



Havarikommissionen

Accident Investigation Board Denmark

Bulletin 2024-30



Serious incident to 9H-QEN (Boeing 738-8AS) in Copenhagen (EKCH) on 3-1-2024

ISSUED MAY 2024

INTRODUCTION

This bulletin reflects the opinion of the Danish Accident Investigation Board regarding the circumstances of the occurrence and its causes and consequences.

In accordance with the provisions of EU Regulation 996/2010, the Danish Air Navigation Act and pursuant to Annex 13 of the International Civil Aviation Convention, the safety investigation is of an exclusively technical and operational nature, and its objective is not the assignment of blame or liability.

The safety investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents and serious incidents.

Consequently, any use of this bulletin for purposes other than preventing future accidents and serious incidents may lead to erroneous or misleading interpretations.

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GENERAL

State file number:	2024-30
UTC date:	3-1-2024
UTC time:	22:25
Occurrence class:	Serious incident
Location:	Copenhagen (EKCH)
Injury level:	None
Aircraft registration:	9H-QEN
Aircraft make/model:	Boeing 737-8AS
Current flight rules:	Instrument Flight Rules (IFR)
Operation type:	Scheduled
Flight phase:	Taxi
Aircraft category:	Fixed wing
Last departure point:	EKCH
Planned destination:	Cologne Bonn (EDDK)
Aircraft damage:	None
Engine make/model:	2 x CFMI CFM56-7B26

SYNOPSIS**Notification**

All time references in this bulletin are Coordinated Universal Time (UTC).

The Area Control Centre in Copenhagen (EKCH) notified the Aviation Unit of the Danish Accident Investigation Board (AIB) of the serious incident on 4-1-2024 at 09:33 hours (hrs).

The AIB notified the Danish Civil Aviation and Railway Authority (DCARA), the Maltese Bureau of Air Accident Investigation (BAAI) the US National Transportation Safety Board (NTSB), the European Aviation Safety Agency (EASA), the Directorate-General for Mobility and Transport (DG MOVE), and the International Civil Aviation Organisation (ICAO) on 12-1-2024.

Summary

Diverging perceptions of the traffic situation on taxiway B led to marginal clearance or a possible collision between the aircraft right wing and a snow removal vehicle.

This serious incident occurred in dark night and under meteorological conditions, which did not require Air Traffic Control (ATC) separation between aircraft and vehicles on the manoeuvring area.

FACTUAL INFORMATION

History of flight

The serious incident between 9H-QEN and a snow removal vehicle occurred on taxiway B in Copenhagen (EKCH).

9H-QEN was on a scheduled IFR passenger flight from EKCH to Cologne Bonn (EDDK).

When holding at the holding point for runway 12 on taxiway B, the tower controller (ATCO) in Kastrup Tower cleared 9H-QEN to cross runway 12 and continue taxiing via taxiway B to the holding point for runway 04R.

At that point, a convoy of 14 snow removal vehicles and one service vehicle performed snow removal on taxiway B. Based on issued ATCO instructions, the mission of the convoy was snow removal on taxiway B and subsequently snow removal on runway 04R.

The snow removal vehicles had their rotating lights turned on.

The ATCO had visual contact with the serious incident site.

When the convoy passed taxiway B3, the two rearmost snow removal vehicles of the convoy turned slightly right to clear snow in the intersection between taxiway B and taxiway E2.

This manoeuvre caused a gap of approximately 40 meters between the third from last snow removal vehicle in the convoy down to the two rearmost snow removal vehicles and the service vehicle.

The convoy stopped on taxiway B awaiting an ATCO clearance to enter runway 04R.

The two rearmost snow removal vehicles caught up with the rest of the snow removal vehicle convoy and stopped to the right of the taxiway edge marking (just outside the double yellow line).

The line-up of the convoy of snow removal vehicles on taxiway B was eight vehicles in a displaced snow removal formation (active snow removal) and six vehicles in line (inactive snow removal) on the taxiway shoulder to the right of the taxiway edge marking.

There was a minor gap between the third from last snow removal vehicle in the convoy down to the two rearmost snow removal vehicles.

The flight crew noticed the involved two snow removal vehicles to the right of the taxiway edge marking.

Because of the positions of and no issued traffic information about the snow removal vehicles, the flight crew considered the vehicles to be of no risk to the aircraft and continued taxiing on the taxiway centreline with a close lookout.

For a visual illustration of taxiways and positions of the aircraft and the involved snow removal vehicles - [see appendix 1](#).

The driver of the rearmost snow removal vehicle noticed that the service vehicle suddenly turned right on taxiway E2, and that an aircraft from behind approached the two snow removal vehicles. The driver expected the aircraft to turn left via taxiway B3 for the holding point for runway 04R.

The driver realised that the aircraft continued taxiing toward the positions of the two rearmost snow removal vehicles and requested the ATCO to stop the aircraft.

“Please stop the aircraft, the aircraft wing is right now passing just overhead the snow removal vehicle” (translated from Danish).

