Transporta nelaimes gadījumu un incidentu izmeklēšanas birojs

Transport Accident and Incident Investigation Bureau of the Republic of Latvia

Brīvības iela 58, Rīga, LV-1011, Latvia, phone +371 67288140, mob. Phone +371 27882103, fax +371 67283339,
E-mail taiib@taiib.gov.lv, www.taiib.gov.lv

DRAFT FINAL REPORT No 4-02/3-21

on the serious incident to the aircraft Airbus A220-300 (CS300) registered YL-CSE operated by airBaltic runway excursion at the Riga International Airport (RIX), on December 3, 2021

The Aircraft Accident and Incident Investigation Bureau of the Republic of Latvia is a governmental, independent of all aviation authorities and, in general, of any other party or entity the interests or missions of which could conflict with the task entrusted to the safety investigation authority or influence its objectivity, organization established by law to investigate and determine the cause or probable cause of accidents and serious incidents that occurred in the civil aviation, as well if necessary for enhancing flight safety incidents. The sole objective of the safety investigation in accordance with Annex 13 to the Convention on International Civil Aviation, the Regulation (EU) No.996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in Civil Aviation as well as Cabinet Regulation No.423 of May 31, 2011 "Procedures of Civil Aviation Accident and Incident investigation" is the prevention of future accidents and incidents. The Report shall contain, where appropriate, safety recommendations. Safety investigation is separate from any judicial or administrative proceedings and Investigation Report is not deal with purpose to apportion blame or liability but only for purpose of the safety enhancement. The Report shall protect the anonymity of any individual involved in the accident or serious incident.

Address:

Brīvības iela 58, Riga, Latvia, LV-1011

E-mail:taiib@taiib.gov.lv,

Tel.: +371 67288140; +371 67288172

TABLE OF CONTENTS

ABBREVIATIONS

ATM	Air Traffic Management
ATPL	Air Transport Pilot's License
ANSP	Air Navigation Service Provider
CVR	Cockpit Voice Recorder
DME	Distance Measuring Equipment
FDR	Flight Data Recorder
METAR	Aerodrome routine meteorological report (in meteorological code)
OFC	Operational Flight Check
QNH	Altimeter setting to obtain aerodrome elevation when on the ground
NOTAM	Notice to Airmen
TO/GA	Take-Off/Go-Around thrust
UTC	Coordinated Universal Time
P	Pilot
PIC	Pilot-in-Command
FO	First Officer
PM	Pilot Monitoring (First Officer)
ADE	Airport Duty Engineer
ADM	Airport Duty Manager
ATC	Air Traffic Controller
ATIS	Automatic Terminal Information Service
ASDA	Accelerate Stop Distance Available
IFR	Instrument Flight Rules
TORA	Take-off Run Available
TODA	Take-off Distance available
LDA	Landing Distance Available
RWY	Runway
ILS	Instrument Landing System
RWYCC	Runway Condition Code
RCR	Runway Condition Report
SNOWTAM	Snow Notam
OM	Aircraft Operation Manual
TLA	Thrust Lever Angle
AGL	Above Ground Level
RFFS	The Rescue and Fire Fighting Services of the Riga airport
TAF	Terminal Area Forecast
TWY	Taxiway
APP	The approach controller
A-SMGCS	Advanced Surface Movement, Guidance and Control Systems
TWR	Tower
TR	Thrust reverses
FMS	Flight Management System (an aircraft operations computer)
QRH	Quick Reference Handbook
MFS	Multi-Function Spoiler

Investigation No 4-02/3-21 **Aircraft:** Bombardier/BD-500-1A11(CS300) **Engines:** Pratt & Whitney Canada Corporation PW1524G-3 **Crew:** 6 **Place:** Riga, Latvia	**Aircraft Registration:** YL-CSE **Type of flight:** Scheduled (BT 102), IFR **Flight:** BTI1M2 **Passengers:** 44 **Date and Time:** 2021.12.03/9.55 UTC

All times in this report are UTC. Local time UTC + 2 hours.

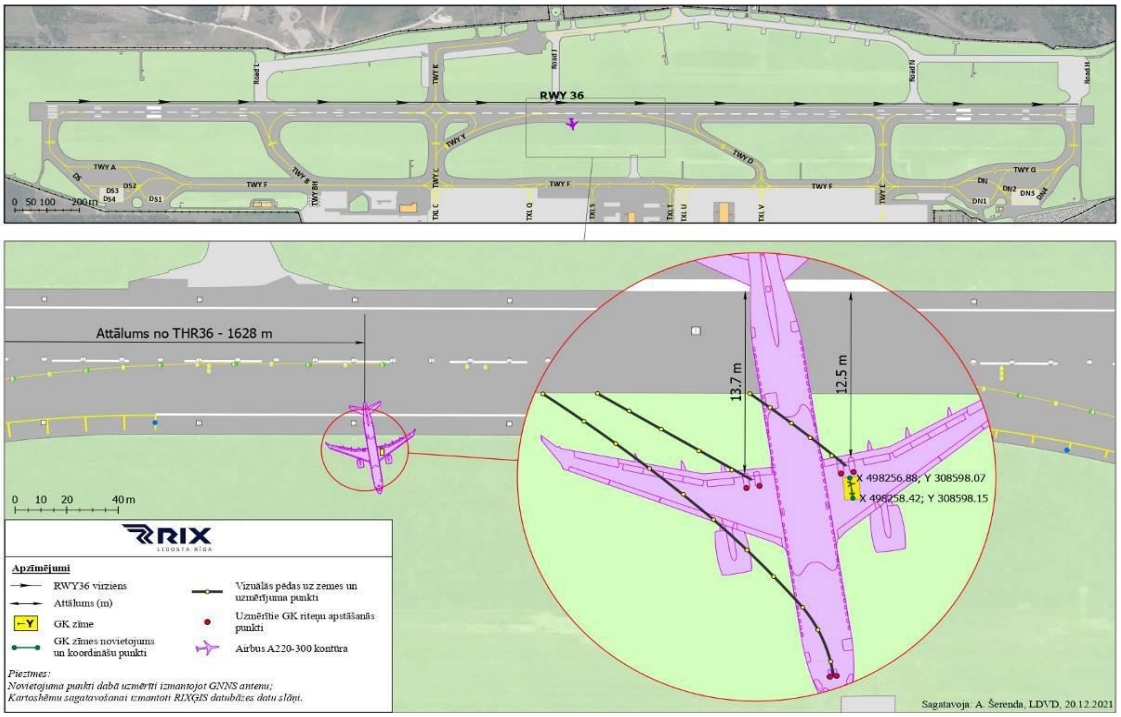
Synopsis

Unless stated otherwise the time in this Report is UTC

The aircraft involved in the serious incident on December 3, 2021 was on the scheduled flight from the international airport Stockholm/Arlanda (**ESSA**) to the Riga International airport (**EVRA**); the aircraft call sign was BTI1M2. This was the second flight on that day for the flight crew.

At **9:55** a.m. the flight BTI1M2 of the AirBaltic airline aircraft suffered a runway excursion after landing on the RWY 36 in the Riga International Airport (RIX). In adverse weather conditions (heavy snowfall) and reduced visibility conditions the aircraft lost directional control, skidded to the right side of the runway, broke the runway exit sign "Y" of the TWY with the LH engine inlet cowl and stopped in snow (see picture 1). The passengers of the aircraft were disembarked safely.

Picture 1: The aircraft at the incident site



Picture 2: Location of the aircraft after the occurrence (source RIX report DP 8203F)

Notification

The Transport Accident and Incident Investigation Bureau of the Republic of Latvia (TAIIB) was notified about the occurrence on December 3, 2021 at 11:59 local time by the RIX OVC.

Immediately after the occurrence the following organizations have been notified by TAIIB according to Annex 13 and Regulation (EU) No 996/2010 of the European Parliament and of the Council of 20 October 2010:

- the International Civil Aviation Organisation (ICAO);
- the European Aviation Safety Agency (EASA);
- the European Commission (EC);
- the Investigation Authority of Canada (TSB);
- the Latvian CAA.

Investigation

The TAIIB of the Republic of Latvia as the State of Occurrence according to Annex 13, Section 5.1 instituted an investigation into the circumstances of the occurrence and started to conduct the investigation with the Canadian TSB as an accredited representative and Airbus as a technical advisor.

In accordance with Article 8 of Council Regulation (EU) No. 996/2010 and in accordance with the Inter-institutional agreement of cooperation between the Latvian

CAA and the TAIIB the CAA experts were included in the safety investigation group. The TAIIB initiated a data collection from the institutions involved in this serious incident: aircraft operator, Riga International airport (RIX), ANS provider under the provisions of Annex 13 to the Convention on International Civil Aviation (Chicago 1944) and the Regulation (EU).

Investigation materials:

- Reports from the airport and the air traffic control (ATC);
- Flight plan;
- Flight crew licences and Medical Certificates;
- Flight crew interviews;
- Images of the airport;
- Flight Safety Report of the airBaltic;
- AirBaltic Investigation Report;
- OPMET and ATIS data;
- METAR and TAF to the Riga Airport;
- FDR and CVR data;
- Riga Tower and Ground radiotelephony transcripts;
- Aircraft Certificate of Registration;
- Aircraft Certificate of Airworthiness;
- Riga airport's Investigation Report;
- RIX related documentation;
- Latvian CAA related documentation.

1. FACTUAL INFORMATION

1.1 History of the Flight

On December 3, 2021 the scheduled flight BT 102 from the Stockholm Arlanda Airport (ARN) to the Riga International airport (RIX) was performed by the airBaltic airlines aircraft A200-300 (BD500 1A11), national registration number YL-CSE.
The aviation serious incident took place during the second flight of the day. The aircraft cockpit were two pilots (PIC and FO) and the third pilot on the jump seat in a function of an observer; the flight leg Captain (PIC) was a Pilot Flying. The cabin crew consisted of the standard three cabin crew members per 44 passengers on board.

During approach to the RWY 36 (landing course 358^0) the aircraft crew received RIX ATIS weather condition. The flight BTI1M2 was cleared ILS approach RWY36 at **9.46.56** by APP ATC. The pilot did not report any deviation in ILS operation.

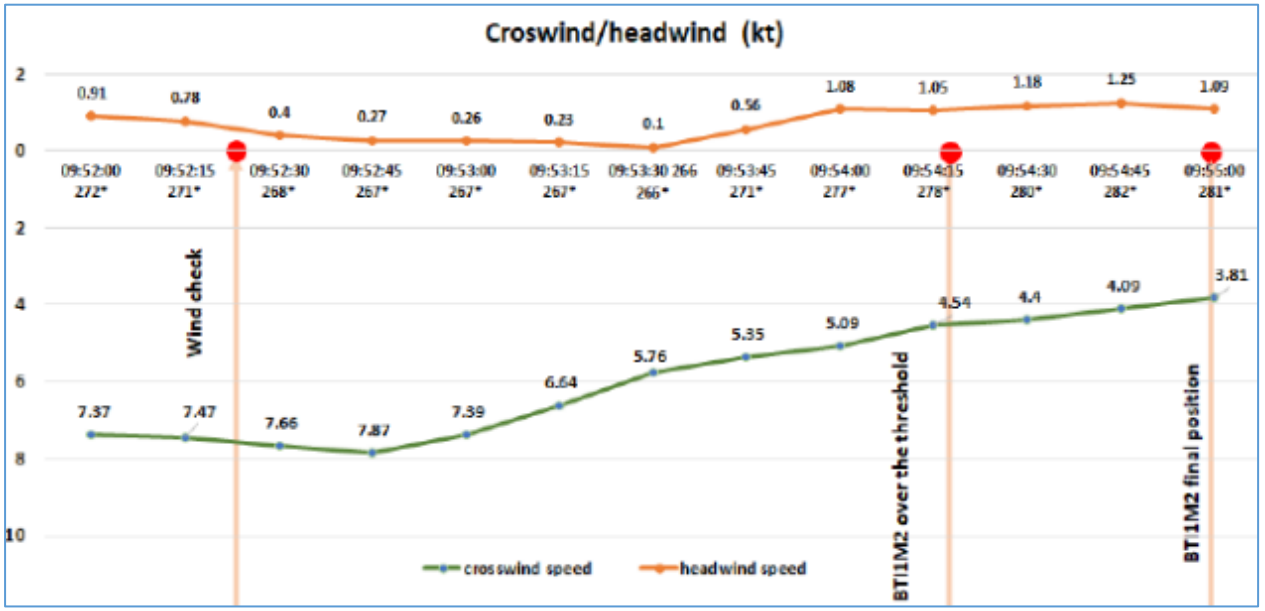
At **09.50.07** TOWER ATC issued landing clearance and up-to-date meteorological information to the flight BTI1M2: "*Wind 260 degrees 6 kt, RVR 1100 meters, heavy*

snow, RWY36 cleared to land, QNH 993". The aircraft was 9.7 NM (nautical miles) from RWY36, and the IAS was 184kt. After passing 4 NM from RWY36 till the threshold of RWY-in-use the flight maintained variable IAS between 133kt and 127kt.

```
RIGA-ATIS
  ICAO:              EVRA
 *INFORMATION:       Z
 *TIME:              0950
  LANDING TYPE:      ILS
  RWY:               36
  TL:                70
  NAVAID:            RWY 36 COND REPORT AT 0441
                     RWY COND CODES 2 / 2 / 2
                     FIRST PART 100 PERCENT 8 MM WET SN
                     SECOND PART 100 PERCENT 8 MM WET SN
                     THIRD PART 100 PERCENT 8 MM WET SN
                     CLR WID 42 M
                     CHEMICALLY TREATED
                     GND CTL IS COMBINED WITH TWR ON 118.105
 *WIND:              280 DEG, 6 KT, VRB BTN 210 AND 340 DEG
 *VISIBILITY:        TDZ 800 M
 *RVR:               1100 M|800 M|800 M
  PRESENT WEATHER:   HVY SN
  CLOUDS:            CLD BKN 500 FT, OVC 900 FT
  AIR.TEMP:          MS 2
  DP.TEMP:           MS 3
  QNH:               0993
 *TREND:             TREND: TEMPO VIS 2000 M, MOD SN
```

Picture 3: RIGA-ATIS EVRA

At **09.52.28** TOWER ATC issued wind check to the flight BTI1M2: "*270 degrees 8 kt*" (3.8 NM out from RWY36). Until landing the surface wind for RWY36 did not change significantly and ATC did not give wind check any more (see picture 4).



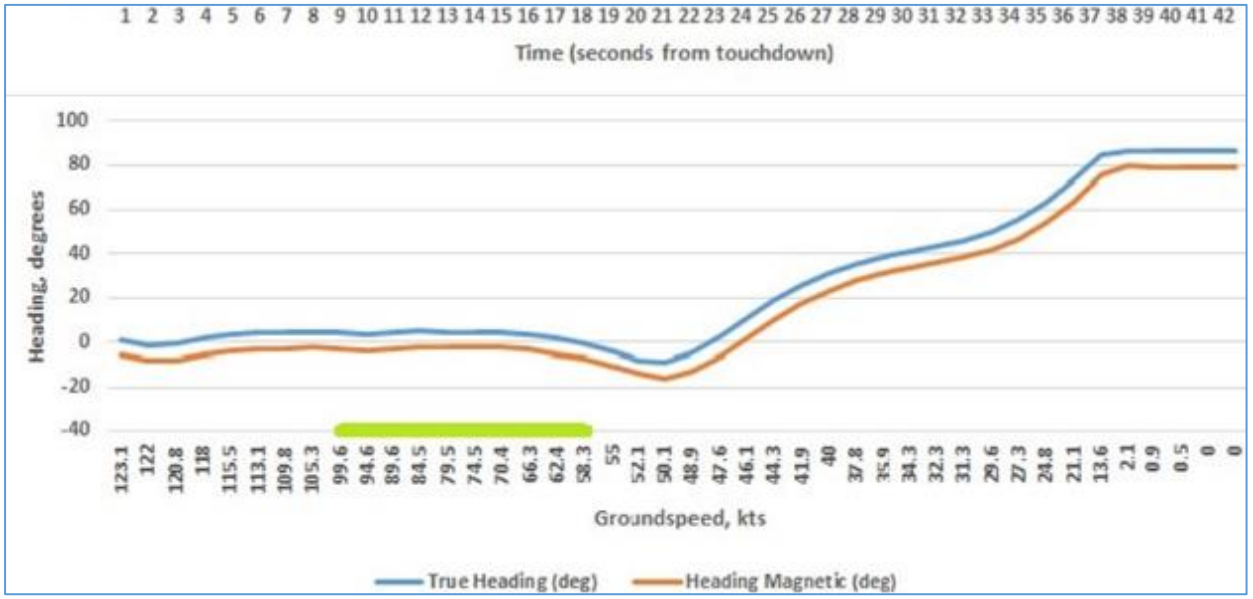
Picture 4: Crosswind/headwind during landing of the RIX

At **09.54.16** the flight BTI1M2 was over the threshold RWY36.

