FINAL REPORT

RUNWAY INCURSION BY A VEHICLE IN CHANGI AIRPORT 22 JUNE 2016

AIB/AAI/CAS.121

Transport Safety Investigation Bureau
Ministry of Transport
Singapore

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The Transport Safety Investigation Bureau

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

For aviation related investigations, the TSIB 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 TSIB 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 TSIB reports should be used to assign fault or blame or determine liability, since neither the safety investigation nor the reporting process has been undertaken for that purpose.

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SYNOPSIS

On 22 June 2016, at about 0940LT, a Changi Tower runway controller noticed that there was an airfield maintenance vehicle, callsign Rover 32, at Taxiway W1 moving towards the edge of Runway 20R. The vehicle then travelled past the runway holding position at Taxiway W1 without clearance. The Airfield Ground Lighting Control and Monitoring System's (AGLCMS) microwave barrier detector (MBD) at that location was triggered and the Runway 1 Controller immediately instructed Rover 32 to vacate the runway.

An arriving B767 was approaching Runway 20R. The Runway 1 Controller cleared the aircraft to land after the vehicle had moved clear of the runway. The aircraft landed safely on Runway 20R.

There was no damage to the aircraft or injury to any person in this occurrence.

The occurrence was classified as an incident.

1 FACTUAL INFORMATION

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

1.1 Sequence of events

1.1.1 On 22 June 2016, an employee of an airport maintenance service provider (AMSP) was tasked to carry out taxiway inspection on pavement defects and paint markings of taxiway at Changi Airport. He drove the vehicle with the callsign Rover 32 for carrying out this task. (Hereinafter Rover 32 refers to the AMSP employee.) Rover 32 was the only person in the vehicle.

1.1.2 At the start of his duties at 0830 hours, Rover 32 attended a daily briefing at the AMSP premises conducted by the AMSP Facilities Manager. The briefing included a reminder that only a Category 1 Airfield Driving Permit (CAT 1 ADP) holder[1] is allowed to operate the radio-telephony set and communicate with Changi Tower. Rover 32 held a CAT 1 ADP.

1.1.3 At 0932 hours, Rover 32 called Changi Tower and requested for permission to enter all taxiways for pavement inspection. Changi Tower allowed Rover 32 to proceed to all taxiways. Rover 32 proceeded towards Taxiway WP via Taxiway V1 and started carrying out inspection around the WP/W1 taxiway junction[2].

1.1.4 According to Rover 32, he unknowingly crossed the runway-holding position at Taxiway W1 as he was focussing on looking out for defects along Taxiway V1 and W1 and thus missed the instruction markings painted on the taxiway pavement, the stop bar lights and the runway guard lights. At its furthest Rover 32 was about 60m beyond the runway-holding position at Taxiway W1 but was still about 30m from the edge of Runway 20R.

1.1.5 The Changi Tower Runway 1 Controller spotted Rover 32 at Taxiway W1. At the same time, the vehicle's infringement of the microwave barrier detector (MBD) of the Airfield Ground Lighting Control and Monitoring System (AGLCMS) at Taxiway W1 triggered an alarm to warn the Changi Tower that there was an intrusion into the protected area of a surface designated for the landing of aircraft. The Runway 1 Controller then instructed Rover 32 to vacate the runway immediately on the ground frequency 121.9MHz. The Tower Coordinator also called Rover 32 on the ground frequency 121.9MHz and reiterated the instructions for the vehicle to vacate the runway. Rover 32 acknowledged the instructions and moved clear of the active runway.

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[1] Only CAT 1 ADP holder is allowed to drive in the manoeuvring area of the airport.

[2] Rover 32 was aware of a report of fading taxiway markings in the vicinity of the WP/W1 taxiway junction.

1.1.6 At this moment, a B767 was approaching Runway 20R. The Runway 1 Controller cleared the B767 to land on Runway 20R after Rover 32 had moved cleared of the runway. The B767 landed safely on Runway 20R[3].

1.2 Personnel Information

1.2.1 Rover 32 was a male driver aged 66. His particulars are as follows:

Working Hours	0830 – 1730 hours
Last rest day	Sunday, 19 June 2016
Airfield Driving Licence Type	Category 1
Date of Issuance	7 November 2014
Validity Period	8 November 2014 to 8 November 2016
Experience as CAT 1 ADP holder	13.5 years

[3] The vehicle was about 30m from the edge of Runway 20R. The threshold of Runway 20R was displaced by 740m from the northern end of the runway, which meant that an arriving aircraft on instrument approach would be about 50-60 m above the vehicle.

1.3 Meteorological information

1.3.1 At the time of the occurrence, the weather was clear and the ground surface condition was dry.

1.4 Recorded data

1.4.1 The air traffic control audio transcripts and the AGLCMS MBD recordings were obtained from the Air Traffic Service provider and from the aerodrome operator.

1.4.2 Close-circuit TV recordings of the area in the vicinity of Taxiway W1 and V1 were obtained from the aerodrome operator. They were useful for verifying the position of Rover 32.

1.5 Medical and pathological information

1.5.1 Rover 32 underwent a medical examination following the occurrence. There was no evidence of any relevant medical/toxicological factors that could affect the driver's performance.

2 DISCUSSION

2.1 The cause of the triggering of the AGLCMS MBD was Rover 32's crossing unknowingly past the MBD at Taxiway W1 which he attributed to his focussing on looking out for defects along Taxiway V1 and W1 and thus missing the instruction markings painted on the taxiway pavement, the stop bar lights and the runway guard lights.