The driver of the second to last snow removal vehicle did not notice the aircraft, until the driver heard aircraft engine noise. Through the sideview mirror, the driver observed the aircraft approaching and feared a collision between the aircraft right wing and the cab of the snow removal vehicle. The driver lied down on the front seat.

As the aircraft passed, the driver heard a scraping sound from the cap top.

The ATCO instructed 9H-QEN to hold position. The flight crew reacted and stopped the aircraft.

At that point, the aircraft had passed the two rearmost snow removal vehicles with marginal wing clearance.

Extracted radio communication between 9H-QEN and Kastrup Tower:

ATCO: “You are overtaking the sweepers. You are not supposed to.”

9H-QEN: “Okay. They are outside the line, and we were going all the way to the holding point.”

ATCO: “Yeah, if you have traffic on the taxiway – of course you go behind.”

ATCO: “xxx (aircraft call sign), you even have a slot time. You cannot depart for the next ten minutes. I do not see the rush.”

9H-QEN: “We are not in a rush – sorry about that.”

The leader of the convoy of the snow removal vehicles called the ATCO, because the clearance between the aircraft right wing and the second to last snow removal vehicle was marginal.

The ATCO informed the flight crew about a potential collision with a snow removal vehicle and asked the flight crew, if they wanted a wing inspection.

The flight crew declined. Because of their close lookout throughout the sequence of events, the flight crew was positive that a collision did not occur.

Injuries to persons

Injuries	Crew	Passengers	Others
Fatal			
Serious			
None	6	174	

Damage to aircraft

None.

Other damage

None.

Personnel informationLicense and medical certificate

The commander – male, 51 years – was the holder of a valid Airline Transport Pilot License (ATPL (A)).

The rating (B737 300-900) was valid until 30-1-2025.

The medical certificate (class 1) was valid until 1-5-2024.

Flying experience

	Last 24 hours	Last 90 days	Total
All types	6:32	163:01	16,970
This type	6:32	163_01	11,690
Landings this type	3	54	>10,000

Aircraft informationGeneral information

Manufacturer:	Boeing Company
Type:	737-8AS
Serial number:	44827-LN-6880
Airworthiness review certificate:	13-11-2024
Engine manufacturer:	CFM International
Engine type:	CFMI CFM56-7B26
Maximum take-off mass:	66,990 kilos (kg)
Mass at time of the serious incident:	63,700 kg

Aircraft dimensions

An extract from the Boeing 737 Flight Crew Operations Manual (dated 4-7-2023).

[See appendix 2.](#)

Meteorological informationAviation Routine Weather Report (METAR)

METAR EKCH	032250Z 08028G41KT 2000 -SN BKN010 BKN014 00/M02 Q0989 TEMPO 08028G40KT 5000 BKN015=
METAR EKCH	032220Z 08027G41KT 2000 -SN BKN009 BKN014 00/M02 Q0989 TEMPO 08028G40KT 5000 BKN015=
METAR EKCH	032150Z 08027G40KT 2000 -SN SCT009 BKN012 00/M02 Q0989 TEMPO 5000 BKN008=

Automatic Terminal Information Service (ATIS)

METAR EKCH This is Copenhagen airport departure information Romeo at 2150. Runway in use 04R. Runway 04R condition report at 2041. Runway conditions codes 5, 5, 5. All parts 100% 3 millimetre slush. Wind 080 degrees 25 knots, maximum 40 knots, minimum 17 knots. Visibility 2000 meters. Light snow. Scattered 900 feet. Broken 1200 feet. Temperature 0. Dewpoint -2. QNH 989. Tempo visibility 5 kilometres. Broken 800 feet. This was Copenhagen airport departure information Romeo.

SNOWTAM

SNOWTAM reported at 21:36 hrs.

SNOWTAM #0007

GG EKZZSCCH EUECYIYS

032136 EKCHZPZG

SWEK0007 EKCH 01032135

(SNOWTAM 0007 EKCH

01032135 04L 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

01032041 04R 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

01032049 12 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH)

SNOWTAM reported at 22:01 hrs.

SNOWTAM #0008

GG EKZZSCCH EUECYIYS

032201 EKCHZPZG

SWEK0008 EKCH 01032200

(SNOWTAM 0008 EKCH

01032135 04L 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

01032041 04R 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH

01032200 12 5/5/5 100/100/100 03/03/03 SLUSH/SLUSH/SLUSH)

Communication

The flight crew was in radio contact with Kastrup Tower (118.580 Megahertz (MHz)).

All drivers in the convoy of snow removal vehicles had access to radio communication with Kastrup Tower via a Frequency Modulation (FM) channel.

All radio communication on frequency 118.580 MHz between aircraft and Kastrup Tower was retransmitted to the active FM channels (FM 1, FM 17, and FM 18).

The AIB obtained the relevant Air Traffic Service (ATS) audio recordings.

The audio recordings were of good quality and useful to the AIB safety investigation.

