitch and roll attitude, magnetic heading, airspeed and engine pressure ratios.

Analysis of the recorded information confirmed that all parameters relevant to this occurrence were normal. The information indicated that a minor heading correction to the right was made immediately before touchdown.

Additional information

About two weeks after the aircraft had been returned to service, with the same flight crew and the co-pilot again handling the controls, the right outboard tyre failed during landing. The evidence indicated that there had not been wheel rotation at touchdown, and the tyre had skidded for about 120 metres before failure. Engineering inspection found that the landing gear lever UP switch No 781, which controls both inner and outer wheel pairs via the anti-skid system, was intermittently inoperative. The area in which the switch was located had been treated with a water dispersant type spray lubricant. This substance appeared to have adversely affected the operation of the switch.

The switch was changed, and the entire system then tested normally. The aircraft was returned to service and no further incidents have been reported.

2. ANALYSIS

The initial occurrence was caused by the failure of the locked wheel protection circuitry for both the inboard and the outboard wheel pairs. Consequently, pressure applied to the right brakes during touchdown would have locked both right wheels.

The protection circuitry became inoperative when switch No 480 failed and an intermittent fault developed in switch No 781.

With the auto brakes disarmed, the brakes can only be applied by manual pressure on the brake pedal. It is possible that the handling pilot inadvertently applied right brake pressure when making the slight heading change which occurred immediately prior to touchdown.

The complete loss of the tread from the right inboard tyre may indicate that some rotation of the wheel occurred after the tyre failed.

The circumstances in which the right outer wheel was locked at touchdown when the second incident occurred, could not be fully substantiated. However, the section of switch No 781 which controls the locked wheel protection for the outboard wheel pair had malfunctioned.

3. CONCLUSIONS

Findings

1. Switch No 480 failed.

2. Switch No 781 malfunctioned intermittently.

3. There was no indication of a problem prior to the touchdown.

4. Immediately before touchdown there was a slight heading correction to the right.

5. The touchdown was smooth.

6. Neither right main landing gear wheel rotated at touchdown.

Significant factors

1. The main wheels' anti-lock systems protection did not function.

2. The right brakes may have been inadvertently applied at touchdown.