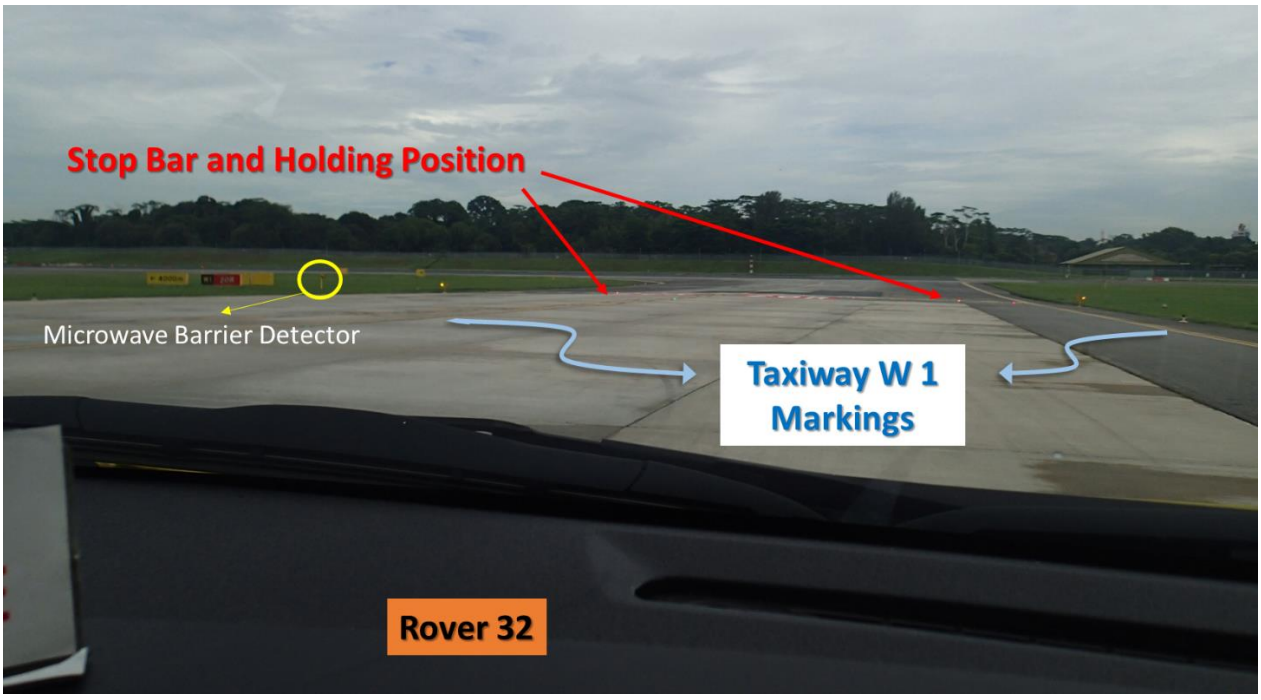
2.2 The investigation team looked into the following aspects:

(a) Workload
(b) Use of technology in runway incursion warning system

2.3 Workload

2.3.1 As a holder of a CAT 1 ADP, Rover 32 was allowed to drive in the manoeuvring area after the clearance was given by ATC. While driving in the manoeuvring area, Rover 32 was required to look out for aircraft movements, communicate with Control Tower and carry out inspection of the taxiway for pavement defects, deteriorating pavement markings and plan for rectification works.

2.3.2 The picture below gives an idea of Rover 32's scope of work (driving, looking out for aircraft, communicating with Control Tower, and carrying out inspection) at the area of Taxiway WP/W1 junction.



2.3.3 It can be quite challenging for a single person to perform the tasks of driving, looking out for aircraft, communicating with Control Tower, and carrying out inspection all at the same time. All these tasks would compete for the same attentional resource of this one person and such a competition could affect a person's situational awareness. Thus, as a result of his focusing on his inspection work, Rover 32 unknowingly strayed beyond the runway-holding position at Taxiway W1.

2.3.4 It would be desirable to have another person in the vehicle to share Rover 32's workload.

2.4 Use of technology in runway incursion warning system

2.4.1 Changi Control Tower has a runway incursion warning system (AGLCMS MBD) installed by the aerodrome operator. The alarm from the AGLCMS MBD confirmed the Runway 1 Controller's suspicion that a runway incursion was imminent and prompted the need to respond to a threat to the arriving aircraft. There is also a graphic display on the panel to indicate the position of Rover 32. This use of technology has provided proactive detection of Rover 32 and warned the Runway 1 Controller of the possibility of a runway incursion.

3 SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the airport maintenance service provider and aerodrome operator.

3.1 Airport maintenance service provider

3.1.1 The AMSP has since 24 June 2016 been deploying two employees for inspections of pavement conditions. One of them will be a CAT 1 ADP holder whose tasks will be to drive in the manoeuvring area of the airport and communicate with Changi Tower. The other person will inspect the pavement conditions, look out for aircraft movement, and help maintain situational awareness. The work description, procedures, roles and responsibilities for Rover 32 and his assistance have also been revised accordingly in the AMSP document *Method of Statement*.

3.1.2 In addition, the AMSP has shared the lessons learnt from this occurrence with the operational staff on 24 June 2016.

3.2 Aerodrome operator

3.2.1 The aerodrome operator has shared this occurrence with holders of CAT 1 ADP. The lessons learnt were presented as a case study as part of the aerodrome's runway incursion prevention programme.

4 SAFETY RECOMMENDATION

4.1 In view of the safety actions taken, no safety recommendation is proposed.