Aerodrome information

General information

Aerodrome Reference Point:	55 37 04.50N 012 39 21.50E
Elevation:	17 feet
Runway directions:	04L, 22R, 04R, 22L, 12, and 30.
Runway dimensions (take-off 04R)	3,300 meter (m) x 45 m
Runway surface:	Asphalt
Width of taxiway B:	23 m
Taxiway lightning:	Blue edge and green centreline

ICAO aerodrome chart

[See appendix 3.](#)

Operational safety investigation

Overview

The below figure from the Advanced Surface Movement Guidance and Control System (A-SMGCS) presents the positions of 9H-QEN and the convoy of snow removal vehicles on taxiway B at the time of the serious incident.

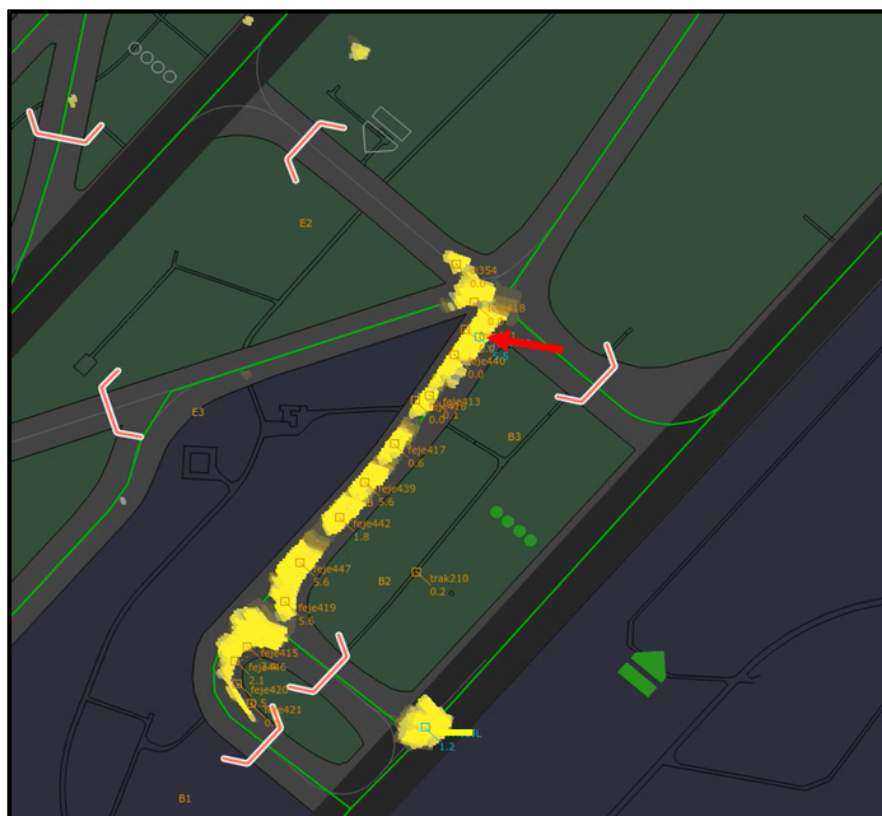


Figure 1. The position of 9H-QEN is marked with a red arrow and a blue square. The line of yellow markings on taxiway B presents the convoy of snow removal vehicles. The figure is not to scale.

The AIB removed the call signs of presented aircraft.

Serious incident site

Measurements in meters of taxiway B.

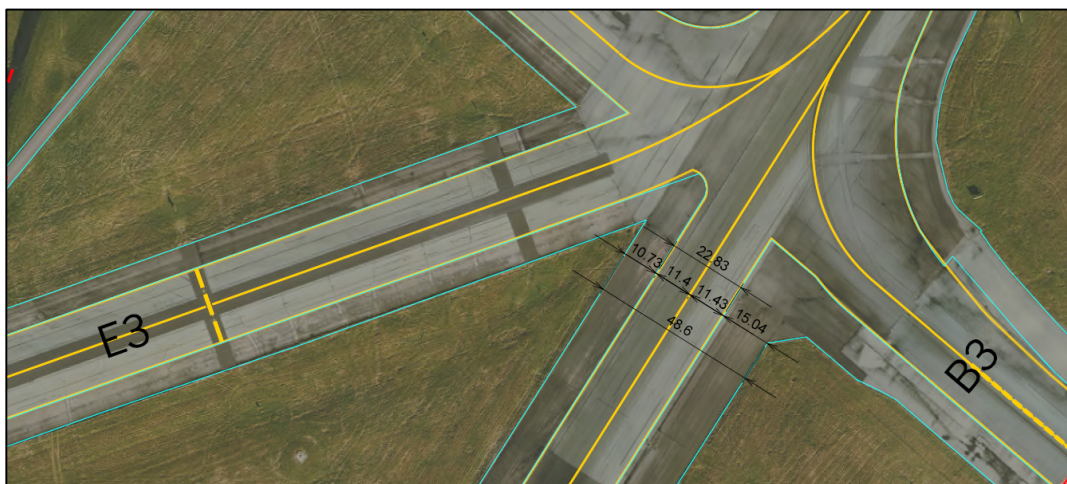


Figure 2. Measurements of taxiway B. The figure is not to scale.

Just after the aircraft right wing passed above the cab of the involved snow removal vehicle, the driver took a photo through the windscreen.