The aircraft landing performance was calculated:

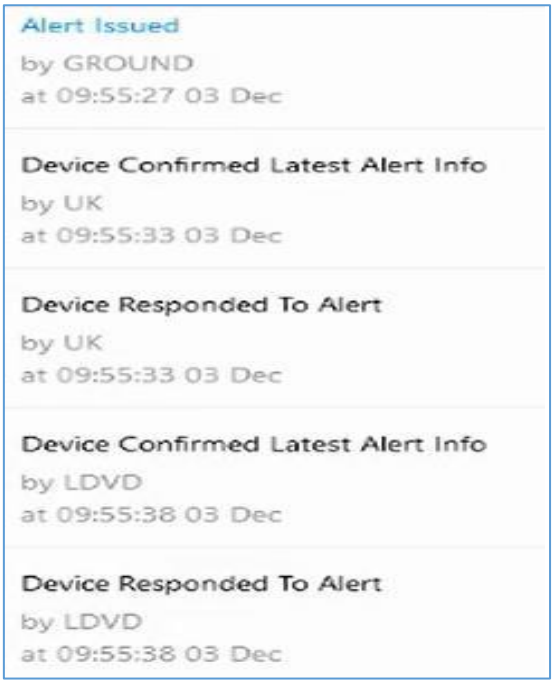
- Aircraft weight: 99840lbs
- Flap 4 configuration
- Autopilot was disengaged at about 150ft AGL
- Autothrottle was engaged
- Vappr: Vref + 5kt = 128kt
- Autobrake Medium was selected
- The final approach was stabilized

At **09.54.23** the aircraft flight BTI1M2 made a touchdown with Autobrake set to MEDIUM. Rudder pedals were used as required to capture and to maintain the runway centreline (ground speed **123** kt).
At **09.54.27** thrust levers were set to Rev Idle (ground speed **115** kt).
At **09.54.36** the aircraft started to yaw left (heading decrease), (ground speed **70** kt).
At **09.54.40** the yaw rate was as about -3.4 deg./sec; Thrust levers were set to 0 deg. (Idle); Full right brake pedal applied, disconnecting the autobrake (ground speed **55** kt).
At **09.54.41** the aircraft started to yaw right, with right wheels skidding; Yaw rate was about 8 deg./sec (ground speed **52** kt).
At **09.54.46** right brake and rudder pedal released; Full left brake and rudder pedal applied; Left wheels skidding observed; Heading was quickly increasing (ground speed **44** kt).
At **09.54.50** right thrust lever increased up to 35 deg., then back to Idle 6 sec later (ground speed **35** kt).
At **09.54.54** full braking applied; All wheel's skidding; Heading was still increasing (ground speed **29** kt).
At **09.54.55** the aircraft exited the runway on the right side (ground speed **27** kt).
At **09.54.58** the aircraft stopped; The longitudinal deceleration was -0.83g and the lateral deceleration was 0.45g (ground speed **0** kt), (see picture 5).



Picture 5: Aircraft deviation after touchdown on the RWY36 (Fragment from FDR data plots)

At **09.55.00** the flight BTI1M2 rolled off to the right between TWYs "Y" and "D". The aircraft came to rest within landing strip and RWY protected area. The landing strip at the Riga aerodrome is established 140 meters from RWY centerline to both sides and the RWY protected area is established 100 meters from RWY centerline to the both sides. Both ATCs did not observe visually the aircraft from TOWER position due to limited visibility and relied on pilot's report and A-SMGCS surface radar.
At **09.55.04** TOWER ATC called the flight BTI1M2 and the pilot reported at once "*we are on right side of RWY*", "*And also, we need push back*". The pilot did not declare an emergency state on board. The TOWER ATC informed immediately the APP controller about the blocked RWY.
At **09.55.15,** after the occurrence, the pilot of the rolled off aircraft requested the TOWER ATC to provide a push back only. The pilot did not request any emergency services to be alerted, neither declare an emergency state on board.
At **09.55.27** the GROUND ATC activated TEAS (Tower Emergency Alerting System). There was a notification "Aircraft Accident" on the aerodrome for all emergency services. LDVD (Aerodrome Operational Unit of the Aerodrome Management and Safety Department) dispatcher and the aerodrome Rescue and Fire Fighting Service (further - RFFS) duty officer responded to alerting signal within the seconds (see picture 6).



Picture 6: Notification from the Tower emergency alerting system (TEAS)

At **09.55.38** the TOWER ATC informed the Aerodrome Duty Engineer (ADE) about the occurrence. The position of the aircraft was given to the engineer.
At **09.56.35** the GROUND ATC requested the LDVD dispatcher about the number of passengers on board of the flight BTI1M2 for further dissemination among the emergency services.
At **09.56.03** the GROUND ATC updated alerting information in TEAS system.

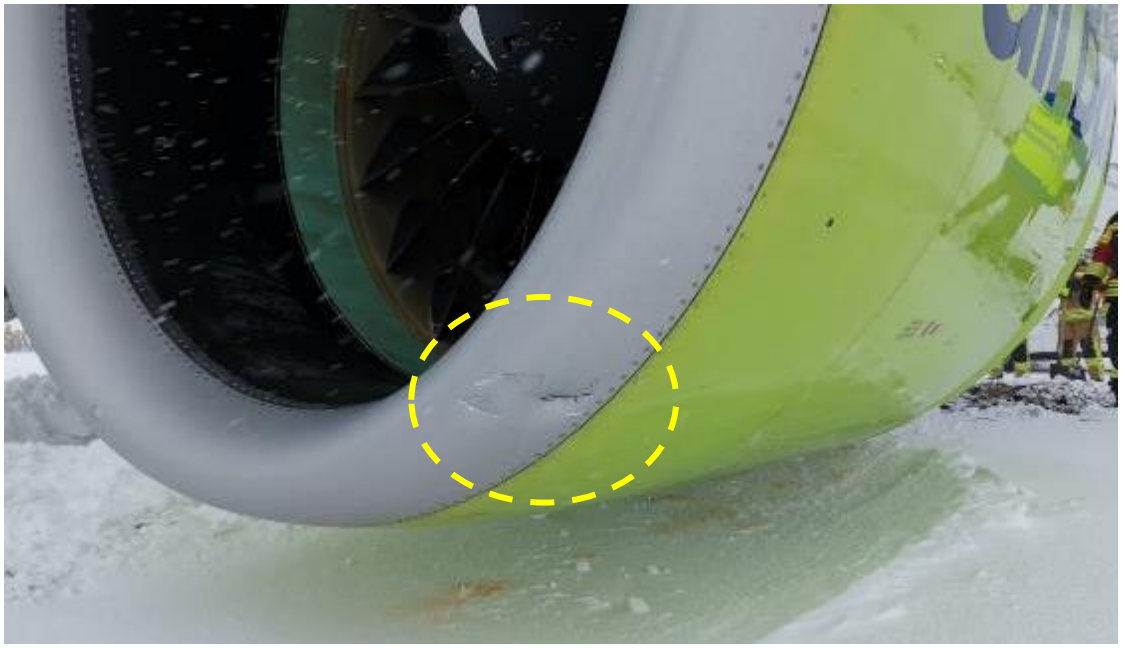
At **09.57.40** the TOWER ATC informed the LDVD dispatcher about the precise location of the rolled off aircraft.
At **09.57.58** the emergency services ARFFS (with call sign Fire 5) requested to enter the RWY. The ATC cleared to occupy the RWY for 4 emergency vehicles. The convoy of ARFFS vehicles entered the RWY via shortest route to the aircraft (via TWY "Y"). Before the emergency services entered the runway the TEAS was updated by the GROUND ATC with the aircraft location. The GRID location "Cell N14" was given on the uniform airport area map according to "Procedure TEAS utilization at Riga Aerodrome". The RIX emergency services, i.e., the RIX Fire brigade (RFFS), confirmed it.
At **09.59.10** the ADE reported that the aircraft is on the RWY and its main gears are on the RWY edge lights, but a half of the aircraft is on the RWY.
At **10.00.20** the GROUND ATC initially instructed the Aerodrome Meteorological Observing Service (Provided by ANSP) officer to change ATIS information and broadcast that the aerodrome was closed till time **11.00** for take-off and landing.
At **10.00** the RFFS arrived at the aircraft.
At **10.01.47** the TOWER ATC requested the pilots of flight BTI1M2 whether they needed more assistance. The pilots reported that they shut down engines and they needed only a push back and additionally it could be necessary the assistance to disembark the passengers.
At **10:15** a passenger boarding ladder, two push-out tractors and a baggage tractor with baggage carts arrived at the aircraft. The passenger boarding ladder could not be placed at the aircraft due to snow; and other vehicles were also stuck in snow.
At **10.38** the passengers disembark completed, no injuries reported.
At **12.00** the aircraft was pushed out on the paved surface of the runway.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others	Total in the aircraft
Fatal	-	-	-	-
Serious	-	-	-	-
Minor	-	-	-	-
None	5	44	1	50
TOTAL	5	44	1	50

1.3 Damage to aircraft

Performing a visual inspection of the aircraft at the incident site some damage of the Inlet Cowl of the LH Engine was detected, caused by contact with a taxiway marking sign (see picture 7).



Picture 7: Damage of the Inlet Cowl of the LH Engine

1.4 Other damage

During the runway excursion the aircraft collided with the taxiway sign "Y" (see picture 8) located on the right side of the runway 36, 1628m from the threshold.

Picture 8: The taxiway sign "Y"

1.5 Personnel information

The flight crew was certified and qualified for the flight in accordance with existing regulations.

PIC	
Age	41
Pilot Licence	ATPL(A) No LVA.FCL.000929A; valid
Medical Certificate (Medical conclusion)	Class 1; No LVA/MED-1-A-0083; valid
Total flying hours	4780:26
Hours on type	324:08
A/C captain hours	918:55
Last base check	26.11.2021
Rest period before duty	17:52
Flying hours last 28 days	50:19
Flying hours last 7 days	23:15
Flying hours last 24 hours before incident	3:32

FO	
Age	59
Pilot Licence	ATPL(A) No LVA.FCL.000744A; valid
Medical Certificate (Medical conclusion)	No LV-LT/MED-1-A-010023; valid
Total flying hours	8268:20
Hours on type	584:54
A/C captain hours	6693:00
Last base check	29.06.2021
Rest period before duty	15:47
Flying hours last 28 days	54:36
Flying hours last 7 days	18:29
Flying hours last 24 hours before incident	4:23

The analysis of the above-mentioned data lets to conclude, that the pilots were not fatigued at the time of the occurrence.

1.6 Aircraft information

The aircraft general information

The A220 manufactured by Airbus Canada Limited Partnership, Mirabel Canada is a twin-engine turbofan transport aircraft.
Year of manufacture: 2017
Serial number: 55007

Engines: PRATT & WHITNEY (CANADA) (PW1521G-3)
Registration: YL-CSC, registered in Latvia on June 15, 2017
MTOM: 67585 kg
Certificate of airworthiness: The certificate No236 was issued by Civil Aviation Agency of the Ministry of Transport Republic of Latvia on June 15, 2017. No Limitations, it was valid.
The weight and centre of gravity were within prescribed limits. The aircraft had sufficient fuel to proceed to the alternate airport.

1.7 Meteorological information

1.7.1 Meteorological information from the Latvian Centre for Environment, Geology and Meteorology

Note No. 4-6/1755 on the actual weather conditions at the Riga International airport on December 3, 2021

Time	Hourly minimum air temperature, °C	Hourly average air temperature, °C	Hourly maximum air temperature, °C	Hourly average relative humidity, %	Hourly average wind speed, m/s	Hourly average wind direction, hub	Hourly maximum wind gusts, m/s	Hourly total rainfall, mm
00.00-01.00	+0,6	+0,7	+0,9	96	3,4	E	5,7	0,3
01.00-02.00	+0,6	+0,7	+0,7	96	3,4	E	5,7	0,3
02.00-03.00	+0,1	+0,4	+0,6	97	3,8	NE	7,3	0,7
03.00-04.00	-0,7	-0,3	+0,2	97	3,7	NE	6,2	0,6
04.00-05.00	-1,3	-1,0	-0,7	97	4,1	N	7,4	1,5
05.00-06.00	-1,6	-1,5	-1,3	98	4,4	N	8,0	1,7
06.00-07.00	-1,6	-1,6	-1,4	98	4,2	N	8,1	1,2
07.00-08.00	-1,7	-1,6	-1,5	98	4,6	NW	8,7	0,8
08.00-09.00	-1,6	-1,4	-1,2	98	5,0	NW	8,7	0,5
09.00-10.00	-1,2	-1,1	-0,9	97	4,9	NW	9,0	1,5
10.00-11.00	-1,3	-1,2	-1,1	97	5,4	NW	10,4	1,2
11.00-12.00	-1,3	-1,2	-1,1	94	4,6	NW	8,9	0,3
12.00-13.00	-1,3	-1,3	-1,2	94	4,3	NW	8,5	0,3
13.00-14.00	-1,3	-1,2	-1,1	95	4,2	NW	7,5	0,8
14.00-15.00	-1,4	-1,3	-1,2	94	4,4	NW	7,9	0,1
15.00-16.00	-1,4	-1,4	-1,3	95	3,6	NW	7,1	0,4
16.00-17.00	-1,4	-1,3	-1,1	97	4,0	NW	8,1	0,2
17.00-18.00	-1,2	-1,0	-0,9	97	4,2	NW	8,5	2,2

TAF forecast for Riga aerodrome from December 3, 2021 06.00UTC through December 4, 06.00UTC, [dispatched December 3, at 6 pm 5:30 UTC]

TAF EVRA 030503Z 0306/0406 32010KT 3000 -SN BR OVC005 TEMPO 0306/0310 1500 SN
OVC010 PROB40 TEMPO 0306/0310 -FZDZ BECMG 0310/0312 9000 NSW OVC015
TEMPO 0312/0318 3000 -SHSN BKN010CB PROB40 TEMPO 0312/0318 2000 SHSN -PL
BECMG 0320/0322 VRB02KT=

TAF forecast proofreading for Riga aerodrome from December 3, 2021 07.00UTC00UTC through December 4, 06.00UTC, [dispatched December 3, at 6 pm 7:43 UTC]

TAF AMD EVRA 030743Z 0307/0406 32010KT 3000 -SN BR OVC005 TEMPO 0307/0312 1500 -FZDZ SN OVC010 BECMG 0312/0314 9000 NSW OVC015 TEMPO 0314/0318 3000 -SHSN BKN010CB BECMG 0320/0322 VRB02KT=

TAF forecast proofreading for Riga aerodrome from December 3, 2021 09.00UTC through December 4, 09.00UTC, [dispatched December 3, at 6 pm 9:25 UTC]
TAF AMD EVRA 030925Z 0309/0409 27007KT 3000 -SN BR OVC005 TEMPO 0309/0313 0700 -FZDZ SN OVC010 BECMG 0313/0315 9000 NSW OVC015 TEMPO 0315/0318 3000 -SHSN BKN010CB=

