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INVESTIGATION REPORT

Accident to the Boeing B777-333 ER registered C-FNNQ

on 24 July 2019
at Paris-Charles de Gaulle (Val-d'Oise)

Time	Around 11:45[1]
Operator	Air Canada
Type of flight	Commercial air transport of passengers
Persons on board	Captain (PF), first officer (PM), 12 cabin crew, 450 passengers
Consequences and damage	Ground agent injured
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in February 2021. As accurate as the translation may be, the original text in French is the work of reference.	

[1] Except where otherwise indicated, the times in this report are in UTC time.

Ground agent hit by a tow bar during a push-back operation

1 - HISTORY OF THE FLIGHT

The crew undertook a scheduled flight departing from Paris - Charles de Gaulle (France) bound for Toronto (Canada).

The scheduled block time was 11:56 and push-back started at 11:44. The push-back operation from stand A38 was carried out by personnel from two separate handling companies: the headset operator works for Air France Industries and the push-back tractor was driven by two agents employed by Airlines Ground Service (AGS). The driver was a trainee completing his training and accompanied by his instructor.

At the end of the push-back, when the aeroplane was nearly on the centreline of the taxiway, the tractor reached its maximum turn angle. The instructor on board the tractor asked the driver to apply the tractor parking brake, alighted the tractor then initiated the operations necessary to disconnect the push-back bar. He actuated the hydraulic extension system of the retractable wheel gear of the tow bar then asked the driver of the tractor to raise the drawbar pin ensuring connection of the bar with the tractor. During this operation, the aeroplane, on which the parking brake was not applied, moved forwards and one of the bar wheels rolled over the right foot of the instructor who became trapped. Under stress, the bar suddenly unhooked from the tractor and hit the instructor's right leg.

One of the bar's shear pins was found ruptured.

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2 - ADDITIONAL INFORMATION

2.1 Push-back procedures

AGS procedures

The following procedures are taken from the operational procedures manual in force at the time of the accident.

The manual specifies that, before a push-back operation, a briefing must take place between the different ground agents (headset operator and tractor driver) to allocate the tasks and pass on any specific details associated with this operation.

The headset operator is the person who liaises with the crew and who is designated in charge of the push-back operation and of communication[(2)] with the tractor driver.

[(2)] This communication is made using hand signals.

The tractor driver is responsible for the aeroplane's path, compliance of the push-back speed, as well as the turn angles. The maximum turn values are indicated by a visual mark that must not be passed.

If the maximum turn values are exceeded or in the event of any other technical issue, the person in charge of the push-back operation:

- ❒ Interrupts the operation and asks the tractor driver to apply the parking brake.
- ❒ Reports the incident to the crew.

The maintenance team is then called upon to perform an inspection that is required before any further manoeuvre and that is carried out according to the directives provided by the maintenance team and the crew.

In the event of shearing of the tow bar shear pins, the person in charge of the push-back operation:

- ❒ Immediately informs the crew of the shearing of the tow bar safety shear pins.
- ❒ Interrupts the operation and asks the tractor driver to apply the parking brake.
- ❒ Asks the crew to apply the aeroplane parking brake.
- ❒ Blocks the nose gear and informs the captain of this.
- ❒ Retrieves the pieces of the tow bar shear pin.
- ❒ Takes stock of the position of the aeroplane.

Depending on the situation and position of the aeroplane, the captain, in agreement with the person in charge of the push-back operation, can decide either to unhook the tractor and the tow bar to release the aeroplane to enable it to leave unassisted, or to continue with the push-back operation if the safety conditions are met once the shear pin has been replaced.

In addition, AGS states that the use of blocks is not mandatory. This item of the procedure is only applied when the operator's own procedures require this. When this is required, the headset operator, if an employee of AGS, installs the block. If the headset operator is employed by another company, the tractor driver installs the block.

Air France Industries' procedures

The Air France Industries' procedures for push-back operations are similar to those of AGS; they also ask for a briefing to be held between the headset operator and the tractor driver before initiation of the operation.

Air Canada procedures

These are also similar to those of AGS and Air France Industries. Air Canada does not require the use of blocks.

2.2 Statements

Tractor driver's instructor's statement

The instructor had been employed by AGS since 2001. He is the only driver instructor and started the second and final week of the driver's practical training which involved asking him to perform push-backs on the most difficult parking areas, including A38 due to its proximity to a grass strip.

On the day of the accident, this was the eighth and last push-back of the day. He stated that he and the driver had arrived approximately 20 minutes before the scheduled block time. The instructor showed the trainee the type of tractor and the type of tow bar to be used.

At the start of the push-back, the driver made a turn that was too wide and had some difficulties following the ground markings. At the end of the push-back, he managed to align the main landing gear on either side of the taxiway centreline. However, the nose gear was still approximately 80 cm from the centreline and the driver performed a final manoeuvre to align the nose gear. During this manoeuvre, the turn angle between the bar and the tractor reached the maximum turn limit and a shear pin ruptured.

The instructor then alerted the headset operator using a hand signal and indicated for him to look towards the shear pin to notify him. Convinced that the headset operator had understood, he thought that the latter had therefore informed the crew and asked them to apply the aeroplane's parking brake. He then told the trainee to apply the tractor parking brake then alighted the tractor. He specified that the nose gear of the Boeing 777 is equipped with a light signalling application of the parking brake. He added that he had not checked whether this light was on before initiating the operations to disconnect the tow bar from the tractor. He firstly lowered the retractable wheel gear of the tow bar then asked the driver to raise the drawbar pin to disconnect the tow bar from the tractor. After this action, the aeroplane began to move forwards and to exert a force on the tow bar. The wheel gear then trapped his right leg and he fell over. The tow bar then suddenly disengaged and hit his right leg.