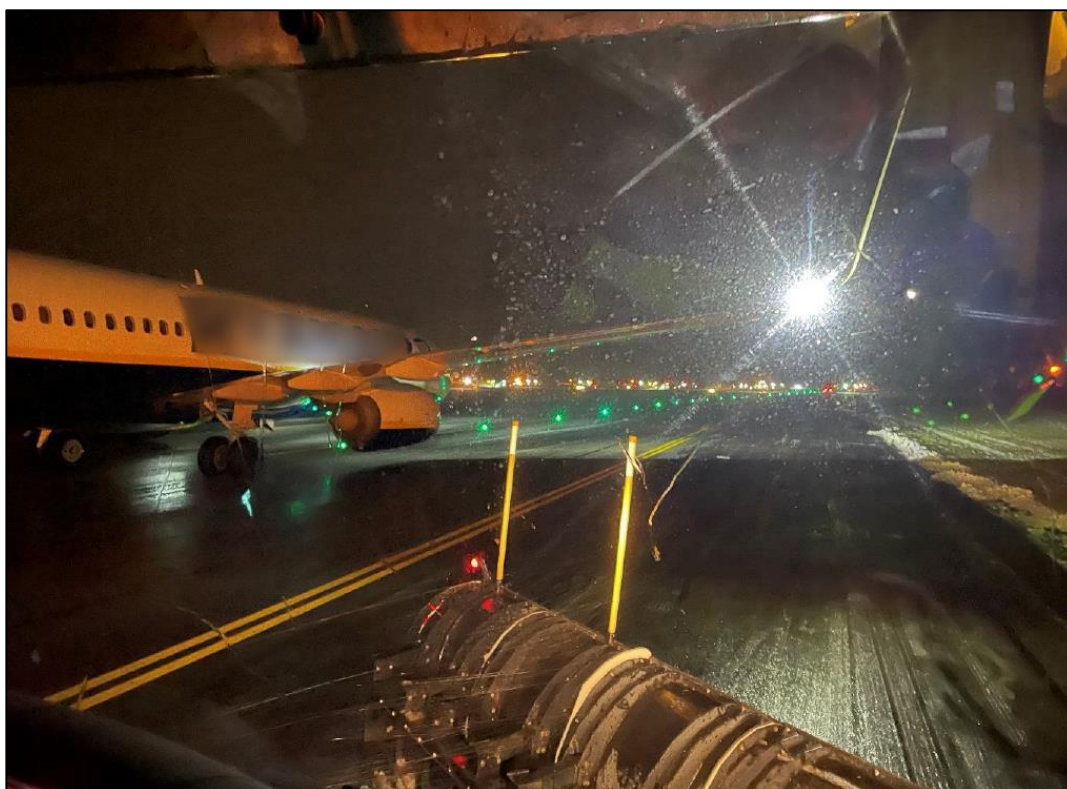


Figure 3. The position of the aircraft and the snow removal vehicle on taxiway B just after passage of the aircraft wing right above the cab of the snow removal vehicle.

The AIB blurred the name of the operator.

Involved snow removal vehicle

Figure 4. The involved snow removal vehicle.

The distance from ground level to the top of the antennas was 3.74 m.

The distance from the rotating lights to the top of the antennas was 0.15 m.

There were no visual damages to the rotating lights.

Measurements of the involved snow removal vehicle - [see appendix 4](#).

Snow removal formation

Active snow removal of a runway in EKCH required a convoy of 14 snow removal vehicles in a displaced snow removal formation (standard line-up).

Active snow removal of a taxiway in EKCH required a convoy of eight snow removal vehicles in a displaced snow removal formation. The excess six snow removal vehicles were inactive and drove in line behind on the taxiway shoulder and outside the taxiway edge marking (standard line-up).

Driving on the taxiway shoulder outside the taxiway edge marking was to reduce the risk of Foreign Object Debris (FOD) (for instance loss of machine parts) on the taxiway.

The ATCO and tower controllers in general in Kastrup Tower had no detailed knowledge of applied driving formations of snow removal vehicles in operation on taxiways.

Air Traffic Management (ATM)/Air Navigation Services (ANS)

Relevant extracts from EASA Part-ATS Annex IV (in compliance with Regulation (EU) 2017/373).

ATS.TR.240 Control of persons and vehicles at controlled aerodromes

- (a) The movement of persons or vehicles, including towed aircraft, on the manoeuvring area of an aerodrome shall be controlled by the aerodrome control

tower as necessary to avoid hazard to them or to aircraft landing, taxiing or taking off.

- (c) Emergency vehicles proceeding to the assistance of an aircraft in distress shall be afforded priority over all other surface movement traffic.
- (d) Subject to the provisions in point (c), vehicles on the manoeuvring area shall be required to comply with the following rules:
 - (1) vehicles and vehicles towing aircraft shall give way to aircraft which are landing, taking off or taxiing;
 - (2) vehicles shall give way to other vehicles towing aircraft;
 - (3) vehicles shall give way to other vehicles in accordance with air traffic services unit instructions;
 - (4) notwithstanding the provisions of points (1), (2) and (3), vehicles and vehicles towing aircraft shall comply with instructions issued by the aerodrome control tower.