Warning for Riga aerodrome from December 3, 2021 03.36UTC through 09.36UTC, [dispatched December 3, at 6 pm 3:36 UTC]
EVRA AD WRNG 1 VALID 030336/030936 EVRA-
RIGA AD HVY SN FCST NC=

Warning for Riga aerodrome from December 3, 2021 07.42UTC through 13.00UTC, [dispatched December 3, at 6 pm 3:36 UTC]
EVRA AD WRNG 2 VALID 030742/031300 EVRA-
RIGA AD FBL FZDZ OBS AT 0741Z NC=

The actual weather at Riga International airport and the TREND forecast in METAR code form from December 3, 2021 during the period. 7:50 to 11:20 UTC
METAR EVRA 030750Z 28006KT 240V330 5000 2200 -FZDZ BR BKN005 OVC009
M02/M02 Q0991 RESN NOSIG=

METAR EVRA 030820Z 28006KT 230V330 1100 0900 R36/1200D SN BKN005 OVC011 M02/M03 Q0991 REFZDZ TEMPO 0700=

METAR EVRA 030850Z 28006KT 230V330 1000 0900 R36/1000U SN BKN005 OVC010 M02/M03 Q0992 RESN TEMPO 3000 -SN=

METAR EVRA 030920Z 27007KT 230V310 1200 1000 R36/1400D SN BKN005 OVC012 M02/M03 Q0992 TEMPO 0700 +SN=

METAR EVRA 030950Z 28004KT 210V340 0750 0650 R36/1300N +SN BKN005 OVC009 M02/M03 Q0993 TEMPO 2000 SN=

METAR EVRA 031020Z 28006KT 220V350 0750 0500 R36/1300U +SN BKN005

OVC010 M02/M03 Q0993 TEMPO 2000 SN=

METAR EVRA 031050Z 27007KT 230V320 0750 0700 R36/1400U +SN SCT003 OVC006 M02/M03 Q0993 TEMPO OVC005=

METAR EVRA 031120Z 27006KT 240V310 1200 0800 R36/1000U SN SCT004 OVC007 M02/M03 Q0994 RESN NOSIG=

1.7.2 SNOWTAM

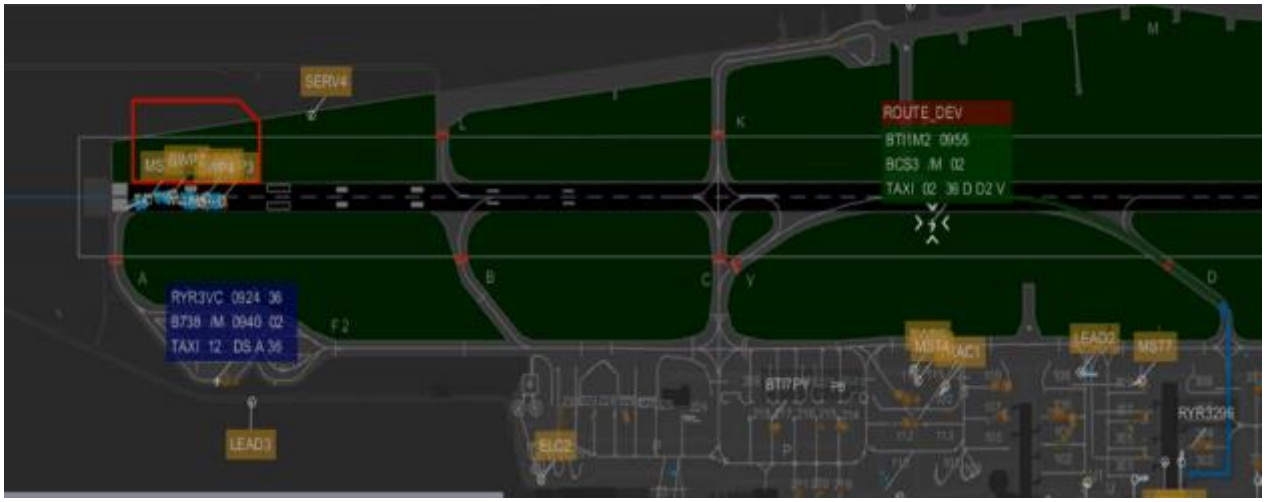
SNOWTAM
SWEV0504 EVRA **12030350**
(SNOWTAM 0504
EVRA
12030350 18 2/2/2 100/100/100 08/08/08 WET SNOW/WET SNOW/WET SNOW 42
RWY 18 SNOW BANK LR21 FM CL. TWY A SNOW BANK. TWY B SNOW BANK. TWY
C SNOW BANK. TWY D SNOW BANK. TWY E SNOW BANK. TWY F SNOW BANK. TWY
G SNOW BANK. TWY K SNOW BANK. TWY Y SNOW BANK. ALL TWYS POOR. ALL
APRONS POOR.)
SNOWTAM (after the occurrence)
SWEV0505 EVRA **12031220**
(SNOWTAM 0505
EVRA
12031220 18 0/0/0 100/100/100 NR/NR/NR COMPACTED SNOW/COMPACTED SNOW/COMPACTED SNOW
RWY 18 SNOW BANK R21 FM CL. RWY 18 SNOW BANK L21 FM CL. RWY 18 ADJ
SNOW BANKS. DRIFTING SNOW. TWY A SNOW BANK. TWY B SNOW BANK. TWY C
SNOW BANK. TWY D SNOW BANK. TWY E SNOW BANK. TWY F SNOW BANK. TWY G
SNOW BANK. TWY K SNOW BANK. TWY Y SNOW BANK. ALL TWYS POOR. ALL
APRONS POOR. DOWNGRADED

NOTAM (after the occurrence)

03 DEC 2021 NOTAM – RWY 18/36 CLSD:
A2084/21 NOTAMN;
A2091/21 NOTAMR A2084/21.

(A2084/21 NOTAMN
Q) EVRR/QMRLC/IV/NBO/A /000/999/5655N02358E005
A) EVRA B) 2112031011 C) 2112031300
E) RWY 18/36 CLSD.)

(A2091/21 NOTAMR A2084/21
Q) EVRR/QMRLC/IV/NBO/A /000/999/5655N02358E005
A) EVRA B) 2112031230 C) 2112031500
E) RWY 18/36 CLSD.)



1.17.3 Broadcasted ATIS information before flight BTI1M2 landed at the Riga airport.

0929 Z.
EXP ILS APCH.
RWY 36.
TRL 70.
RWY 36 COND REPORT AT 0441
RWY COND CODES 2 / 2 / 2
FIRST PART 100 PERCENT 8 MM WET SN
SECOND PART 100 PERCENT 8 MM WET SN
THIRD PART 100 PERCENT 8 MM WET SN
CLR WID 42 M
CHEMICALLY TREATED
GND CTL IS COMBINED WITH TWR ON 118.105.
WIND 270 DEG, 6 KT, VRB BTN 220 AND 320 DEG.
VIS. TDZ 900 M.
RVR TDZ 1200 M MID 1100 M END 1700 M.
WX HVY SN.
CLD BKN 500 FT, OVC 1200 FT.
T MS 2.
DP MS 3.
QNH 0992.

END OF INFO X

0946 Z.
EXP ILS APCH.
RWY 36.
TRL 70.
RWY 36 COND REPORT AT 0441
RWY COND CODES 2 / 2 / 2
FIRST PART 100 PERCENT 8 MM WET SN
SECOND PART 100 PERCENT 8 MM WET SN
THIRD PART 100 PERCENT 8 MM WET SN
CLR WID 42 M
CHEMICALLY TREATED
GND CTL IS COMBINED WITH TWR ON 118.105.
WIND 290 DEG, 5 KT, VRB BTN 210 AND 340 DEG.
VIS. TDZ 900 M.
RVR TDZ 1200 M MID 800 M END 800 M.
WX HVY SN.
CLD BKN 500 FT, OVC 900 FT.
T MS 2.
DP MS 3.
QNH 0993.
END OF INFO Y

0950 Z.
EXP ILS APCH.
RWY 36.
TRL 70.
RWY 36 COND REPORT AT 0441
RWY COND CODES 2 / 2 / 2
FIRST PART 100 PERCENT 8 MM WET SN
SECOND PART 100 PERCENT 8 MM WET SN
THIRD PART 100 PERCENT 8 MM WET SN
CLR WID 42 M
CHEMICALLY TREATED
GND CTL IS COMBINED WITH TWR ON 118.105.
WIND 280 DEG, 6 KT, VRB BTN 210 AND 340 DEG.
VIS. TDZ 800 M.
RVR TDZ 1100 M MID 800 M END 800 M.
WX HVY SN.
CLD BKN 500 FT, OVC 900 FT.
T MS 2.
DP MS 3.
QNH 0993.
TREND TEMPO VIS 2000 M, MOD SN.
END OF INFO Z

1.8 Aids to Navigation

At the time of the incident, Riga International Airport had the following radio navigation and landing aids for runway 36: ILS CAT II, GP, DME and VOR. All navigation aids were functioning at time of the event without any remarks.

Type of aid, MAG VAR, Type of supported OPS (for VOR/ILS/MLS, give declination)	ID	Frequency, Channel number, Service provider	Hours of operation	Position of transmitting antenna coordinates	Elevation of DME transmitting antenna
1	2	3	4	5	6
DVOR/DME 7.0° E/ 2012	RIA	112.050 MHz CH-57Y SJSC "Latvijas gaisa satiksme"	H24	565515.1N 0235754.7E	100 FT
LOC 18 ILS CAT II	IRV	111.100 MHz	H24	565404.3N 0235803.0E	
GP 18		331.700 MHz	H24	565556.3N 0235814.3E	
DME18	IRV	CH - 48X SJSC "Latvijas gaisa satiksme"	H24	565556.3N 0235814.3E	100 FT
LOC 36 ILS CAT II	IRP	108.100 MHz	H24	565624.9N 0235826.2E	
GP 36		334.700 MHz	H24	565433.2N 0235800.6E	
DME36	IRP	CH - 18X SJSC "Latvijas gaisa satiksme"	H24	565433.2N 0235800.6E	100 FT
VOR/DME 7.0° E/2010	TUK	112.300 MHz CH-70X SJSC "Latvijas gaisa satiksme"	H24	565550.1N 0231423.9E	200 FT

The ILS System was fully operational. ATCs and technical staff did not perform any input into the system and the system did not show any failures when landing traffic was provided by ILS approach on RWY36.

1.9 Communications

The radio communications between the crew and the Riga Tower (TWR) on frequency 118.1MHz, the Riga Approach (APP) controller on frequency 129.925MHz, the Riga Ground Controller (GMC) on frequency 118.805 MHz were recorded and made available to the TAIIB for evaluation.

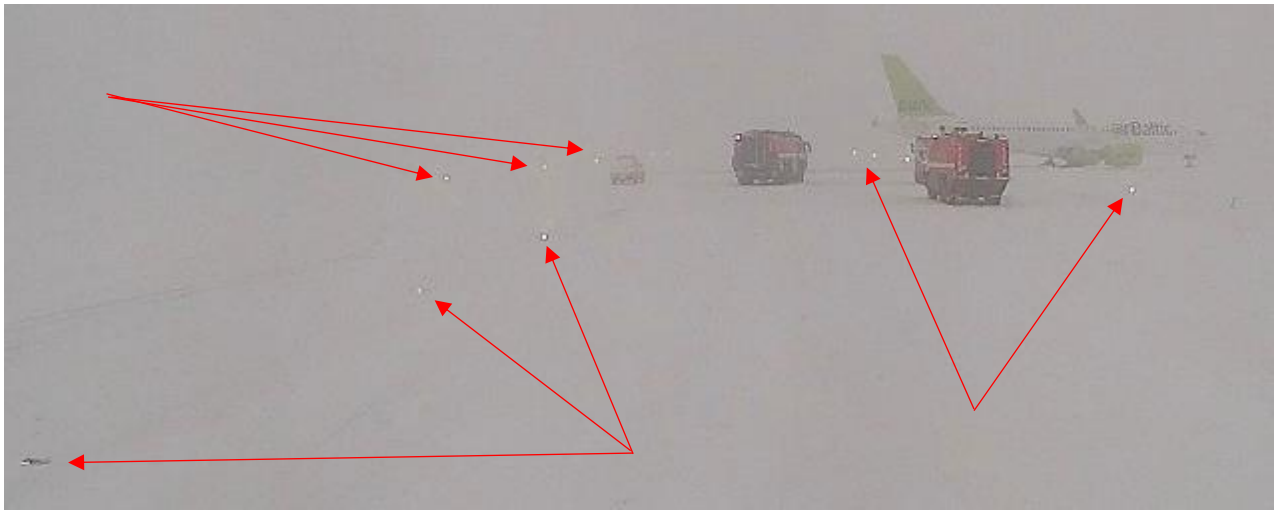
1.10 Aerodrome information

Riga International airport (EVRA) has been approved for VFR and IFR operations. The airport has one runway 18/36. The dimensions of runway 18/36 is 3200 x 45 meters, CONC+ASPH composite construction. The runway used for landing during the serious incident was No 36 (True BRG 005.15°)

Declared Distances

RWY designator	TORA(m)	TODA(m)	ASDA(m)	LDA(m)
36	3200	3200	3200	3200

The AGL (Aerodrome ground lighting) system was fully operational and operated for 100% of its brightness power according to AERODROME MANUAL – PART E11.1 – Operating Instructions for aerodrome lighting system. The AGL was working at the time of the occurrence, the side lights of the runway and centerline lights were not covered with snow, what can be seen in the video from RFFS vehicles approaching the aircraft approximately 4 minutes after the serious incident (see picture 9).



Picture 9: Screenshot of the video recording from the RFFS vehicle

1.11 Flight recorders

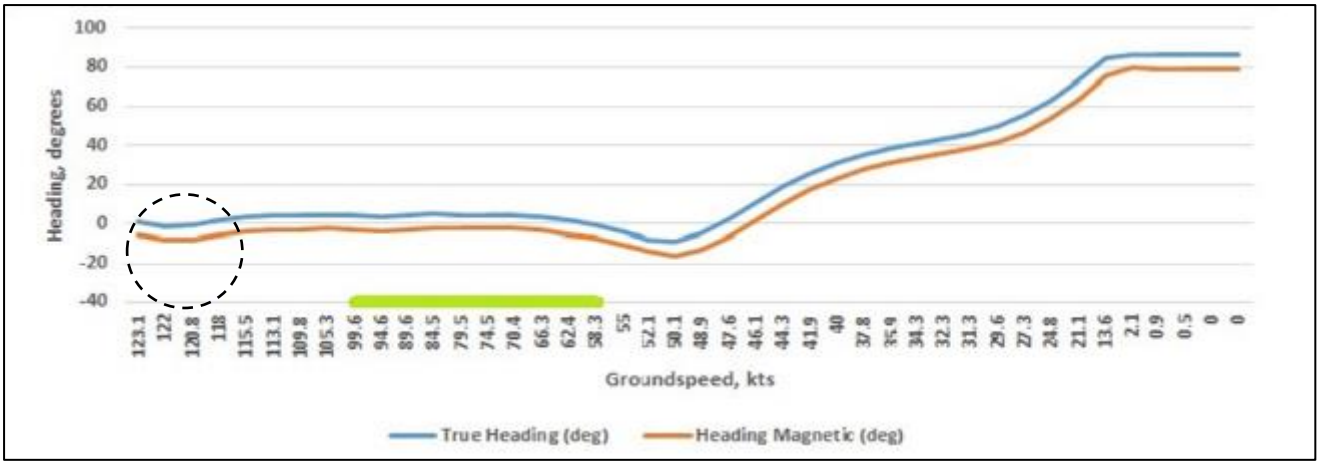
1.11.1 Cockpit Voice Recorder (CVR)

Recordings from the aircraft's CVR (Honeywell SSCVR) were downloaded and the CVR data were of good quality and used in the investigation. The CVR contained 5 hours 48 minutes of recordings.

