

FINAL REPORT

**AIRBUS A350-900, REGISTRATION 9V-SMS
DOOR DAMAGE BY CATERING TRUCK**

28 JANUARY 2019

AIB/AI/CAS.176

**Transport Safety Investigation Bureau
Ministry of Transport
Singapore**

9 January 2020

The Transport Safety Investigation Bureau

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SYNOPSIS

On 28 January 2019, while unloading food carts from the aircraft, a catering truck damaged the aft-most door on the right side of the aircraft, the door hinge and the door frame.

The Transport Safety Investigation Bureau classified this occurrence as an incident.

AIRCRAFT DETAILS

| | | |
|-----------------------------|---|--|
| Aircraft type | : | Airbus A350-900 |
| Operator | : | Singapore Airlines |
| Aircraft registration | : | 9V-SMS |
| Numbers and type of engines | : | 2 x Rolls Royce Trent XWB |
| Date and time of incident | : | 28 January 2019, 0815 hours Singapore time |
| Location of occurrence | : | Singapore Changi Airport |

FACTUAL INFORMATION

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

1.1 History of the flight

- 1.1.1 In the morning of 28 January 2019, an A350-900 aircraft parked at Singapore Changi Airport was scheduled for departure at 0920 hours. A catering truck came to dock at the aircraft's Door 4R (i.e. the aft-most door on the right side of the aircraft) to offload used food carts and replenish new food carts. The cabin platform of the truck was raised to almost the level of the aircraft floor deck to facilitate food cart operation¹ (see **Figure 1**).

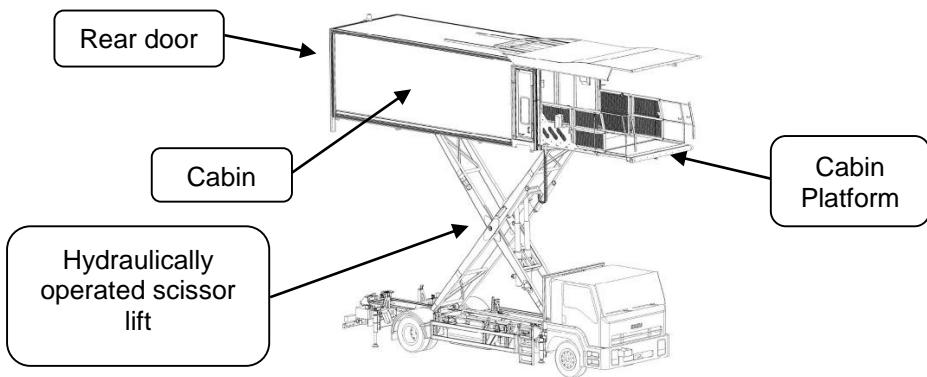


Figure 1: Schematic of the catering truck

- 1.1.2 At 0815 hours, the truck operator noticed that the cabin platform had lowered by itself during the food cart operation and was no more level with the aircraft floor deck. He used the up-down toggle switch at the front cabin control panel to try to level up the platform but found that the switch was not working. He then went to the rear of the cabin to use the up-down toggle switch of the rear cabin control panel to level up the platform.
- 1.1.3 From the location of the rear cabin control panel, the truck operator could not see the platform². He asked a colleague in his catering servicing team to stand at the front end of the platform to monitor the platform rising to Door 4R as he made the platform height adjustment.
- 1.1.4 As part of the loading operation, a safety shoe (see **Figure 2**) was placed on the platform underneath the aircraft door (see **Figure 3**). This safety shoe system prevents damage to the aircraft door by adjusting the height of the catering truck platform downwards if the aircraft door lowers towards the

¹ More on platform raising in paragraph 1.4.1

² The rear cabin control panel was meant to be used for cart loading operation via the rear door of the catering truck when the truck is parked with the rear docked at the loading bay of the in-flight catering centre (more on this in paragraph 1.4).

platform during loading operations. A compressing of the safety shoe by the aircraft door would trigger a lowering of the platform.