ATS.TR.245 Use of surface movement surveillance equipment at aerodromes

Where deemed necessary, in the absence of visual observation of all or part of the manoeuvring area or to supplement visual observation, advanced surface movement guidance and control systems (ASMGCS) or other suitable surveillance equipment, shall be utilised by the air traffic services unit in order to:

- (a) monitor the movements of aircraft and vehicles on the manoeuvring area;
- (b) provide directional information to pilots and vehicle drivers as necessary;
- (c) provide advice and assistance for the safe and efficient movement of aircraft and vehicles on the manoeuvring area.

ATS.TR.250 Essential traffic and essential local traffic information

- (a) Essential traffic information shall be given to controlled flights concerned whenever they constitute essential traffic to each other.
- (b) Essential local traffic information known to the air traffic controller shall be given without delay to departing and arriving aircraft concerned.

ATS.TR.265 Control of aerodrome surface traffic in low-visibility conditions

- (a) When there is a requirement for traffic to operate on the manoeuvring area in conditions of visibility, which prevent the aerodrome control tower from applying visual separation between aircraft, and between aircraft and vehicles, the following shall apply:
 - (1) at the intersection of taxiways, an aircraft or vehicle on a taxiway shall not be permitted to hold closer to the other taxiway than the holding position limit defined by intermediate holding positions, stop bar or taxiway intersection marking, in accordance with the applicable aerodrome design specifications;

- (2) the longitudinal separation method on taxiways shall be as specified for each particular aerodrome by the air traffic services provider and approved by the competent authority, taking into account the characteristics of the aids available for surveillance and control of ground traffic, the complexity of the aerodrome layout and the characteristics of the aircraft using the aerodrome.

Standardised European Rules of the Air (SERA)

Relevant extract from EASA Part-SERA (in compliance with Regulation (EU) 2020/469).

SERA.3210 Right-of-way

(d) Surface movement of aircraft, persons and vehicles.

- (1) In case of danger of collision between two aircraft taxiing on the movement area of an aerodrome or equivalent part of an operating site, the following shall apply:

- (iii) an aircraft which is being overtaken by another aircraft shall have the right-of-way and the overtaking aircraft shall keep well clear of the other aircraft.

(4) Movement of persons and vehicles at aerodromes:

- (iii) Emergency vehicles proceeding to the assistance of an aircraft in distress shall be afforded priority over all other surface movement traffic.

- (iv) Subject to the provisions in (iii), vehicles on the manoeuvring area shall be required to comply with the following rules:

- (A) vehicles and vehicles towing aircraft shall give way to aircraft which are landing, taking-off or taxiing;

European Rules for Aerodromes

Relevant extract from EASA Part-ADR Annex IV (in compliance with Regulation (EU) 139/2014).

AMC2 ADR.OPS.A.065 (a) Reporting of the runway surface condition.

(2) Situational awareness section:

- (x) plain-language remarks.

Danish ATS instructions

The valid ATS instructions (in Danish) complied with and clarified the extracted paragraphs from EASA Part-ATS Annex IV.

- a) An extracted definition on essential traffic from ATS instruction 5. An AIB translation from Danish:

Note.

Essential traffic is, cf. ATS instruction 1, every aircraft, vehicle or personnel on or near the maneuvering area or traffic in the departure or final approach area that might be a threat to the in question aircraft.

An elaboration on ATC operational handling (extract) of essential traffic on ground:

At EKCH and two other Danish major aerodromes, traffic information is not issued to traffic on taxiways when a sequence is established. It is expected that aircraft

keep their own appropriate separation to “ahead taxiing”. ATC does not necessarily know that minimum required separation.

- b) An extract on aerodrome low-visibility operations valid for Kastrup Tower, runway 04L/R, from the local ATS instruction 5 chapter 12.1. The below extract is an AIB translation from Danish:

General 12.1.1 At establishment of low-visibility operations, following conditions are to be fulfilled:

“3 km signal” on FM 1 shall have been in operation for at least 10 minutes.

Vehicles on the manoeuvring area shall be under control.

At RVR values below 800 meters, vehicles on the manoeuvring area shall be logged.

- c) An extract on aerodrome low-visibility operations valid for Kastrup Tower, runway 04L/R, from the local ATS instruction 5 chapter 12.1.5. The below extract is an AIB translation from Danish:

When the RVR is below 550 meters, Tower shall ensure separation between aircraft and between aircraft and vehicles on the manoeuvring area.

ANALYSIS

General

The commander was properly licensed.

The aircraft was airworthy, and the technical status of the aircraft had no influence on the sequence of events.

The snow removal in progress on taxiway B was under ATC control. The snow removal vehicles had their rotating lights turned on, and the convoy was clearly visible to the surroundings.

The ATCO had visual contact with the serious incident site.

The weather conditions allowed appropriate visual contact between the aircraft and the convoy of snow removal vehicles and did not require ATC separation between aircraft and vehicles on the manoeuvring area.

The reported SNOWTAM at 21:36 hrs and at 22:01 hrs did not contain situational awareness information on snow removal in progress.