1.11.2 Flight Data Recorder (FDR)

Recordings from the aircraft's FDR (Honeywell SSFDR) were downloaded and presented as 2D plots. The analysis of the FDR data reveals:

The aircraft touchdown executed within the touchdown zone with vertical acceleration is recorded at max 1.7G. The nose wheel on the ground is recorded 1 sec after the main wheels contact with 122kts groundspeed on the centerline of the runway. Initially, during the landing roll, the aircraft deviated slightly right from the centerline.



Picture 10: Fragment from FDR data plots of the aircraft heading

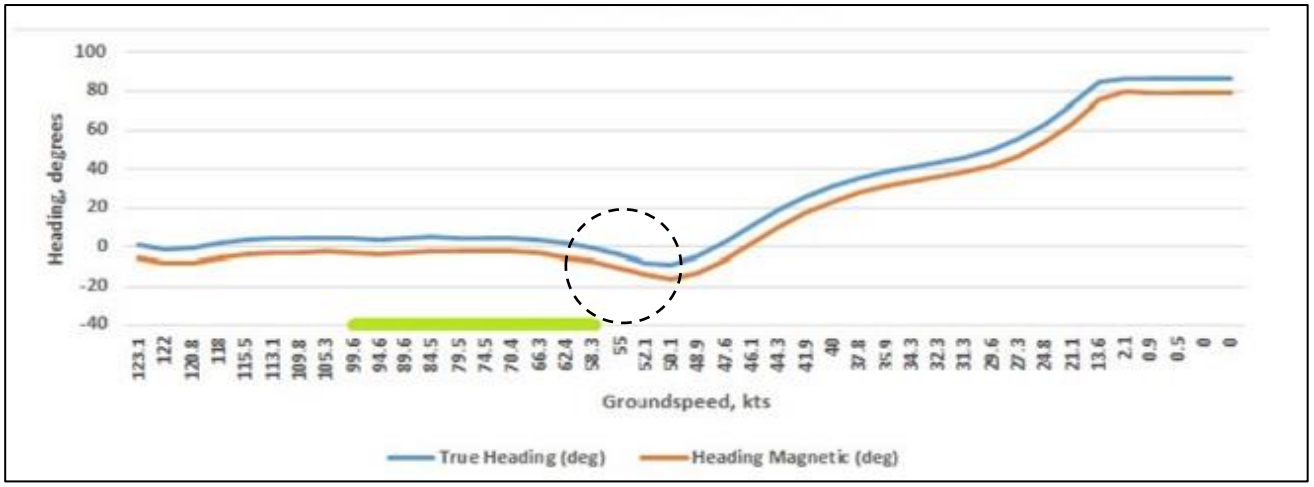
The spoilers were deployed, the autobrakes were used in "MID" position for landing [calculated after meteorological information date received from the TOWER ATC].

Initially the aircraft slight right deviation from the centerline was compensated by using of the left rudder inputs. The aircraft returned to the centerline.

Picture 11: Fragment from FDR data plots of rudder pedal

The left rudder input was kept within approx. 0,2 -1,5 degrees until the aircraft deviated noticeably to the left, reaching a maximum distance of 15 meters to the left from the centerline.

While the autobrakes were still in use at ~66kts groundspeed the heading changed to the 13 degrees to the left. In the FDR the aircraft heading is recorded at 344 degrees while the autobrakes turned off at a groundspeed of 50kts.



Picture 12: Fragment from FDR data plots of the aircraft heading

The Autothrottle was disconnected 3 sec after the touchdown at the 118kts groundspeed (see picture 13: 1). The thrust reversers [TR] were deployed at 105kts groundspeed 7 sec after the touching of the landing gears on the runway (see picture 13: 2).

Picture 13: Fragment from FDR data plots of thrust levers

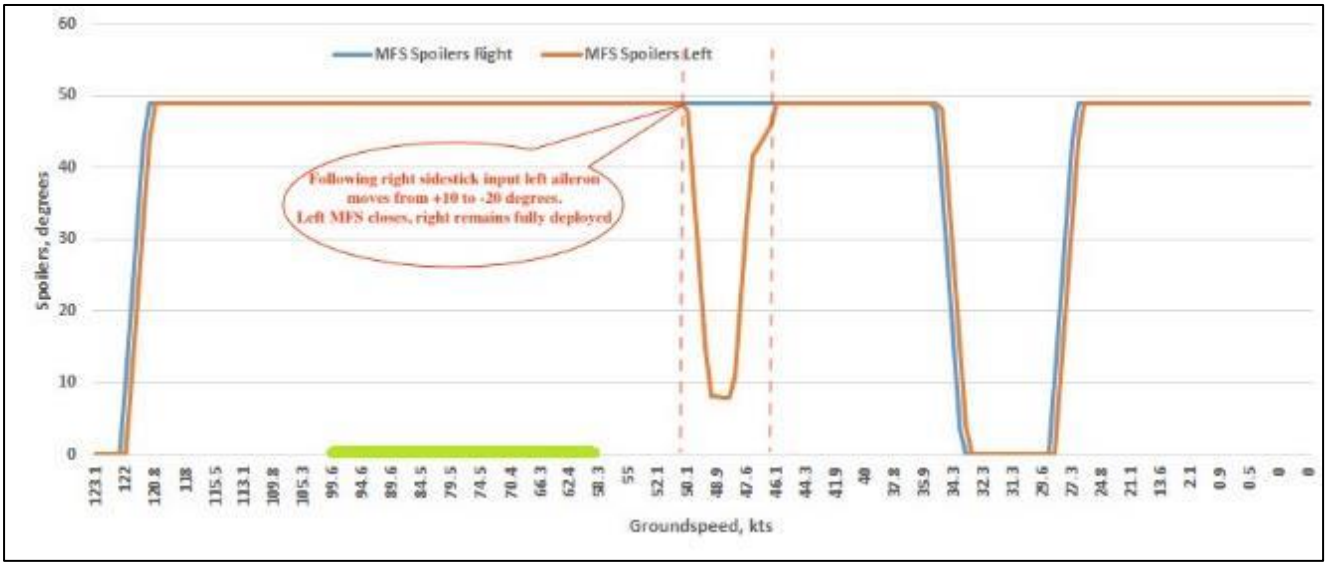
The N_1 torque of engines increased to 39% recorded during TRs deployment (see picture 14: 1). The TRs were in use for 9 seconds and stowed at 58.3kts groundspeed together with the autobrake setting deactivation (see picture 14: 2).

Picture 14: Fragment from FDR data plots of N_1

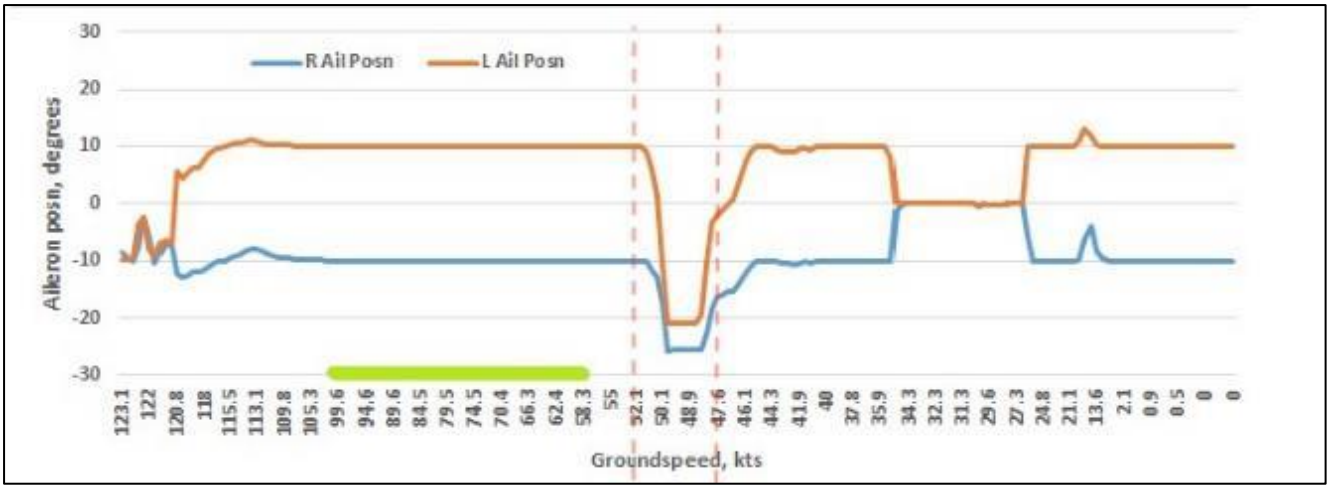
Before the TR's disconnection at 62.4.3kts groundspeed the right brake pedal was rapidly applied up to 100% (that caused an autobrake disconnection) where the left brake pedal recorded at 0% brake application and after ~7 sec the right brake pedal was released. Simultaneously with the right brake pedal application the left rudder pedal was applied from 0.5 degrees to 3.5 degrees.

This pilot's actions possibly caused that the aircraft started to rapidly veer to the right at the groundspeed of approx. 50kts.

Simultaneously with the left rudder and the right brake application the right sidestick input was detected, which commanded the left MFS spoiler to retract where the right MFS spoiler remained fully deployed.

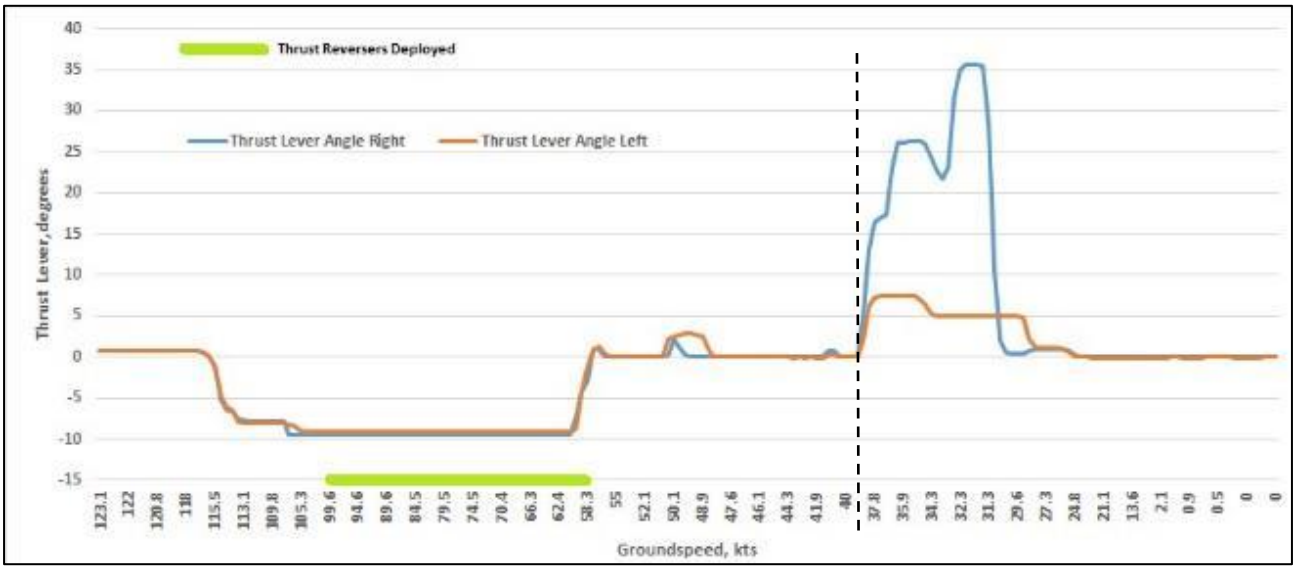


Picture 15: Fragment from FDR data plots of spoilers



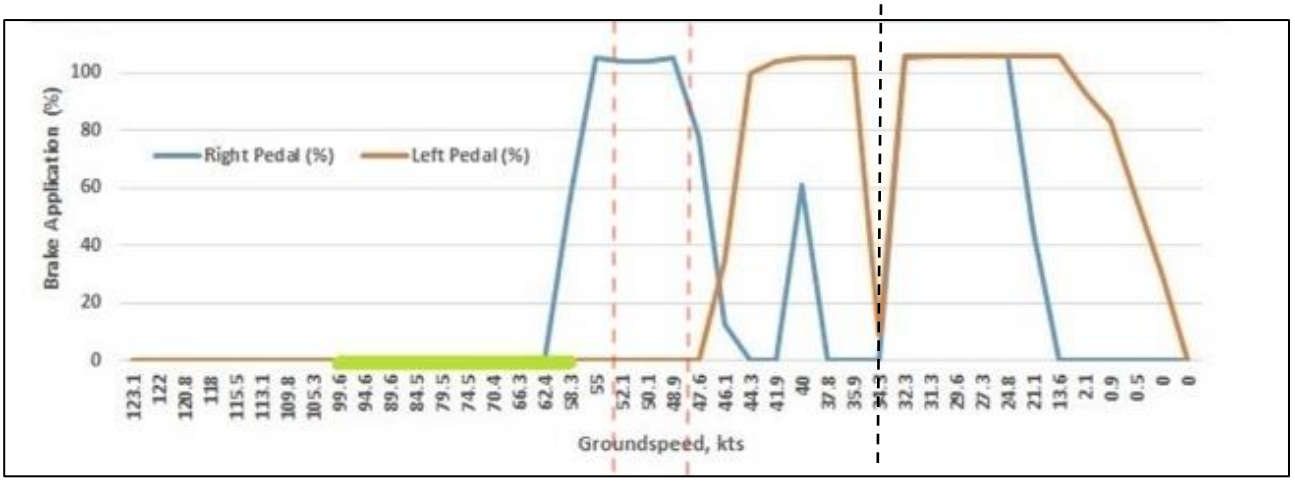
Picture 16: Fragment from FDR data plots of aileron position

At a groundspeed of 39kts and the aircraft heading ~30 degrees right from the RWY centerline the pilot attempted to use the thrust levers to prevent the aircraft drifting to the right and skidding off from the RWY by increasing power on both the left (7.5 degrees) and the right (35.7 degrees) engines; as a result, the spoilers were retracted.