Figure 2: Safety shoe



Figure 3: Illustration of the positioning of safety shoe (highlighted in yellow)

- 1.1.5 According to the truck driver, when his colleague in front signalled to him to stop raising the platform because of an impending door contact with the safety shoe, he released the toggle switch to stop the platform from rising. However, the platform continued to rise. He then activated the emergency stop switch and the platform stopped rising. By then the platform had already made contact with Door 4R and lifted it upwards (see **Figure 4**).

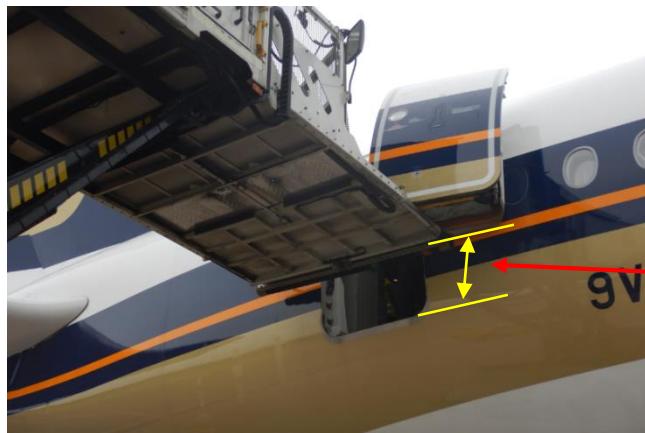


Figure 4: Vertical displacement of Door 4R

1.2 Personnel information

1.2.1 Truck operator details

| | |
|-------------------------------------|-------------------------------|
| Age | 57 |
| Licence | Airport Driving Permit holder |
| Catering truck operating experience | 17 years |

1.3 Damage to aircraft

- 1.3.1 The truck cabin platform lifted Door 4R upwards causing the door hinge to twist (see **Figure 5**). The adjoining door frame was also damaged.



Figure 5: Damage to the door hinge

- 1.3.2 The safety shoe was found sandwiched between Door 4R and the platform (see **Figure 6**).



Figure 6: Sandwiched safety shoe

1.4 Catering servicing

1.4.1 Loading and unloading of food carts

- 1.4.1.1 For loading and unloading of food carts at the in-flight catering centre, catering trucks would be parked with their rear facing the loading bay and the cabin platform would be raised to be level with the loading bay floor. The height of the platform was adjusted via the up-down toggle switch at the truck's rear cabin control panel. With the truck's rear door opened, the truck operator could observe the platform rising and make height adjustments from the rear cabin control panel.
- 1.4.1.2 The height of the loading bay was 1.8m. Using the up-down toggle switch at the rear cabin control panel, it was possible for the truck's cabin platform to be raised to a height beyond 1.8m.
- 1.4.1.3 For loading and unloading of food carts at the aircraft, the catering truck would be positioned perpendicular to the aircraft with the truck's front facing the aircraft. The height of the cabin platform was adjusted via the up-down toggle switch at the truck's front cabin control panel. The truck operator could observe the platform rising and make height adjustments from the front cabin control panel.
- 1.4.1.4 The truck operator would first raise the platform to a height slightly below the level of the aircraft floor deck where he was able to open and swing out the aircraft door. The opened aircraft door would be just above the platform. At this point, the safety shoe (see paragraph 1.4.3) would be placed under the aircraft door between the platform and aircraft door. Since the platform was not perfectly levelled with the aircraft floor deck, a small ramp was placed to facilitate the movement of the food carts in and out of the aircraft.

1.4.1.3 After the loading and unloading of the food carts were over, the safety shoe would be removed, the aircraft door would be closed and the truck cabin platform would be lowered.

1.4.2 Cabin control panels

1.4.2.1 The front and rear cabin control panels were powered by the truck's electrical power and were similar in design, consisting of a master switch, an up-down toggle switch (to raise/lower the cabin platform) and an emergency stop switch (see **Figure 7**).