Overtaking snow removal vehicles

ATCO perception

The ATCO issued a taxi instruction to the flight crew of 9H-QEN to the holding point for runway 04R.

Three elements likely provoked an ATCO perception that the whole convoy of 14 snow removal vehicles occupied taxiway B:

- In darkness, difficulties in distinguishing visually from the tower cab the exact position of each individual snow removal vehicle on taxiway B.
- A cluttered and uniform A-SMGCS presentation of the convoy of 14 snow removal vehicles on taxiway B.
- No detailed knowledge of the applied driving formation of the 14 snow removal vehicles on taxiway B.

Based on visual cues and A-SMGCS, the ATCO most likely considered the convoy to be one unit, like an aircraft, occupying taxiway B and not requiring ATCO operational sequencing.

For that reason and from an ATCO point of view, overtaking the convoy on taxiway B was neither physically possible nor rational. 9H-QEN was in a logic traffic sequence behind the convoy, and the ATCO expected the flight crew of 9H-QEN to ensure own separation to ahead traffic.

The ATCO perception of the traffic situation did not require the issue of traffic information on essential traffic.

Flight crew perception

The following elements in combination probably had influence on the flight crew decision-making process:

1. An acknowledged instruction to taxi all the way to the holding point for runway 04R.
2. The service vehicle exited taxiway B via taxiway E2.

3. A line-up of six snow removal vehicles to the right of the taxiway edge marking, combined with a minor gap between the third from last snow removal vehicle in the convoy down to the two rearmost snow removal vehicles, might have caused a flight crew visual illusion that the convoy gave right-of way.
4. The line-up of six snow removal vehicles just outside the taxiway edge double yellow line might mentally have blocked a flight crew risk assessment on the relationship between conditions like:
 - taxiway width (23 m) versus aircraft wingspan (35.79 m) versus height of the snow removal vehicles (3.74 m and unknown to the flight crew).
 - bottom of winglet height (4.06 m - 4.32 m)
 - loading
 - oleo and tire pressure
 - centre of gravity
 - dihedral of wings
 - potential dynamic wing flexing during taxi
5. The flight crew was positive that a close lookout, while taxiing on the centreline, ensured appropriate clearance to pass the snow removal vehicles.
6. In darkness, a potential flight crew misperception of a safe vertical and horizontal distance from all obstacles.
7. The flight crew did not challenge the perceived traffic situation.

Flight crew perception of the traffic situation unintentionally provoked a rationale that overtaking the snow removal vehicles did not constitute a flight safety risk.

The AIB finds it most likely that the actual circumstances led to marginal clearance or a possible collision between the top of the antennas of the snow removal vehicle and the underside of the aircraft right wing.

Continuous flight

The snow removal crew reported a suspicion of a potential collision between the snow removal vehicle and the aircraft. However, the flight crew declined a wing inspection.

From a general flight safety point of view, the AIB questions the flight crew decision-making on continuing the flight, because any ground collision might cause non-observable damages to the aircraft leading to later and potentially irreversible impact.