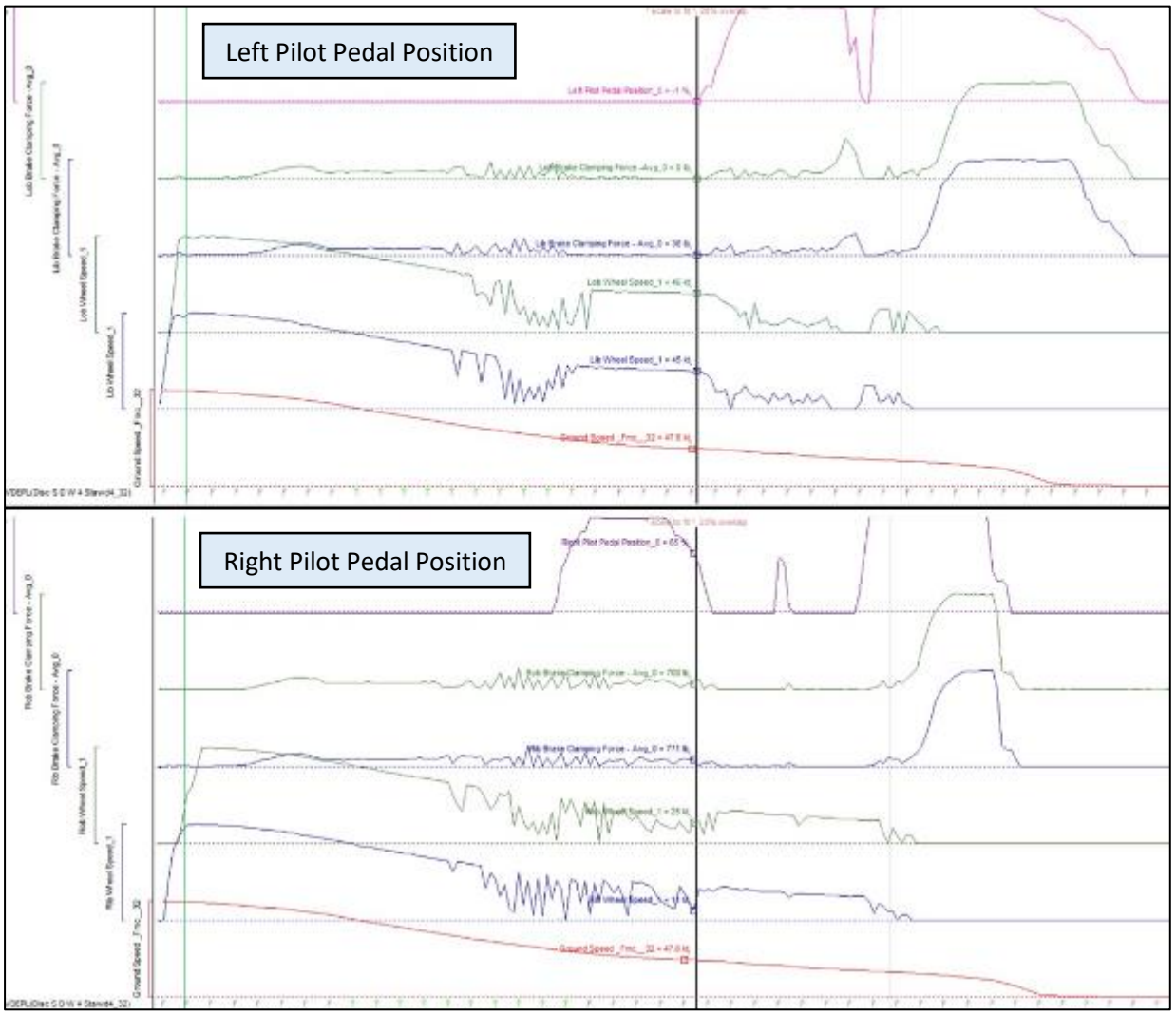
Picture 17: Fragment from FDR data plots of thrust levers

At a groundspeed of 34kts a symmetric brakes application was recorded while the aircraft continued to skid to the right and left the RWY at a groundspeed of ~30kts with rapid spikes in the lateral and longitudinal acceleration at ~0.71G and ~0.79G. The aircraft stopped finally on a heading 79 degrees.



Picture 18: Fragment from FDR data plots of brake application

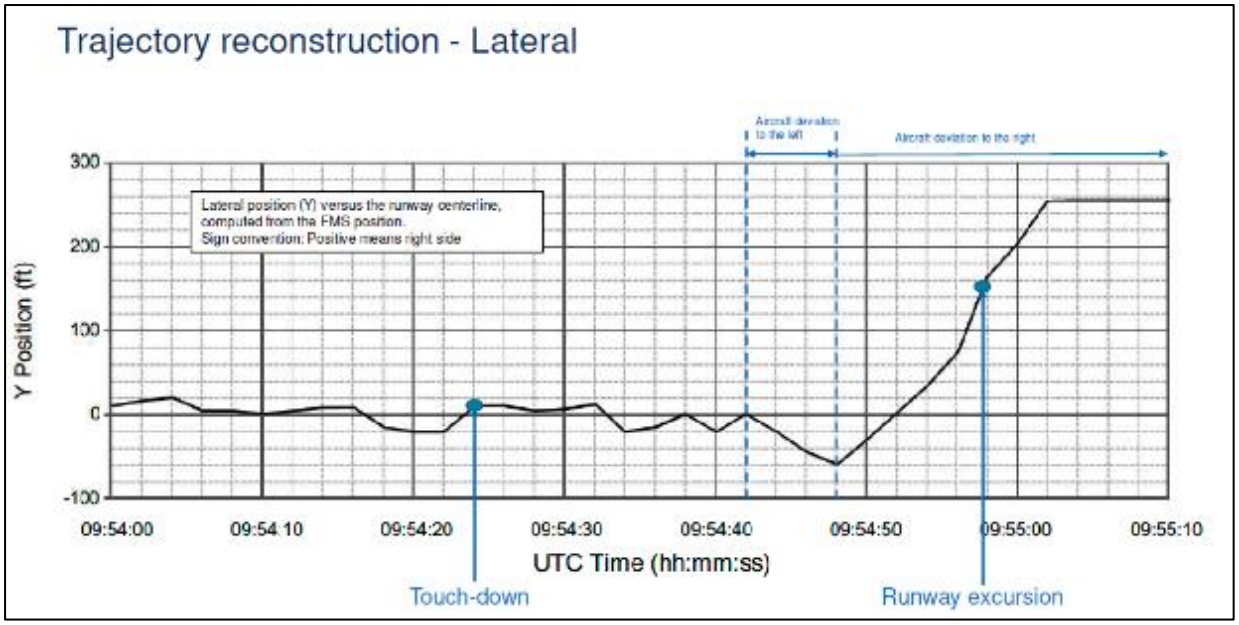
A slippery runway condition with anti-skid activation and uneven brake clamping force and wheels blocking were recorded during the braking process until the aircraft left the runway's paved surface (see picture 19).

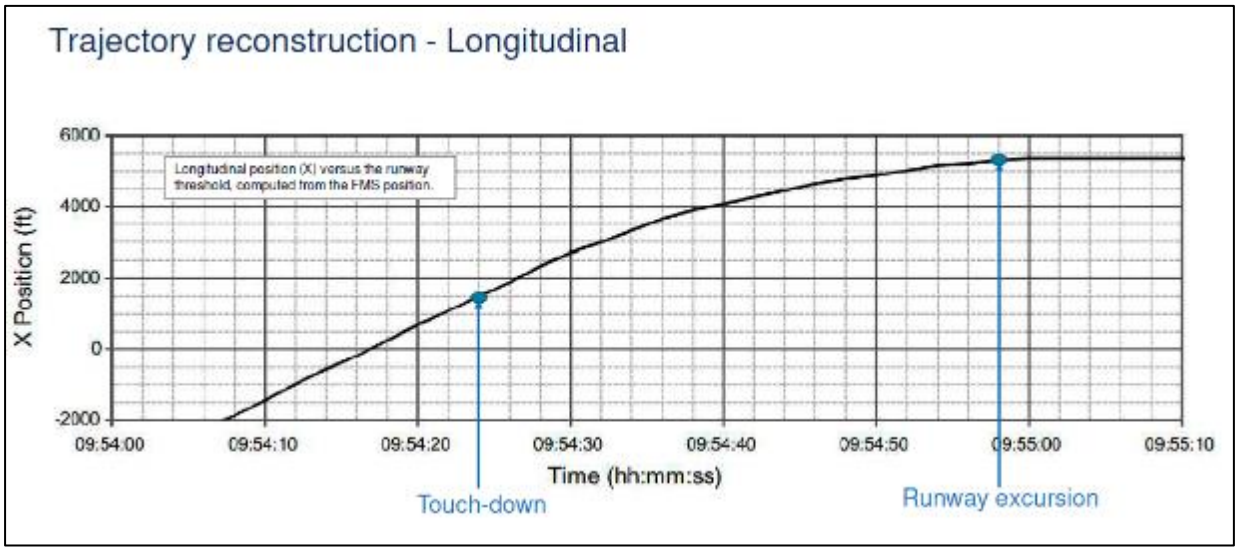


Picture 19: FDM plots of the aircraft brake application

1.11.2.1 Preliminary analysis of FDR data and simulation from Airbus Company on January 24, 2022

Using the FDR data of the aircraft, the aircraft manufacturer prepared a ground track preliminary analysis. The results indicate:





Runway conditions assessment

The Operational Landing Performance was run on the engineering simulation tool and compared to the flight data of the event:

• Two sets of data were run:

– Assuming the use of 2 Thrust Reversers at Max Reverse Thrust (ref. TR2)

– Assuming no Thrust Reversers (ref. TR0)

Note: The flight data of the subject event shows that the TLA angle was -10deg during landing, meaning that the Thrust Reverser was between Idle Reverse Thrust and Max Reverse Thrust

– The Idle Reverse Thrust is at a TLA of -6deg

– The Max Reverse Thrust is at a TLA of -18deg

• Simulation assumptions for both sets of data:

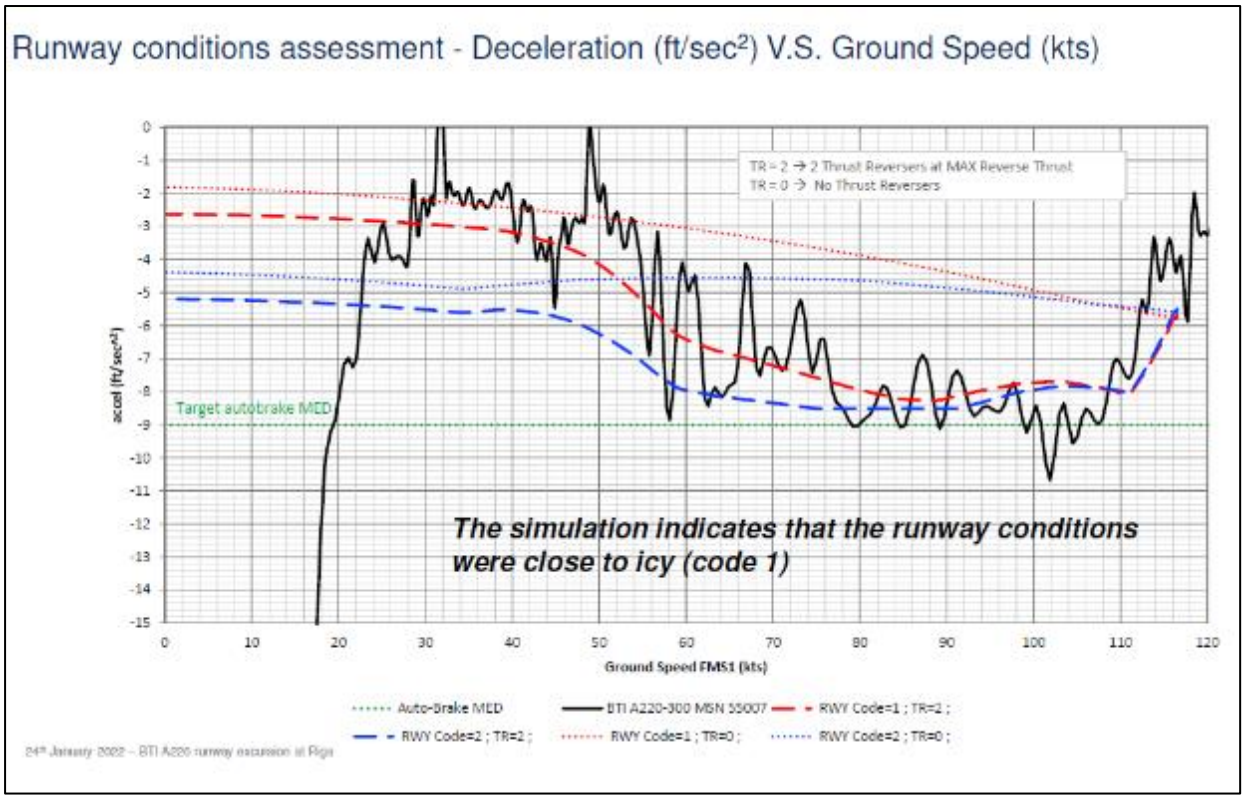
– Weight: 99840lbs

– Pressure altitude: 580ft

– OAT: -2deg

– Autobrake: Medium

– Runway codes: 1, 2, 3 and 4



Summary

• On 03 December 2021 at 10:00am, during landing at Riga airport RWY 36, the aircraft slid off the runway

• The flight data analysis has highlighted:

– A sliding runway with wheels skidding and anti-skid activity

– A left departure caused by a left wind gradient, counteracted by full right brake and rudder pedal. The aircraft then started to deviate right

– No braking system issue

• The runway condition assessment indicates that the runway conditions were close to icy (code “1”)

– Wheels skidding and high anti-skid activity

– According to ATIS, the runway conditions code was “2”

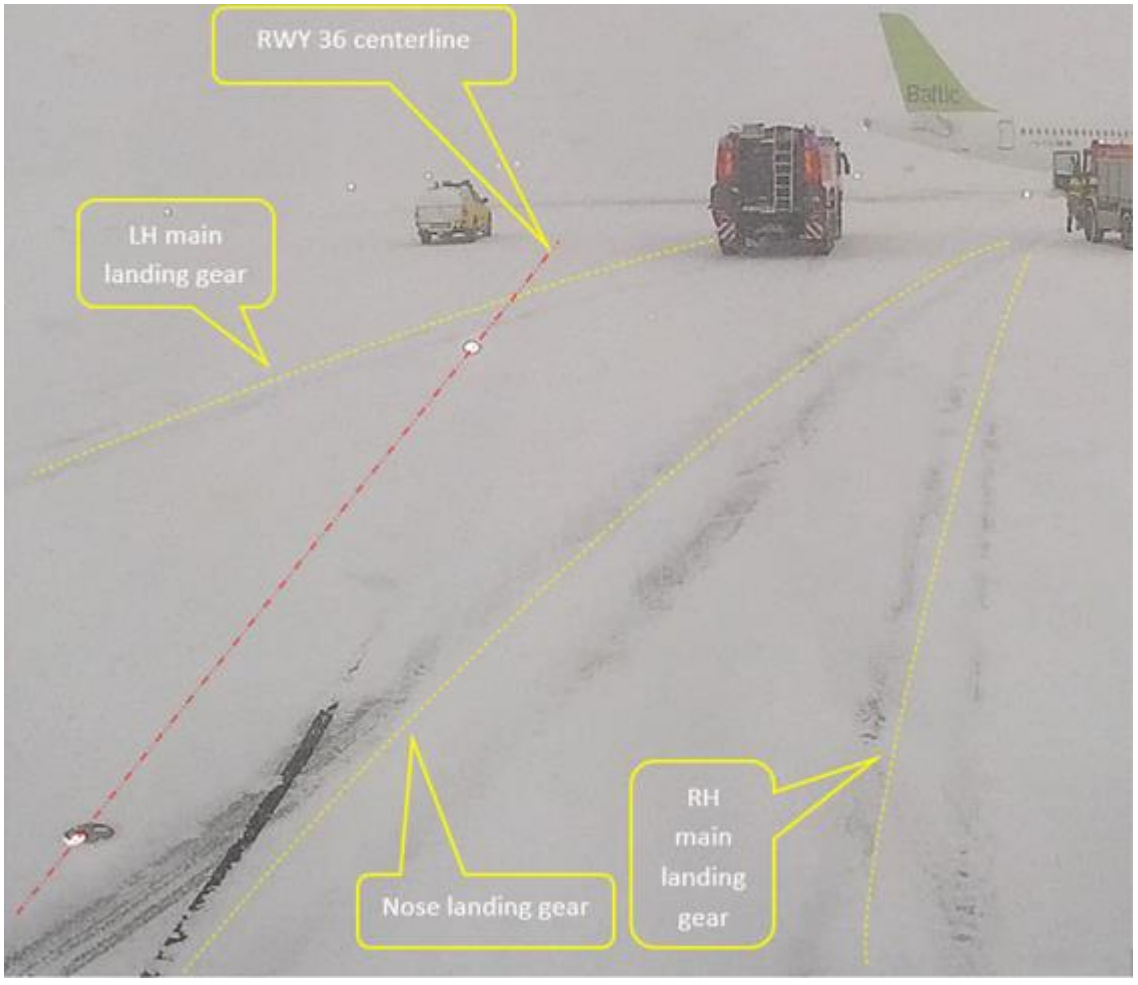
• The wind assessment indicates a left crosswind, of about 09kts gusting at 16kt

– According to ATIS, there was a left crosswind of 290deg / 05kt

Conclusion. The preliminary FDR data analysis and the simulation by the Airbus Company points to the same facts mentioned in the Investigation Report of the TAIIB and supports the investigators' conclusions except for the unconfirmed information about the wind gusts during the landing of the aircraft, which doesn’t coincide with the TOWER ATC report. According to the airport meteorological information, the crosswind at the time of landing was 278/4.54kts.