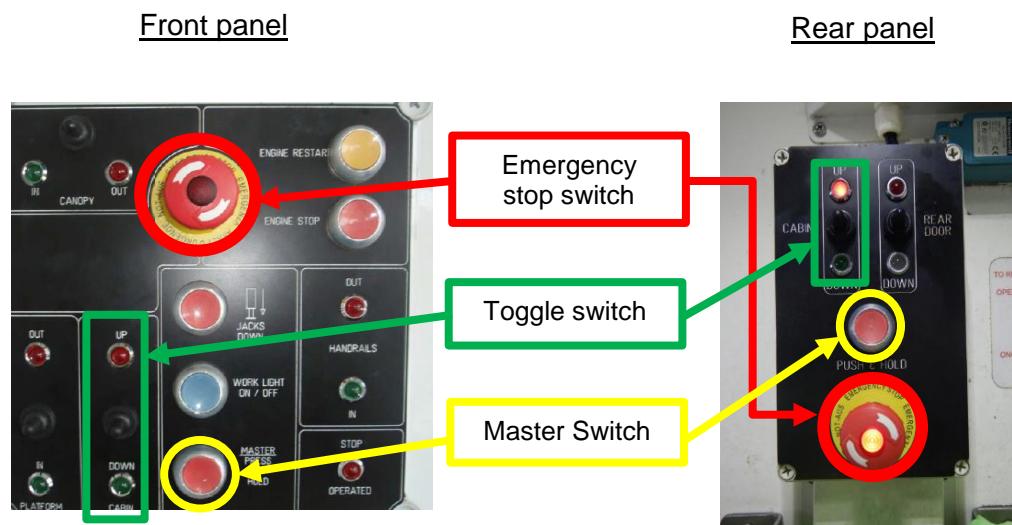


Figure 7: Front and rear cabin control panels

1.4.2.2 To adjust the height of the truck cabin platform, the truck operator would depress the master switch and then input an up or down command using the toggle switch. Releasing the master switch would stop the movement of the truck cabin platform. Alternatively, activating the emergency stop switch would cut off the truck's electrical power to the control panel and this would also stop any cabin platform movement.

1.4.3 Safety shoe

1.4.3.1 The truck was fitted with a safety shoe system to prevent damage to the aircraft door. When in use³, the safety shoe would be placed on the cabin platform underneath an open aircraft door. If the aircraft lowered itself (e.g. due to increased weight after refuelling or cargo loading) to the extent of causing the door to come into contact with and compress the safety shoe, this would trigger a command to the hydraulic pump of the truck cabin scissor lift to automatically lower the cabin platform until the safety shoe was no longer compressed.

³ The safety shoe is stowed in a holder on the cabin platform when not in use.

- 1.4.3.2 In this occurrence, the safety shoe was found sandwiched between Door 4R and the platform. The safety shoe had been compressed during the platform height adjustment by the truck operator, yet this apparently did not result in the triggering of the safety feature of automatic lowering of the cabin platform.

1.5 Tests and research

1.5.1 Cabin control panel abnormal functioning

- 1.5.1.1 After the occurrence, the catering company (i.e. the employer of the truck operator) engaged an independent vehicle surveyor to examine the incident truck. The front and rear cabin control panels were found to be working⁴ and there were no other abnormalities with these panels. The abnormalities as reported by the truck operator could not be replicated.
- 1.5.1.2 Separately, the investigation team also examined the front and rear cabin control panels of the incident truck and found no abnormalities with their operations.

1.5.2 Uncommanded lowering of catering truck cabin platform

- 1.5.2.1 The catering truck cabin was equipped with a CCTV. CCTV footage showed that, at the time of the occurrence, the cabin platform was lowering relative to the aircraft without any down command from the cabin control panel.
- 1.5.2.2 The investigation team conducted a test consisting of loading the cabin of the incident truck with weight blocks and found that the platform was lowering by about 6cm every 20 minutes.
- 1.5.2.3 According to the truck manufacturer, the optimal engine idle rotational speed was about 900 revolutions per minute (RPM)⁵. Upon examining the catering company's fleet of catering trucks, the truck manufacturer found that the incident truck had a very high engine idle speed of 1,200RPM, while the other trucks were at 900RPM. However, there was no evidence that the catering company had modified the engine idle rotational speed from 900RPM to 1,200RPM⁶.
- 1.5.2.4 When the incident truck's engine idle speed was reset to 900RPM, the lowering rate of the platform decreased to about 1cm every 45 minutes.

⁴ In particular, the platform stopped moving after the up-down toggle switch at the rear cabin control panel was released.

⁵ Apparently the catering company was not aware of this 900RPM idle speed setting and had never been concerned about this setting as the regular truck/engine servicing had been left to the local agent of the truck manufacturer.