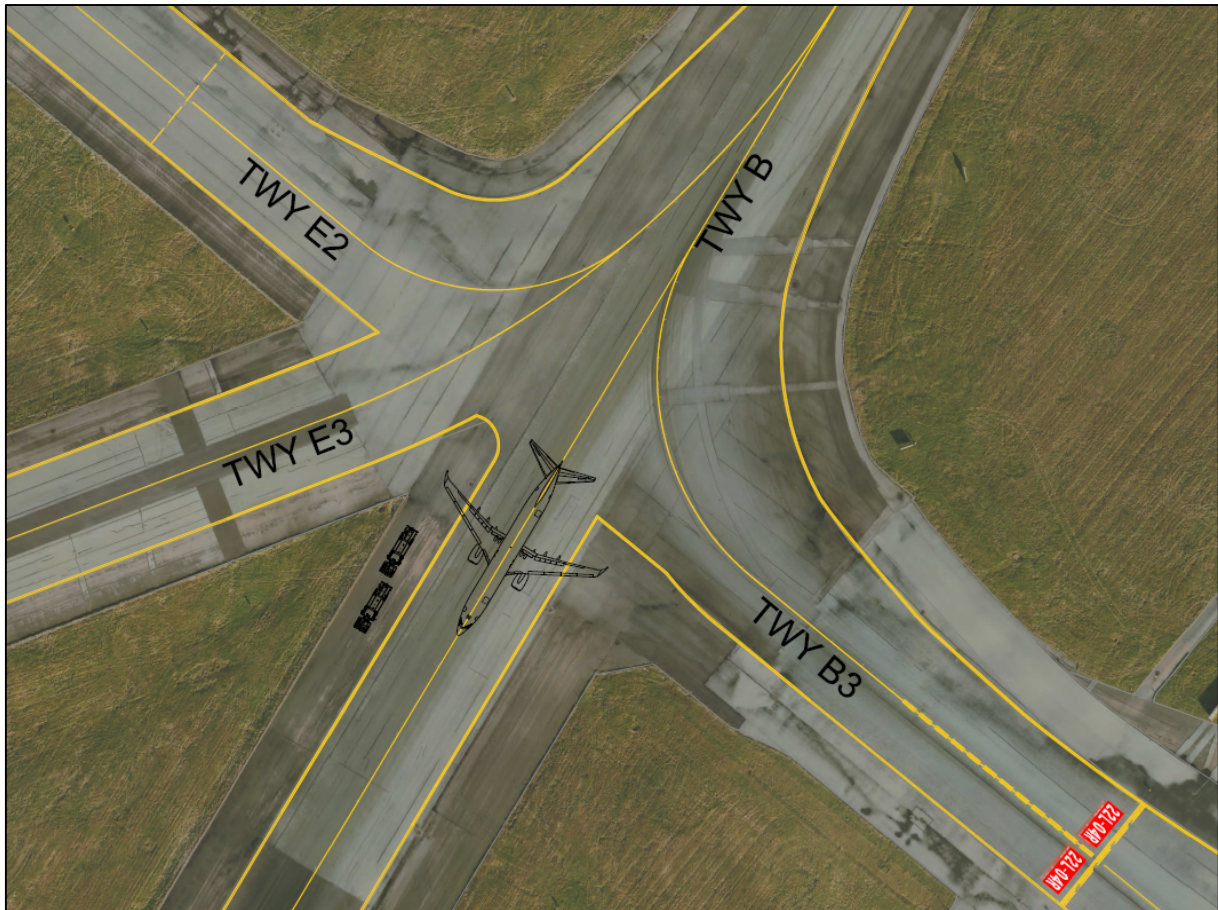
AIB proposed risk mitigation

- The issue of SNOWTAM situational awareness information on actual snow removal in progress might increase flight crew vigilance.
- Irrespective of requirements, instructions, and operational handling, mutual challenge communication might strengthen situational awareness.
- Knowledge sharing between the provider of air traffic service and the aerodrome on applied formations of snow removal vehicles in operation might increase situational awareness.
- Any suspicion of an aircraft ground collision requires a pre-flight inspection.

CONCLUSIONS

Summary

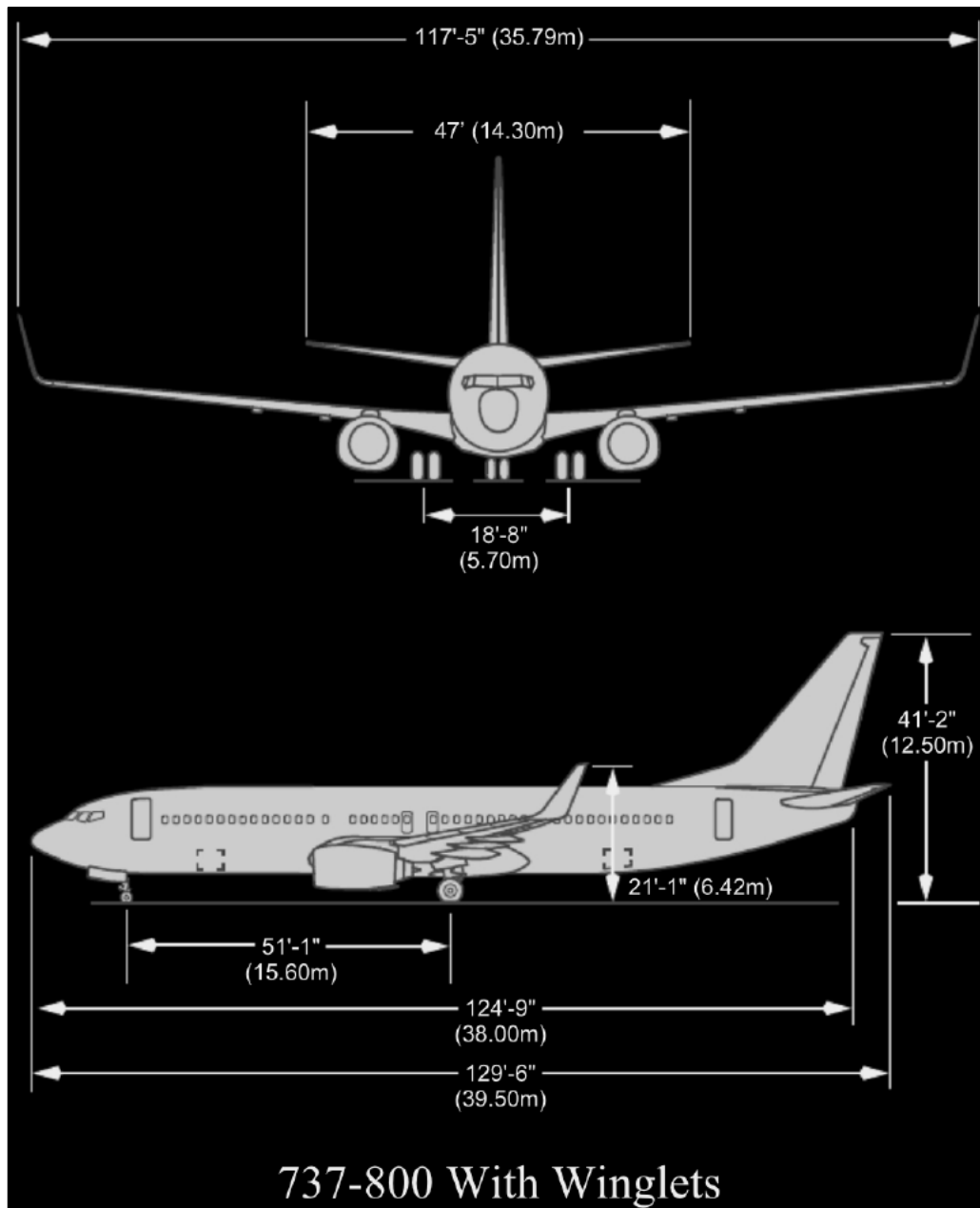
Diverging perceptions of the traffic situation on taxiway B led to marginal clearance or a possible collision between the aircraft right wing and a snow removal vehicle.