1.12 Wreckage and impact information

At 150-200 m, before the aircraft left the paved surface of the runway and stopped, the tire marks of the aircraft indicated a crossing of the trajectory of the nose landing gear and the right main landing gear, after the nose landing gear deviated to the right from the runway centerline and the aircraft began to move perpendicularly to the runway (see picture 20a and 20b).



Picture 20a: The aircraft tires marks were visible on the runway

Picture 20b: The aircraft tires marks were visible on the runway

1.13 Medical and pathological information

The State police attended the flight crew in the hospital, where blood samples were taken from the Pilot and the First Officer to reveal any presence of narcotics or medicines. No such substances were found in the screening.

1.14 Fire

There was no fire before or after the occurrence.

1.15 Survival aspects

At **09.55.04** when the aircraft stopped, the TOWER ATC called the flight BTI1M2 and the pilot reported at once "*we are on right side of RWY*", "*And also, we need push back*". The pilot did not declare an emergency state on board. The pilot did not request any emergency services to be alerted. The FO of the aircraft communicated with the ATC by radio. After that, there was no communication of the aircraft crew with the ATC and the RFFS.

At **9:56** the message "*ACCIDENT A220-300 airBaltic, ran off the RWY, 44 people on board*" appeared on the TEAS screen located at the RFFS station, the buzzer was working, but the location of the serious incident was not reflected.

At **9:58** the RFFS received a clarification from TEAS about the incident site and the RFFS vehicles left the RFFS station. The delay of the RFFS departure from the fire station for 2 minutes occurred due to the failing information about the position of the target.

At **10.00** the RFFS arrived at the aircraft but the passenger boarding ladder could not be placed at the aircraft due to snow.

At about **10.24** the aircraft pilots received information via intercom from the cabin crew

that the firemen attached the boarding ladder to the aircraft left back (L2) door. The firemen were knocking at the door and without any further feedback or communication with the aircraft crew the firemen opened the door from outside.

At **10.29** the passengers disembarked from the aircraft through the L2 door.

At **10.38** the passenger evacuation completed. The passengers from the flight BTI1M2 were delivered to the airport's terminal by buses.

At **11.12** the aircraft unloading (baggage, cargo, and mail) was completed.

1.16 Tests and research

1.16.1 Highlights

The data from the CVR were synchronized with those from the FDR and the data collected on the runway.

1.16.2 Flight simulation

A series of simulator tests was conducted to support the investigation of this serious incident.

The flight situation simulation of the serious incident was simulated at the airBaltic training centre using an Airbus A220 (300/100) Full Flight Simulator CAE7000XR series FFS.

On August 28, 2022, three inspector-pilots from the Latvian CAA and two TAIIB representatives, as well as an airBaltic company's pilot-instructor, participated in the flight simulation of December 3, 2021 (see picture 21).

Picture 21: The simulating process of the flight situation on the Airbus A220 full flight simulator

The purpose of the experiment was to replicate the flight conditions and pilot actions on the day of the occurrence and to define likely causes of the serious incident. It was not possible to reconstruct completely the condition of the runway on the simulator, but the settings were as close as much as possible to what they were at the time of the occurrence.

It is not possible to set on the simulator different thicknesses of the contamination on different parts of the runway, as it was on the occurrence day.

The simulator settings were set so that the runway was covered with ice 100% (RWYCC 1/1/1). The simulated runway condition assessment performed by aircraft manufacturer Airbus indicates that the runway conditions were close to icy (RWYCC 1/1/1). Snowfall, crosswind, and other settings were according to the moment of the occurrence. Each of the pilots made 3-4 landings in the conditions that were at the time of the occurrence. All landings were successful and it was possible to control the aircraft to keep on the runway and to stop successfully.

Also, some landing attempts were made with the set of maximum allowable crosswind value for this runway condition of 10kts, in accordance with Item 1.6 of Part B of the Airline Operations Manual.

Wind Limitations in accordance with Operator's OM Part B

Tailwind Conditions:
The maximum tailwind component approved for landing is **10 kts.**
Crosswind Conditions (Landing):
The maximum crosswind component approved for landing is **29 kts**.

Runway CC	**Equivalent Pilot Reported Braking Action / FC**	**Maximum Crosswind Component**
4	Good to Medium / 0.39 – 0.36	27 kts
3	Medium / 0.35 – 0.30	20 kts
2	Medium to Poor / 0.29 – 0.25	10 kts
1	Poor / ≤ 0.25	10 kts
0	NIL	NIL

Several landings were also made in crosswinds of **15 kts** perpendicularly to the runway (see picture 22). All landings were successful.

Picture 22: Setting of maximum data in the simulator for landing

There was an attempt to simulate a landing repeating the actions of the pilots by the flight controls according to the FDM data during the landing manoeuvre; the flight result fully reflected what happened in the serious incident.

1.17 Organizational and management information

1.17.1 Riga International Airport – Operation and Service in winter

The Operating Instructions of Riga Airport - LV 1119 I (further- Operating Instructions) (version 37, valid from 04.11.2021) LEI E9 provide the runway surface assessment for the Riga International Airport in accordance with EASA Executive Director Decision 2021/003/R of 4 March, 2021 (Amendment 5 to the Acceptable Means of Compliance and Guidance Material to Commission Regulation (EU) No 139/2014), Procedures for Air Navigation Services (PANS) - Aerodromes (Doc 9981), ICAO Global Reporting Format for runway surface conditions (GRF).

The Global Reporting Format for the condition of the runway surface at the Riga Airport was introduced from 04.11.2021.

The Operating Instructions are a new approach to the Assessment, Measurement and Reporting of the Runway Surface Condition which were developed and introduced at the Riga Airport in accordance with ICAO Circular 355 (AN/211) since November 4, 2021 and the Riga Airport staff started trainings according to the program "Assessment of the Runway Surface Condition - PD 0671 P" (version 01, valid from 02.11.2021).

The Operating Instructions' section E9, subsection E9.1 defines that the Airport Duty Engineer (further – ADE) must inspect the runway and taxiways at least 6 times a day (24 h). But in the Operating Instructions' subsection E9.2 item 4.5 it is determined that

the runway surface condition assessment is based on the Runway Condition Assessment Matrix (RCAM) table based on factors directly related to an aircraft braking performance in correlation with the runway surface contaminants and a certain temperature. The table E9-3 "Runway Condition Assessment Matrix (RCAM)" also includes the evaluation criteria as well as the downgrade evaluation criteria of the Riga Airport runway (see picture 23).

RCAM:

Virsmas stāvoklis, kontaminants	RWYCC	Pilota ziņojums (lai ↓ vai ↑*)
DRY, WET un citi ≤ 25%	6	-
WET, FROST, SLUSH, DRY SNOW, WET SNOW (≤3 mm)	5	GOOD ↓
COMPACTED SNOW (kad OAT ≤ -15°C)	4	GOOD TO MEDIUM ↓
DRY/WET SNOW ON TOP OF COMPACTED SNOW, DRY SNOW, WET SNOW (>3 mm) SLIPPERY WET, COMPACTED SNOW (kad OAT > -15°C)	3	MEDIUM ↓
STANDING WATER, SLUSH (>3mm)	2	MEDIUM TO POOR ↓ vai ↑
ICE	1	POOR ↓ vai ↑
WET ICE, WATER ON TOP OF COMPACTED SNOW, DRY SNOW vai WET SNOW ON TOP OF ICE	0	LESS THAN POOR ↑

* - paaugstināt var tikai RWYCC 0, 1 vai 2 un ne augstāk par 3. ** - ja izdots NOTAM.

Aizpildīšanas secība: 1) identificē kontaminanta pārklājumu %, 2) identificē kontaminanta tipu virs 25%, 3) identificē kontaminanta dziļumu mm, 4) nosaki RWYCC

	1.trešdaļa *FIRST PART*	2.trešdaļa *SECOND PART*	3.trešdaļa *THIRD PART*
4) RWYCC **CODE**			
	☐↓ *Downgraded* ☐↑ *Upgraded*	☐↓ *Downgraded* ☐↑ *Upgraded*	☐↓ *Downgraded* ☐↑ *Upgraded*
1) ***COVERAGE*** (**Pārklājums %**)	☐ *25* ☐ *50* ☐ *75* ☐ *100* ☐ *NR*	☐ *25* ☐ *50* ☐ *75* ☐ *100* ☐ *NR*	☐ *25* ☐ *50* ☐ *75* ☐ *100* ☐ *NR*

Pārklājumam zem 10% atzīmē RCR nav nepieciešams, izņemot noslēguma RCR, norādot DRY, kad kontaminants izkusis
Pārklājumam no 10% līdz 25% atzīmē RWYCC 6 un pārklājumu 25%, pārklājumam virs 25% atzīmē RWYCC pēc RCAM un faktisko pārklājumu %.

3) ***DEPTH*** (**Dziļums, mm**)	☐ ____ ☐ *NR*	☐ ____ ☐ *NR*	☐ ___ ☐ *NR*

Dziļumu norāda tikai SLUSH (≥3mm), DRY SNOW(≥3mm), WET SNOW(≥3mm) vai STANDING WATER (≥4mm)

Picture 23: The Riga Airport Runway Condition Assessment Matrix (RCAM) for winter

In the Item 4 of the Operating Instructions, it is described in detail how to conduct a runway surface condition assessment and what is to do in the case of "*If the last runway condition report (RCR) reported a contaminated or slippery wet runway (i.e., a condition description other than DRY or WET)".* In this case *"the ADE should perform the runway surface condition assessment at the beginning of each duty to be able to verify physically the actual situation*".
The section E9.1 sub-section "*Reporting the runway condition to the TWR (Riga Tower ATC) dispatcher*" describes in detail and with examples the procedure for reporting the runway surface condition and includes examples of reporting samples.

Actions of the responsible services of the Riga Airport on the day of the occurrence:

At **5.00** (UTC) the ADE took up the duty and started the organizing of the snow removal process on the runway. From the beginning of the shift and until **11:21** the ADE did not publish any RCR. During this time SNOWTAM was not updated. The last RCR was issued by the previous ADE at **3.51**.

Due to extremely adverse weather the snow removal operations were frequently conducted on the RWY. The runway surface was contaminated by 8 mm of wet snow and also there were snowbanks on the runway 21 meters to the left and right from the runway centreline. The runway operational (cleared) width was 42 meters due to the snowbanks.
According to the previous RCRs the runway condition codes were changed from "4" to "2" during ~3 hours. It lets conclude, the weather became worse, that means the runway contaminate changed too, presumably from "WET SNOW" to "COMPACTED SNOW" (closely to type "ICE"). Despite the change of the contaminant type the ADE, involved in the serious incident, did not update the RCR, which could have affected the operations of the aircraft pilots during landing.
At **9.39.45** (16 minutes before the occurrence) the pilot of the flight BTI3G2 gave a message to the TWR dispatcher after landing: "*Braking action is* ***very poor****… on the… on the runway*".

At **9.39.54** the ADE confirmed to the TWR dispatcher, that he had heard the information from the pilot of the flight BTI3G2 on the radio: "*Braking action is* ***very poor*** *on the runway*".

At **9.44** the ADE said on the aerodrome internal radio channel 923: "*There is bad braking on the runway, but there is nothing more we can do*".

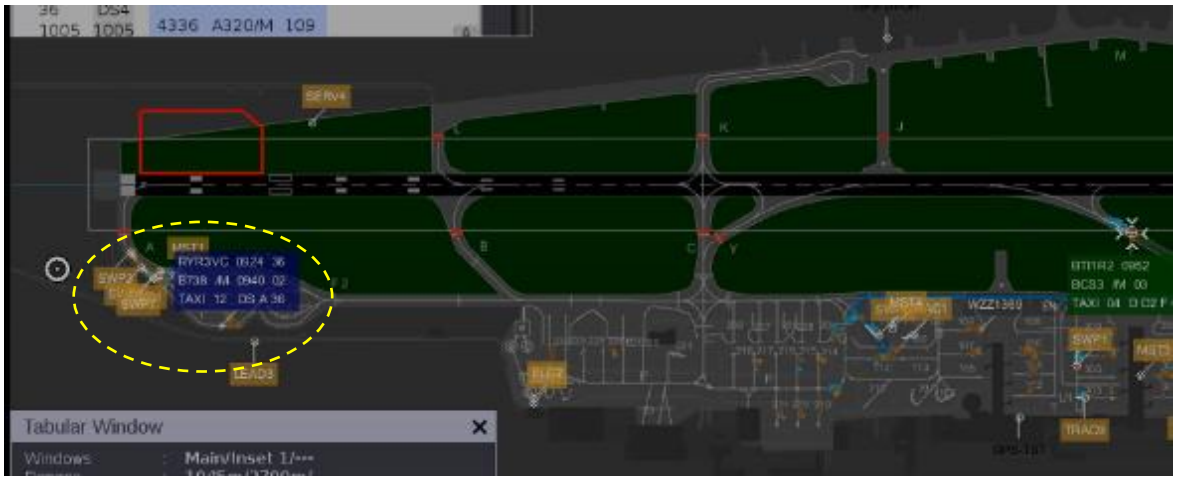
At **09.48** the ADE instructed the GROUND ATC to warn pilots that the taxiways' conditions are very poor, very slippery. He also reported that he will try to find time to issue a new SNOWTAM because there are changes in the RWY condition.

At **09.49** another airBaltic flight BTI1R2 landed. The controller instructed the pilots to be careful while taxiing and warned them about the condition of the taxiway and the apron. The pilot responded that "*they feel it*" (the aircraft was still on the RWY approaching the exit TWY "D").

Note: *From 5:00 a.m. the runway was periodically cleaned by the snow cleaning vehicles and vacated immediately after each snow removal. Between 06:00 and 07:50 the runway was cleaned several times continuously and then the runway was vacated for airport traffic (3 departures and 7 arrivals during this period). From 7:50 a.m. and till the serious incident the runway was cleaned periodically and vacated again after each runway cleaning (no one took off, 7 flights arrived during this time period).*

Neither Riga airport nor TOWER ATC procedures require that the runway cleaning activities take precedence over the airport traffic during a heavy snowfall.

At **9.49.54** the snow cleaning vehicles arrived at the taxiway "A" turn to clean the sections 3 and 2 of the RWY36; the vehicles stopped and waited for the landing of the flight BTI1M2 (see picture 24).