The instructor explained that blocks are very rarely used. He added that he had not felt particularly stressed on the day of the accident as the aeroplane was on time. He had not felt particularly tired.

Tractor driver's statement

Having worked as a ramp agent at AGS for a year and a half, he was completing his second week of training to become a tractor driver. This was the first time he had encountered a situation involving rupture of the tow bar shear pin. He stated that for the push-back operation, he had been at the wheel of the tractor and accompanied by his instructor. A third person, in direct communication by headset with the aeroplane crew was standing near the nose gear.

He specified that no briefing had taken place between them and the headset operator prior to the push-back operation. At the end of the push-back, now in the position in which the tow bar should be removed, the instructor alighted the tractor. The driver applied the tractor parking brake. He could not remember if he had made the signal to ask the headset operator to ask the crew to apply the aeroplane parking brake. He added nevertheless that he had systematically done this on other occasions. He remained in the driver's seat of the tractor throughout the operation. At the request of his instructor, he raised the drawbar pin to release the tow bar. He saw the aeroplane move forwards and the tow bar subjected to force then hit the leg of the instructor.

He was convinced that the headset operator had understood the situation and asked the crew on board the aeroplane to apply the parking brake. He added that the use of a block in addition is not systematic and that, to his knowledge, only one operator makes this mandatory in its procedures.

Headset operator's statement

On the day of the accident, the headset operator arrived at the parking area and positioned himself without conducting a briefing with the driver of the tractor and his instructor.

From the start of the push-back, he noticed that the driver had turned too widely. He stated that this had been rectified towards the end of the operation. During the final manoeuvre, he saw that the tractor was at maximum turn angle. He did not identify the rupture of the nose pin but observed that neither the tow bar nor the tractor were aligned. He did not see the driver or the instructor make a hand signal to indicate the stop and request for application of the aeroplane parking brake. He saw the instructor alight the tractor that was still moving and approach the tow bar and thought that he was going to disconnect the bar to enable the tractor to make a manoeuvre to improve its alignment. He then saw the aeroplane move forwards and the tractor move backwards. According to him, it was at this time that the shear pin ruptured and he immediately asked the crew to apply the parking brake.

Crew statement

The crew explained that, during the push-back manoeuvre, the tractor was positioned perpendicularly to the aeroplane's centreline. They added that they had heard a noise that they identified to be a rupture of the tow bar shear pin.

The crew then saw the driver and the instructor have a brief discussion and the instructor alight the tractor. With the tractor no longer in sight, the aeroplane moved forward and the crew stated that they immediately applied the parking brake. As they did so, they received the request to apply the parking brake from the headset operator.

The crew asked if anyone was injured then called the emergency services via the ground services. The situation lasted around 45 minutes. After checking the condition of the aeroplane and confirming the absence of damage, the crew took off.

3 - LESSONS AND CONCLUSION

3.1 Scenario

The statements collected differ in such a way that the investigation was unable to determine the exact sequence of the accident[3], in particular:

- the exact time of the shear pin rupture;
- whether signals were exchanged between the headset operator and the agents on board the tractor.

The fact is that the driver's instructor alighted and started to remove the tow bar without the aeroplane parking brake being applied and without blocks in position. During disconnection of the bar, a forward movement of the aeroplane led to the immobilisation of the agent, his foot trapped under a tow bar wheel. This agent was then struck by the tow bar after it was released.

[3] The analysis of video recordings of the parking area did not make it possible to see the last moments of the occurrence.

3.2 Contributing factors

The following factors may have contributed to the accident:

- A misunderstanding between the tractor driving crew and the headset operator. The lack of a briefing may have resulted in this misunderstanding that was also between the personnel of two separate companies. The headset operator is expected to initiate procedures in the event of an anomaly during the push-back operation. As this agent was unaware of any anomaly, the immediate application of these procedures, including the request to apply the aeroplane parking brake, may have been compromised.
- The lack of implementation of a block on the nose gear. The investigation showed that the positioning of a block depends on the air operator's procedures and is not systematic.
- The headset operator's late action in asking the crew to apply the aeroplane parking brake as soon as he saw the driver's instructor initiate removal of the tow bar, despite this surprising him and him not fully understanding the reason for this action at this time.
- The failure of the driver's instructor to check the signal light on the landing gear equipping this type of aeroplane before initiating the tow bar removal operation.

3.3 Lessons

The risks inherent to ground handling activities were the topic of a symposium organised by the DGAC in December 2015[4].

The French National Research and Safety Institute (INRS) published a brochure[5] aimed at companies working at airports, focusing on the prevention of risks associated with coactivity around aircraft on the ground.

[4] https://www.ecologie.gouv.fr/symposium-securite#e5

[5] http://www.inrs.fr/media.html?refINRS=ED%206180

Lastly, the International Air Transport Association (IATA) also published documents focusing on ground handling operations: the "*Airport Handling Manual*" (AHM) and the "*IATA Ground Operations Manual*" (IGOM). The AHM defines the standards applicable to ground handling operations by IATA member airlines and their ground handlers. Its supplement, the IGOM, describes the operational procedures aimed at ensuring the uniformity, safety and efficacy of these activities.