APPENDIX 1[Return to history of flight](#)

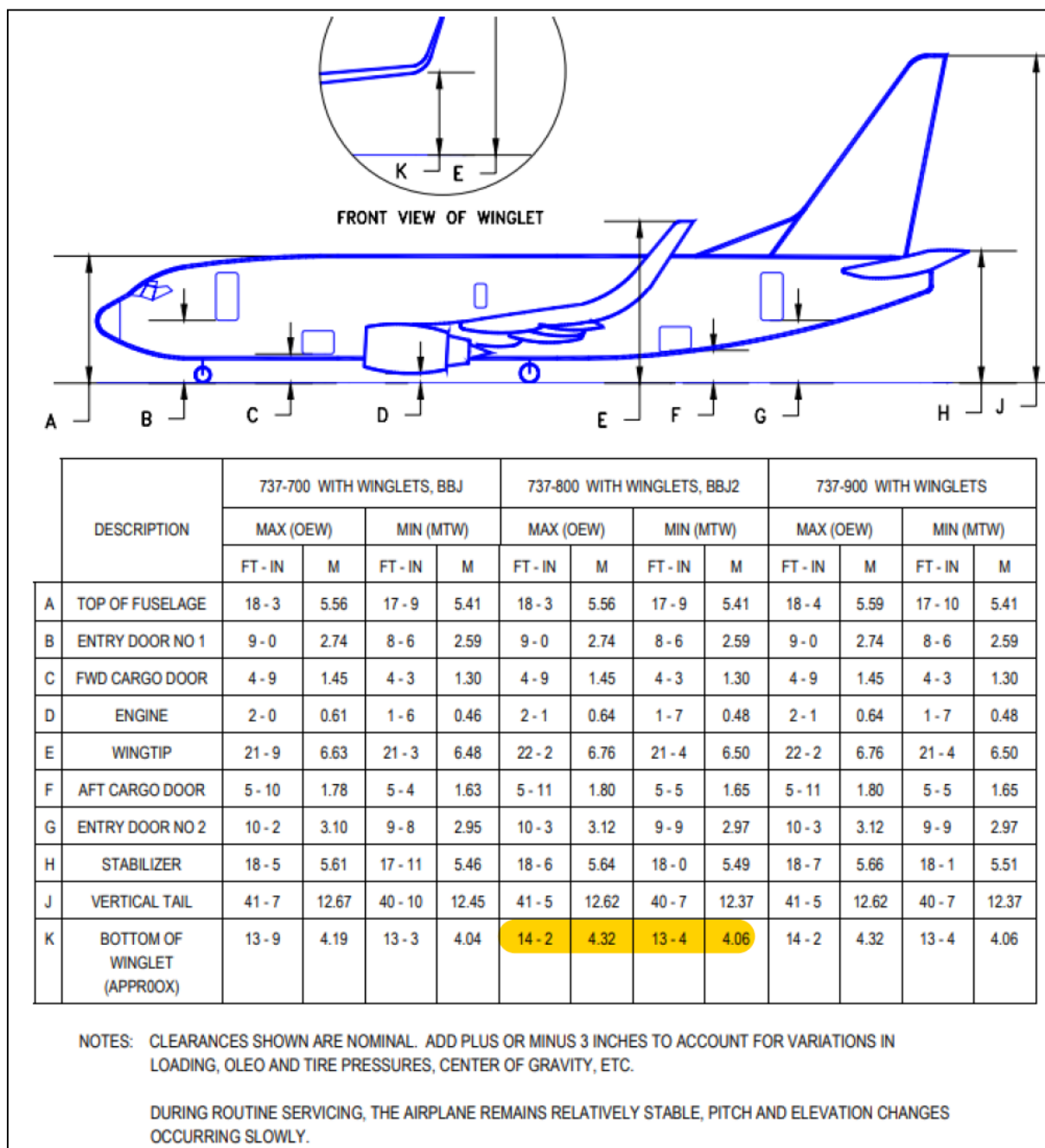
Note. Appendix 1 is solely an illustration and is not to scale.

APPENDIX 2

(Page 1 of 2)

[Return to aircraft dimensions](#)

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[Return to aircraft dimensions](#)

APPENDIX 4

[Return to the involved snow removal vehicle](#)