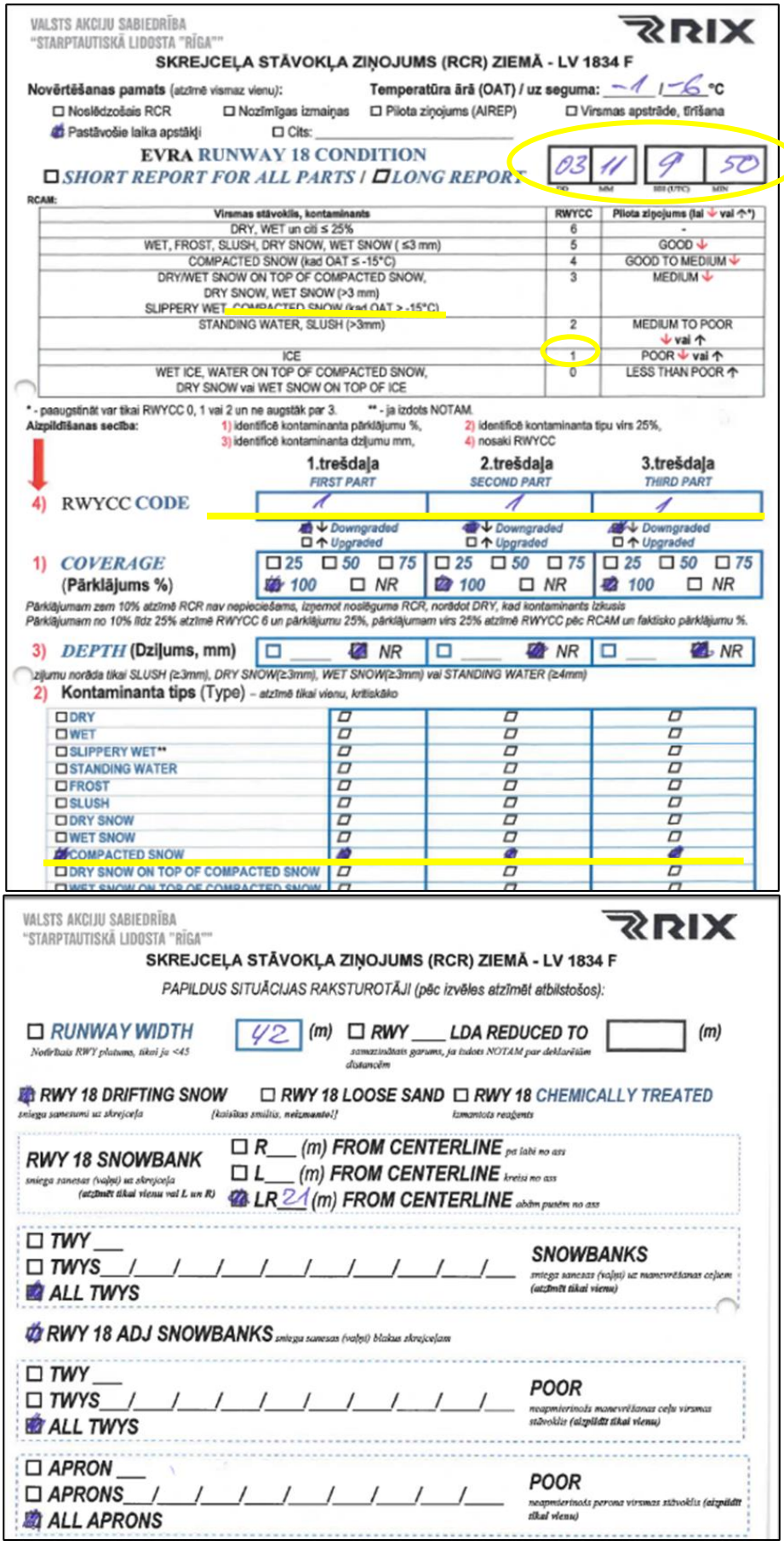


Picture 24: Screenshot of the A-SMGCS TWR

Shortly before **9:50** (5 minutes before the occurrence), the ADE determined that the runway surface condition was below the code "2", so the ADE completed the RCR report form (see picture 25) but did not provide the information about the runway condition to the TWR ATC as it is specified in the “Operating Instructions of Riga Airport - LV 1119 I”.

According to the new drafted RCR:

- the RWYCC code was "1";
- the air temperature was -1^0 C and the surface temperature was -6^0 C degrees;
- the runway coverage of all three parts was 100%;
- the depth of the runway coverage was not specified;
- the type of contaminant was compacted snow (critical);
- the RWY width - 42m;
- snowbanks - 21m from the centerline of the RWY.



VALSTS AKCIJU SABIEDRĪBA
"STARPTAUTISKĀ LIDOSTA "RĪGA""

RIX

SKREJCEĻA STĀVOKĻA ZIŅOJUMS (RCR) ZIEMĀ - LV 1834 F

Novērtēšanas pamats (atzīmē vismaz vienu): Temperatūra ārā (OAT) / uz seguma: -1 / -6 °C

☐ Noslīdzošais RCR ☐ Nozīmīgas izmaiņas ☐ Pilota ziņojums (AIREP) ☐ Virsmas apstrāde, tīrīšana

☑ Pastāvošie laika apstākļi ☐ Cits: _____

EVRA RUNWAY 18 CONDITION

☐ SHORT REPORT FOR ALL PARTS / ☐ LONG REPORT

03 | 11 | 9 | 50

DD | MM | HH (UTC) | MIN

RCAM:

Virsmas stāvoklis, kontaminants	RWYCC	Pilota ziņojums (lai ↓ vai ↑*)
DRY, WET un citi ≤ 25%	6	-
WET, FROST, SLUSH, DRY SNOW, WET SNOW (≤3 mm)	5	GOOD ↓
COMPACTED SNOW (kad OAT ≤ -15°C)	4	GOOD TO MEDIUM ↓
DRY/WET SNOW ON TOP OF COMPACTED SNOW, DRY SNOW, WET SNOW (>3 mm) SLIPPERY WET, COMPACTED SNOW (kad OAT > -15°C)	3	MEDIUM ↓
STANDING WATER, SLUSH (>3mm)	2	MEDIUM TO POOR ↓ vai ↑
ICE	1	POOR ↓ vai ↑
WET ICE, WATER ON TOP OF COMPACTED SNOW, DRY SNOW vai WET SNOW ON TOP OF ICE	0	LESS THAN POOR ↑

* - paaugstināt var tikai RWYCC 0, 1 vai 2 un ne augstāk par 3. ** - ja izdots NOTAM.

Aizpildīšanas secība: 1) identificē kontaminanta pārklājumu %, 2) identificē kontaminanta tipu virs 25%, 3) identificē kontaminanta dziļumu mm, 4) nosaki RWYCC

	1.trešdaļa FIRST PART	2.trešdaļa SECOND PART	3.trešdaļa THIRD PART
4) RWYCC CODE	1	1	1
	☑ ↓ Downgraded ☐ ↑ Upgraded	☑ ↓ Downgraded ☐ ↑ Upgraded	☑ ↓ Downgraded ☐ ↑ Upgraded
1) COVERAGE (Pārklājums %)	☐ 25 ☐ 50 ☐ 75 ☑ 100 ☐ NR	☐ 25 ☐ 50 ☐ 75 ☑ 100 ☐ NR	☐ 25 ☐ 50 ☐ 75 ☑ 100 ☐ NR
3) DEPTH (Dziļums, mm)	☐ ____ ☑ NR	☐ ____ ☑ NR	☐ ____ ☑ NR

Pārklājumam zem 10% atzīmē RCR nav nepieciešams, izņemot nosīdzumā RCR, norādot DRY, kad kontaminants izkusis
Pārklājumam no 10% līdz 25% atzīmē RWYCC 6 un pārklājumu 25%, pārklājumam virs 25% atzīmē RWYCC pēc RCAM un faktisko pārklājumu %.

dziļumu norāda tikai SLUSH (≥3mm), DRY SNOW(≥3mm), WET SNOW(≥3mm) vai STANDING WATER (≥4mm)

2) Kontaminanta tips (Type) – atzīmē tikai vienu, kritiskāko

☐ DRY	☐	☐	☐
☐ WET	☐	☐	☐
☐ SLIPPERY WET**	☐	☐	☐
☐ STANDING WATER	☐	☐	☐
☐ FROST	☐	☐	☐
☐ SLUSH	☐	☐	☐
☐ DRY SNOW	☐	☐	☐
☐ WET SNOW	☐	☐	☐
☑ COMPACTED SNOW	☑	☑	☑
☐ DRY SNOW ON TOP OF COMPACTED SNOW	☐	☐	☐
☐ WET SNOW ON TOP OF COMPACTED SNOW	☐	☐	☐

VALSTS AKCIJU SABIEDRĪBA
"STARPTAUTISKĀ LIDOSTA "RĪGA""

RIX

SKREJCEĻA STĀVOKĻA ZIŅOJUMS (RCR) ZIEMĀ - LV 1834 F

PAPILDUS SITUĀCIJAS RAKSTUROTĀJI (pēc izvēles atzīmēt atbilstošos):

☐ RUNWAY WIDTH 42 (m) ☐ RWY ___ LDA REDUCED TO ___ (m)
Notīrītais RWY platums, tikai ja <45 — samazinātais garums, ja izdots NOTAM par deklarētām distancēm

☑ RWY 18 DRIFTING SNOW — sniega sanesumi uz skrejceļa
☐ RWY 18 LOOSE SAND — [kaisītas smiltis, neizmanto!]
☐ RWY 18 CHEMICALLY TREATED — izmantots reaģents

RWY 18 SNOWBANK — sniega sanesas (valņi) uz skrejceļa (atzīmēt tikai vienu vai L un R)
☐ R___ (m) FROM CENTERLINE pa labi no ass
☐ L___ (m) FROM CENTERLINE kreisi no ass
☑ LR 21 (m) FROM CENTERLINE abām pusēm no ass

☐ TWY ___
☐ TWYS___/___/___/___/___/___/___/___/___/___
☑ ALL TWYS

SNOWBANKS — sniega sanesas (valņi) uz manevrēšanas ceļiem (atzīmēt tikai vienu)

☑ RWY 18 ADJ SNOWBANKS sniega sanesas (valņi) blakus skrejceļam

☐ TWY ___
☐ TWYS___/___/___/___/___/___/___/___/___/___
☑ ALL TWYS

POOR — neapmierinoši manevrēšanas ceļu virsmas stāvokļi (aizpildīt tikai vienu)

☐ APRON ___
☐ APRONS___/___/___/___/___/___/___/___/___/___
☑ ALL APRONS

POOR — neapmierinošs perona virsmas stāvoklis (aizpildīt tikai vienu)

Picture 25: Copy of the completed RCR at 9.50 (UTC)

In accordance with the interview of the ADE, he planned to check the runway condition after the landing of the flight BTI1M2 in order to evaluate the runway at the site according to the RCAM and to report the current runway surface condition code to the TWR ATC.

Totally 4 RCR report forms were completed on December 3, 2021 before to the serious incident, that is:

1. at **0:40,** the RWYCC code "4";
2. at **1:49,** the RWYCC code "3";
3. at **3:51,** the RWYCC code "2"; this RCR repot was current till the serious incident;
4. at **9:50,** the RWYCC code "1"; this RCR report wasn't announced.

The ADE, involved at the serious incident, was successfully and timely trained according to the training programs “Cleaning of the airfield from snow and ice” PD 0600P and “Assessing the condition of the runway surface” PD 0617P.

1.18 Additional information

1.18.1 ICAO procedures of assessment of the runway condition

The assessment of the runway condition is regulated by the ICAO Doc 9981:

- The procedure of the runway condition assessment is based on a matrix table II-2-5 (further RCAM). The RCAM (see picture 26) allows the assessment of the runway condition code, using associated procedures from a set of observed runway surface condition(s) and a correlated pilot report of braking action based on the table II-2-4 (see picture 27).
- The description of runway surface condition used in the runway condition report [RCR] defines the action requirements for the aerodrome services and aircraft pilots.

RUNWAY CONDITION ASSESSMENT MATRIX (RCAM)			
Assessment criteria		Downgrade assessment criteria	
Runway condition code	Runway surface description	Aeroplane deceleration or directional control observation	Pilot report of runway braking action
6	• DRY	---	---
5	• FROST •WET (The runway surface is covered by any visible dampness or water up to and including 3 mm depth) ***Up to and including 3 mm depth:*** • SLUSH • DRY SNOW • WET SNOW	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	GOOD
4	***-15°C and lower outside air temperature:*** • COMPACTED SNOW	Braking deceleration OR directional control is between Good and Medium.	GOOD TO MEDIUM
3	• WET ("slippery wet" runway) • DRY SNOW or WET SNOW (any depth) ON TOP OF COMPACTED SNOW ***More than 3 mm depth:*** • DRY SNOW • WET SNOW ***Higher than -15°C outside air temperature[1]:*** • COMPACTED SNOW	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	MEDIUM
2	***More than 3 mm depth of water or slush:*** • STANDING WATER • SLUSH	Braking deceleration OR directional control is between Medium and Poor.	MEDIUM TO POOR
1	• ICE [2]	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	POOR
0	• WET ICE [2] • WATER ON TOP OF COMPACTED SNOW [2] • DRY SNOW or WET SNOW ON TOP OF ICE [2]	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	LESS THAN POOR

[1] Runway surface temperature should preferably be used where available.
[2] The aerodrome operator may assign a higher RWYCC (but no higher than code 3) for each third of the runway, provided the procedure in PANS-Aerodromes, Doc 9981, 1.1.3.15 is followed.

Picture 26: RCAM (Source ICAO Doc 9981, table II-2-5)

- The correlation of the runway condition codes and pilot reports of the runway braking action is a combined form of the runway condition assessment matrix (RCAM) and is also a tool for aircraft pilots to be used when assessing the runway surface conditions (see picture 27).

Pilot report of runway braking action	*Description*	*Runway condition code (RWYCC)*
N/A		6
GOOD	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal	5
GOOD TO MEDIUM	Braking deceleration OR directional control is between good and medium	4
MEDIUM	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced	3
MEDIUM TO POOR	Braking deceleration OR directional control is between medium and poor	2
POOR	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced	1
LESS THAN POOR	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain	0

Picture 27: Source ICAO Doc 9981, table II-2-4

1.18.2 The aircraft operator procedures of assessment of the runway condition

The airBaltic company's Quick Reference Handbook (QRH) for the aircraft BD−500−1A11 includes a section "*Landing*" Article D "*Runway conditions assessment matrix*" to be used for pilot reports of runway braking action. It contains the same but simplified information without the runway status code "0" (see picture 28).

Runway condition code	Runway surface condition description	Pilot-reported braking action
	• Wet (includes damp and 3 mm (0.12 in.) depth or less of water) 3 mm (0.12 in.) depth or less of: • Slush • Dry snow • Wet snow	
4	–15°C and colder outside air temperature: • Compacted snow	Good to medium
3	• Wet ("slippery when wet" runway) • Dry snow or wet snow (any depth) over compacted snow More than 3 mm (0.12 in.) depth, of: • Dry snow • Wet snow Warmer than –15°C outside air: • Compacted snow	Medium
2	More than 3 mm (0.12 in.) depth, of: • Water • Slush	Medium to poor
1	• Ice	Poor

Picture 28: QRH for aircraft BD−500−1A11 (QRH page 03−02B−74)

1.19. Useful or effective investigation techniques

NIL

2. ANALYSIS

2.1 General

The flight crew was properly certificated and qualified in accordance with existing regulations and company requirements. The flight crew fatigue was likely not a factor in this occurrence. The aircraft was properly certificated, equipped and maintained in accordance with existing regulations. No evidence indicated of any structural, engine, or system failures before the serious incident.

2.2 Weather limitations and conditions

The TOWER ATC issued landing clearance and up-to date meteorological information to the flight BTI1M2: "*Wind 270 degrees 8 kt, RVR 1100 meters, heavy snow, RWY36 cleared to land, QNH 993*". Until the flight BTI1M2 landing the surface wind for the

RWY36 did not change significantly and the ATC did not give wind check any more. According to the RIGA-ATIS, the runway condition code was “2”. The coverage of all three parts of the runway was 100% and the depth of the runway’s wet snow coverage was 8mm and there were snowbanks on the RWY 21 meters to the left and right from the runway centreline. According to the meteorological information about the actual weather conditions at the Riga International Airport, the wind indicated a maximum left crosswind of about 4.6 kts with a headwind of 1.1 kts, when the flight BTI1M2 was over the threshold of the RWY36.

The RIGA-ATIS weather conditions were checked timely and recorded in the electronic Operational Flight Plan (OFP) and the RWY36 was in use due to prevailing wind conditions. The aircraft landing performance was calculated and showed a full compliance with the published aircraft limitations and was within limits for ILS approach in accordance with the Operator’s OM Part A.

Before the serious incident the condition of the runway surface was downgrading due to extremely adverse weather conditions, and the snow removal work was often carried out on the runway, but this was complicated because of intensive aircraft traffic at the Riga airport. At the time of the occurrence the runway surface was covered with compacted snow about 8 mm, which physical properties corresponded to the ICE condition according to the RWYCC runway condition code "1". A slippery runway condition is also confirmed by the anti-skid operation, uneven brake application and wheel blocking recorded by the FDM throughout the braking process.