⁶ There were two knob switches that can be used to adjust engine RPM. These switches were usually covered up and not easily accessible for adjustment, but the knobs could have loosened by itself over time or been adjusted during maintenance, resulting in the engine RPM change.

ANALYSIS

2.1 The investigation team looked into the following:

- (a) Uncommanded lowering of the truck cabin platform
- (b) Safety mechanism of the safety shoe

2.2 **Uncommanded lowering of the truck cabin platform**

- 2.2.1 The uncommanded lowering of the truck cabin platform was probably a result of the higher-than-normal engine idle speed setting of 1,200RPM. The excessive engine RPM could cause the hydraulic pump of the truck cabin scissor lift, which ran off the engine RPM, to generate excessive hydraulic pressure that led to the hydraulic scissor lift moving in a way that lowered the cabin platform slowly over time.
- 2.2.2 Apparently the catering company using this truck manufacturer's catering trucks were not aware of the 900RPM idle speed setting. This piece of information was not available in the truck manufacturer's maintenance manual at the time of the occurrence. The existing maintenance regime also did not require the monitoring of engine RPM.

2.3 **Safety mechanism of the safety shoe**

- 2.3.1 The safety shoe was supposed to be a feature that would prevent damage to the aircraft door. When compressed, it was supposed to trigger a command to the hydraulic pump of the truck cabin scissor lift to lower the cabin platform until the safety shoe was no longer compressed. In this occurrence, the safety shoe did not trigger any platform-lowering command when compressed.
- 2.3.2 According to the truck manufacturer, the design of the safety shoe system was such that any command from the cabin control panels (front or rear) would override the safety shoe's safety mechanism of automatically generating a platform lowering command. Apparently this was not made known to the truck operators who might have been falsely believing that the safety shoe's safety mechanism would equally work when the safety shoe was compressed by a rising cabin platform instead of by a lowering aircraft door.

CONCLUSIONS

From the evidence available, the following findings are made. These findings should not be read as apportioning blame or liability to any particular organisation or individual.

- 3.1 The catering truck had a higher-than-normal engine idle RPM. This resulted in excessive hydraulic pressure that led to the hydraulic scissor lift moving in a way that lowered the cabin platform.
- 3.2 The optimal engine idle speed of 900RPM desired by the truck manufacturer was not made known to the truck operator.
- 3.3 The rear control panel was not meant for raising the cabin platform during catering operation to aircraft.
- 3.4 In the existing design of the truck cabin safety system, any command from the cabin control panels (front or rear) would override the safety shoe's safety mechanism to automatically cause a lowering of the cabin platform.

SAFETY ACTIONS

During the course of the investigation and through discussions with the investigation team, the following safety actions were initiated by the truck manufacturer and the catering company.

4.1

The truck manufacturer has taken the following actions:

- (a) Requiring a weekly check to verify that the engine idle speed is 900RPM.
- (b) Requiring catering companies using its trucks to modify the safety shoe such that the activation of the safety shoe's safety mechanism will cut off the main engine and stop all functions, except the safety shoe mechanism of automatically generating a platform lowering command via the hydraulic pump.
- (c) Requiring that the rear cabin control panel can only be used to raise the cabin up to a height of 1.8m and that only the front cabin control panel can be used to raise the cabin to above 1.8m (the typical height of a loading bay).
- (d) Setting an acceptable level of cabin lowering (the limit was set at 1cm of lowering over 45 minutes).

The truck manufacturer has also updated the truck operating manual to reflect all the above requirements.

4.2

The catering company has taken the following actions:

- (a) Modification of all its catering trucks such that the rear cabin control panel can only be used to raise the cabin up to a height of 1.8m and that only the front cabin control panel can be used to raise the cabin to above 1.8m.
- (b) Modification of the safety shoe designed as required by the truck manufacturer.
- (c) Updating of its cabin services procedure manual to require truck operators to verify, before each truck usage, that the engine idle speed is 900RPM usage. This is more than the weekly check required by the truck manufacturer.

5 SAFETY RECOMMENDATION

- 5.1 In view of the safety actions taken by the truck manufacturer and the catering company, no safety recommendation is proposed.