Despite the slippery runway condition, 6 minutes before the occurrence, at **09.48** the previous scheduled flight BTI1R2 landed without an uneventful at the airport "Riga". It was the aircraft Airbus A220-300 operated by airBaltic. The investigation assumes that the runway condition for the previous flight arriving at 09.48 was possible the same or very similar as for the flight involved in the serious incident.

2.3 Analysis of simulated landings on a contaminated runway

During the landing of the flight BTI1M2 at the Riga International Airport it was a heavy snowfall and slippery, that caused a low friction condition on the RWY36. After the touchdown zone the aircraft's reverse was applied and the autobrake function was activated, but after 9 seconds of operation the thrust reverser was disabled, but a second before the aircraft's autobrakes were deactivated by pressing the right brake pedal due to the pilot's attempt to compensate manually the aircraft's minor deviation from the runway centerline to the left.

It is possible that in these meteorological conditions the actions of the pilot of controlling the aircraft during the ground landing roll were hasty, because the simulation of the flight situation on the CAE7000XR simulator showed positive results using correct technique to counteract crosswind and with a longer using of the automatic aircraft

control system during the ground landing roll under the maximum conditions set on the simulator: runway surface condition ICE and a crosswind 10 knots.

> Note: *When the runway surface conditions are uncertain or possibly slippery and wet, it is important to use all available means of the deceleration, including the full reverse. The thrust reverse and speed brakes should not be deactivated, and the braking force should be maintained until the aircraft was safely decelerated.*

The analysis of the simulation results allows to conclude that the pilot's incorrect actions during the landing of the aircraft may have caused the pilot's inability to maintain directional control of the aircraft.

2.4 Runway Condition Reporting

2.4.1 Evaluation of the runway surface condition

16 minutes before the serious incident the pilot of the flight BTI3G2 reported the TWR ATC about the runway braking action and assessed it as "*very poor*", that does not correspond to the assessment matrix of the runway condition (RCAM) "*poor*" or "*less than poor*" according to the Table II-2-5 of ICAO Doc 9981 (see paragraph 1.18).

Thus, it can be assumed that one of the factors that contributed to the serious incident was possible the disagreement and misunderstanding in the exchange of information about the aircraft braking action between the services of the Riga International Airport and the airBaltic aircraft pilot concerning the assessment of braking action efficiency and due to the unclear wording.

2.4.2 Operation and maintenance activities of Riga International Airport employees

After the analysing of all available information concerning maintenance, evaluation and reporting of the runway surface condition, A-SMGCS records and GPS data, as well as the activities of the Riga Airport employees involved in the occurrence, the investigators concluded that the identified lacks in the operation and airport runway maintenance possible could have contributed to the serious incident:

- increased workload of the ADE and lack of time to inform the ATC about the runway surface condition in heavy snowfall;
- no update of the RCR even under extremely adverse weather conditions;
- insufficient feedback from the ATC dispatcher concerning the information of the ADE about intensity of the airport traffic, that significantly affected the frequency of the runway cleaning;

- lack of control by the ADM [Aerodrome Duty Manager] or by the ATC dispatcher of the timely updating of the situation concerning the runway surface condition;
- the rescue service [RFFS] arrived at the incident site after 4 minutes, as the place of the occurrence was not reported to the TEAS immediately;
- lack of communication between the rescue services [RFFS] and the aircraft crew at the incident site;
- lack of any ATC dispatcher's response after receiving of the aircraft pilot's report concerning the assessment of braking action ("*very poor*") [AERODROME MANUAL PART E9 "Inspection of the movement area" Items 4.3.4 and 4.3.6];
- belated decision of the ADE to assess the runway surface condition based on his experience and intuition [AERODROME MANUAL PART E9 "Inspection of the movement area" Item 4.3.7].

Assessing and reporting the condition of the runway (RCR) was necessary in order to provide the flight crew with the information by the ATC dispatcher, as well as for the safe operation of the aircraft. To prevent the conditions for a serious incident, the ADE should have downgraded the runway surface condition code based primarily on his experience, competence, or other circumstances, especially after the receiving of the pilot's report from the previous flight BTI3G2 concerning the aircraft braking action effectiveness, that was not done timely, so possible the preconditions for the serious incident were not prevented by other airport services.

The use of the Global Reporting Format for the evaluating of the condition of the runway surface [ICAO Doc 9981] without the use of friction equipment only a month since November 4, 2021, probably could not have been sufficient for the employees of the Riga Airport services to assess objectively the effectiveness of the snow removal operations and as well as to evaluate correctly the runway condition in adverse weather conditions.

2.5 Analysis of the runway condition assessment of the airport "Riga" in winter period in relation to the requirements of ICAO RCAM

In accordance with the ICAO Doc 9981 Table II-2-5 (see paragraph 1.18) of the Runway Condition Assessment Matrix (RCAM), the runway surface description "COMPACT SNOW" (with outside air temperature above minus 15 degrees Celsius) corresponds to the runway condition code "3". But taking into consideration the geographical position of the International Airport "Riga", that is, close proximity to the Baltic Sea, the aggregate condition of snow as "COMPACT SNOW" (solid contaminant and its depth does not matter) is more likely to correspond to the "ICE" value due to the influence of wind, temperature and other environmental conditions in winter, therefore the expected friction based on the overall assessment of the runway condition reduces, thus, the runway surface characteristic "COMPACT SNOW" is more likely to conform with the code "2". If the runway surface condition "COMPACTED SNOW" by the air temperature around zero would correspond to the code "2" in the matrix (RCAM), then

the downgrading of the runway surface condition code by one unit might have created a different situation to prevent the precondition for this occurrence.

According to the FDM data of the aircraft, which highlighted the anti-skid activity corresponding to a slippery runway, as well as according to the engineering simulation by AIRBUS, the coefficient of friction of the runway was close to the runway condition "ICE" corresponding to RCAM code "1". The airport's runway condition code was due to be downgraded and was downgraded from code "3" to code "2" the last time before the occurrence at 3.51, but the actual runway condition at the serious incident time was the code "1".

Therefore, it is possible, that after the receiving of information about the RWYCC code "1" the crew of the flight BTI1M2 would not have landed at the Riga airport, but would have flown to an alternative airport in accordance with the airBaltic company procedures.

2.6 Actions of the aircraft flight crew during landing

The RWY36 was in use at the Riga airport due to prevailing wind conditions. The reported visibility was low due to heavy snowfall. The reported RWYCC was 2/2/2 and the wind 280/4kts, left crosswind. The crew calculated the landing performance for the reported weather that showed no evidence of any limitation exceedance defined in the Operator's OM Part B.

At 09.54 the flight BTI1M2 performed the actual landing on the RWY36 (Landing course 358º) and at an appropriate speed. The touchdown was executed within the touchdown zone and on the centerline of the runway. Initially during the landing roll the aircraft deviated slightly right from the centerline, the deviation was compensated by using of a left rudder input. The aircraft returned to the centerline. The left rudder input was kept within approximately 0,2 -1,5 inches until the aircraft deviated noticeably to the left, reaching a maximum distance of 15 meters to the left from the centerline. The inappropriate pilot's actions were applied to counteract the left crosswind and deviation from the centreline (correct rudder and aileron inputs help to counteract aircraft tendency to turn into the wind). No right rudder pedal was applied to correct the deviation left from the RWY centerline.

Note: *Piloting technique during a crosswind take-off and landing. During a crosswind take-off and landing, there is a tendency for the upwind wing to lift and for the aircraft to turn into the wind (weathercock). In some aircraft the roll spoilers will deflect when an aileron input is made which, in turn, can exacerbate the tendency for the aircraft to turn into the wind. When flying an aircraft equipped with roll spoilers* ***it is important to know whether/exactly how much the stick or control wheel can be applied*** *without causing an asymmetric roll spoiler deployment.*

At a speed of approximately 52 kts instead of using the right rudder input the left rudder input was increased to approx. 3,5 inches with simultaneously applied right brake (maximum deflection). An asymmetric brake (right brake) application during this stage possibly contributed to further escalation, a subsequent aircraft side skid and a runway excursion at a maximum heading of 79 degrees.

Unintentional or inappropriate use of sidestick (left aileron deflection from +10 to -20 degrees reflected in FDM) at this point led to left MFS spoiler retraction but the right MFS spoiler remained fully deployed. At this speed aerodynamical forces are minimal but persist, which possibly deteriorate the existing condition.

At this stage, the aircraft was out of control.

Scrutinizing the CVR data, flight crew conversations during the event and subsequent pilot explanations it is obvious that FO (Pilot non-flight, who occupies the right-hand seat) was aware of the escalating situation but did not take any actions (neither mutual nor handling) or actions were well too late to prevent or to stop the escalation of the situation. According to the flight crew conversation, it is possible to assume that the PIC (pilot flying, pilot occupying the left seat) lost situational awareness at some point and was not aware of the aircraft's position during the ground roll.

The analysis of the flight crew's actions during the landing of the A220-300, registration number YL-CSE, suggests that the pilot's inappropriate handling of the control inputs and excessive application of the aircraft's brakes may have been caused by an increased level of stress (possibly "Tunnel Vision") during operation in adverse conditions.

2.7 Process of the flight training of airline pilots

During the investigation the pilot training records were scrutinized to reveal potential gaps in the pilot training and checking process.

The available information about the training process of the pilot involved in the serious incident reveals that the pilot had the Type Rating Training Course (Initial training) for the aircraft type BD-500 (A220) from September 1 till November 26, 2020. The course training records reveal some deficiencies of the pilot's flight skills: incorrect manipulation with the sidestick, pumping of the rudder for the directional control, untimely and inadequate rudder pedals input to ensure directional control, unnecessary application of brakes, etc. In the first Latvian CAA Skill test and proficiency check after the Rating Training Course the pilot failed due to "*Insufficient skills. Lack of time*." After the additional training the test was passed. In 2021, the pilot had further Flight Trainings. The Flight Training Records contain remarks of the flight instructors, namely, periodical uncertainty in command of the aircraft and crew and lack of exchange of flight information with the pilot-monitoring [FO] when flying manually.

The investigation has analysed the all available (provided) information about the training process of the pilot involved in the serious incident and suggests that there are potential gaps in the company pilots' selection, training and checking programs, as well as in the information exchange and analysis by the airline's training department. The

investigation has no access to the information on how the operator collects and analyses the information gathered during the training process.

There is a possibility that the pilot with obvious deficiencies during the training and checking period was authorized for line operations without having additional training or another means of mitigation to minimize potential risks.

A similar situation with incorrect pilot actions during the landing in crosswind and gusty conditions occurred on June 21, 2018 at the Riga International airport with the airBaltic aircraft A200-300, registration number YL-CSC [Final Report No 4-02/1-18(4-19)]. The FDR data of the involved aircraft showed the application of the right rudder pedal with a simultaneous increase of the left brake pedal application. The higher brake force application on the left-hand side main gear wheels caused the aircraft deviation to the left with a subsequent aircraft side skid. The investigation of this serious incident concluded, that the Root cause of the incident [21/06/2018] was related with uncoordinated asymmetric actions of the flight crew in controlling of the aircraft during the landing.

Analysing the actions of the airline pilots in both situations, the investigators can assume that the repeated cause of the incidents was the improper handling of the aircraft by the crews to counteract crosswind conditions. It is likely possible that the airline pilot training program has not been updated considering possible deficiencies and the previous incident.

3. CONCLUSIONS

During the process of the investigation the following conclusions were made and these are not to be read as apportioning blame or liability to any specific organization or individual.

3.1 Findings

- The aircraft had a valid airworthiness certificate;
- The mass and centre of gravity was within the limitations;
- The aircraft was properly certificated, equipped and maintained;
- No evidence indicated any preimpact structural, engine or system failures. The damage to the aircraft was created by external factors;
- The flight crew was properly certificated and qualified;
- Flight crew fatigue was likely not a factor in this serious incident;
- There were no abnormalities reported by the crew during the flight;
- The flight crew prepared for the approach and set the aircraft landing performance in accordance with the Operation Manual;
- The ATC information on the weather conditions was provided constantly;
- The actual condition of the runway surface differed from that declared in the RCR;

- Although the runway surface was contaminated with compacted snow, but there was enough friction coefficient on the runway for the aircraft to make an uneventful landing and to stop on the available runway length;
- The PIC was not able to maintain the directional control of the aircraft probably due to inappropriate aircraft handling technique;
- It is possible, the airline pilot training program did not include enough training of pilots' skills in applying of the aircraft braking system, flight controls using basic handling skills;
- There was no compliance with the requirements of the "Operating Instructions of Riga Airport - LV 1119 I" in the work of the airport responsible services;
- The ADE [Aerodrome Duty Engineer] did not change the RWYCC (runway condition code) despite rapidly deteriorating weather conditions;
- There was an incorrect phraseology used by airline pilots and airport services, which possibly caused incorrect interpretations of the runway conditions;
- The ADE had little experience with the new Global Reporting Format for assessing of the runway surface conditions, especially in rapidly changing adverse weather conditions;
- The cleaning of the runway during a heavy snowfall is not defined as a priority in relation to the traffic of aircraft at the Riga Airport;
- There was no communication and coordination of actions between the TOWER ATC, the RFFS [rescue service] and the aircraft crew in case of emergency access into the aircraft.

3.2 Causes

3.2.1 Primary cause

Uncontrolled skidding of the aircraft from the runway surface.

3.2.2 Contributing causes

- Heavy snowfall, crosswind, and low visibility;
- The untimely updating of the situation concerning the runway surface condition;
- Misunderstanding in the exchange of information about the aircraft braking action;
- The pilot’s incorrect actions in a non-standard flight situation;
- Lack of the Crew Resource Management (CRM).

3.2.3 Root cause

- Incorrect distribution of priority of the runway cleaning an adverse weather condition in relation to the traffic of aircraft;
- Insufficient control of the airport responsible services for updating the situation concerning the runway surface condition;
- Different interpretation of the runway evaluation by airline pilots and airport services;

- Shortcomings in the airline training program regarding the actions of pilots in non-standard flight situations.

3.2.4 Proximate cause

Inappropriate aircraft handling technique on landing during the ground roll out stage.

4. SAFETY RECOMMENDATIONS

4.1 In connection with the identified deficiencies in the maintenance, operation, assessment of the runway surface condition and reporting at the airport, the Transport Accidents and Incident Investigation Bureau is addressing the following safety recommendations to the Riga International Airport operator:

Recommendation LV2022001

Supplement the ADM's duties with a control over the runway pavement condition assessment process, providing additional control (especially in adverse weather condition) to prevent a situation where one employee (ADE) carries out a systematic runway surface condition assessment, organizes cleaning works and is responsible for the RCR preparation and submission to the TWR ATC, and as a result is not able to perform all duties in a timely manner in accordance with the requirements of the "Operational Instructions of the Riga Airport LV-1119 I".

Recommendation LV2022002

Define the cleaning of the runway during a heavy snowfall as a priority in relation to the traffic of aircraft at the Riga International airport.

Recommendation LV2022003

Consider the necessity to develop procedures for communication and coordination of actions between the TOWER ATC, the rescue services [RFFS] and an aircraft crew in case of emergency (a headset for a via intercom, using the TOWER ATC, etc.).

4.2 In connection with the identified deficiencies in the flight crew actions during the landing, the Transport Accidents and Incident Investigation Bureau is addressing to the airBaltic airline company as the aircraft operator the following safety recommendations:

Recommendation LV2022004

Review the flight crew training program related to elements of Crew Resource Management training, such as resilience development and case studies, and prepare necessary changes to the training program based on the results of the assessment.

Recommendation LV2022005

Review the operator initial, recurrent training and checking program including elements of training pilots actions in non-standard flight situations.

March 20, 2023 Riga

Investigator in charge Vilis Kipurs

Director of Transport Accident
and Incident Investigation Bureau Anita Skinuma