

FINAL REPORT



INCIDENT 498/18

State Commission on Aircraft Accidents Investigation (PKBWL)

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FINAL REPORT

Incident

OCCURRENCE NO – 498/18

AIRCRAFT – Airbus A-330-200, C-GTSL

DATE AND PLACE OF OCCURRENCE – 16 March 2018, EPWA



The Report is a document presenting the position of the State Commission on Aircraft Accidents Investigation concerning circumstances of the air occurrence, its causes and safety recommendations. The Report was drawn up on the basis of information available on the date of its completion.

The investigation may be reopened if new information becomes available or new investigation techniques are applied, which may affect the wording related to the causes, circumstances and safety recommendations contained in the Report.

Investigation into air the occurrence was carried out in accordance with the applicable international, European Union and domestic legal provisions for prevention purposes only. The investigation was carried out without application of the legal evidential procedure, applicable for proceedings of other authorities required to take action in connection with an air occurrence.

The Commission does not apportion blame or liability.

In accordance with Article 5 paragraph 6 of the Regulation (EU) No 996/2010 of the European Parliament and of the Council on the investigation and prevention of accidents and incidents in civil aviation [...] and Article 134 of the Act – Aviation Law, the wording used in this Report may not be considered as an indication of the guilty or responsible for the occurrence.

For the above reasons, any use of this Report for any purpose other than air accidents and incidents prevention can lead to wrong conclusions and interpretations.

This Report was drawn up in the Polish language. Other language versions may be drawn up for information purposes only.

WARSAW 2022

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Abbreviations

Abbreviation	Meaning
ACARS	Aircraft Communication Addressing and Reporting System
ACC	Area Control Centre
ALTN	Alternate airport
APP	Approach Control
APU	Auxiliary Power Unit
ATC	Air Traffic Control
ATIS	Automatic Terminal Information Service
ATOM	Actual Take-off Mass
ATS	Air Traffic Services
BEA	Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile
CBZ	Central Reporting Database
CRM	Crew Resource Management
CVR	Cockpit Voice Recorder
EASA	European Aviation Safety Agency
EPWA	Warsaw Chopin Airport
ETA	Estimated Time of Arrival
FL	Flight Level
FO	First Officer
ft	Foot (unit of length – 0.3048 m)
hPa	Hectopascal (unit of atmospheric pressure.)
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
kt	Knot (unit of speed–1.852 km/h)
LKPR	International Aerodrome Praha-Ruzyně
LMT	Local Mean Time
LVTO	Low Visibility Take-Off

MEL	Minimum Equipment List
MTOM	Maximum Take-Off Mass
NIL	None
OFF	Operational Flight Plan
OPC	Operator Proficiency Check
ORO	Organization Requirements for Air Operations
PAN PAN	Radiotelephony urgency signal
PANSA / PAŻP	Polish Air Navigation Services Agency
PANS-ATM	Procedures for Air Navigation Services – Air Traffic Management
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
RMK	Remark
RVR	Runway Visual Range
RWY	Runway
SCAAI / PKBWL	State Commission on Aircraft Accidents Investigation
SMS	Safety Management System
SOP	Standard Operating Procedures
STAR	Standard Instrument Arrival
TSB	Transportation Safety Board of Canada
TWR	Aerodrome control tower
TWY	Taxiway
ULC	Civil Aviation Authority
UTC	Co-ordinated Universal Time
VTSG	Krabi International Airport

General information

Occurrence reference number:	498/18			
Type of occurrence:	INCIDENT			
Date of occurrence:	16 March 2018			
Place of occurrence:	EPWA, Poland			
Type and model of aircraft:	AIRBUS A-330-200			
Aircraft registration marks:	C-GTSL			
Aircraft user/operator:	Air Transat			
Aircraft Commander:	ATPL(A)			
Number of victims/injuries:	Fatal	Serious	Minor	None
	-	-	-	353
Domestic and international authorities informed about the occurrence:	ULC, EASA, ICAO, SIAs of France and Canada			
Investigator-in-Charge:	Bogusław Trela			
Investigating Authority:	State Commission on Aircraft Accidents Investigation (PKBWL)			
Accredited Representatives and their advisers:	BEA (France), TSB (Canada)			
Document containing results:	Final Report			
Safety recommendations:	None			
Addressees of the recommendations:	Not applicable			
Date of completion of the investigation:	29 December 2022			

Synopsis

On 19 March 2018 State Commission on Aircraft Accidents Investigation was informed by the Polish Air Navigation Services Agency and Warsaw Chopin Airport Duty Officer about the incident that had occurred on 16 March 2018.

The Airbus A-330-200, registration C-GTSL, flight number TVP7617, operated by Air Transat airline wet leased for Smartwings airline performing a flight from VTSG to EPWA when approaching the LIMVI waypoint (first STAR waypoint on the way to EPWA, boundary of EPWA TMA) was instructed by ATC to reduce the speed to the minimum clean (the minimum speed at which an aircraft can be flown in a clean configuration). The restriction was caused by snow removal from the runway at EPWA.

The C-GTSL flight crew requested coordination of a shorter approach route to the airport due to minimum fuel. The flight crew were asked several times by the air traffic control about *endurance* (total available fuel quantity expressed by the remaining flight time), but they did not respond. When the flight crew were asked to confirm declaration of emergency, they denied, but at the same time they informed that such a situation would occur if they were not cleared to approach and land on EPWA soon.

During the exchange of correspondence, the flight crew did not reply to the air traffic controllers about the current fuel quantity (remaining flying time). The airplane landed uneventfully on EPWA at 15:53 hrs¹.

The investigation into the occurrence was conducted by the PKBWL Investigation Team in the following composition:

Bogusław Trela	Investigator-in-Charge
Jakub Cichocki	Team Member
Grzegorz Pietraszkiewicz	Team Member

After the investigation PKBWL has determined the following causes of the incident and factors contributing to its occurrence:

- 1) The delay of departure by 2 h and 50 min.
- 2) Take-off with the minimum fuel required for the flight.
- 3) Change in weather conditions along the flight route resulting in increased fuel consumption.
- 4) Change in weather conditions at the destination requiring a delay in landing.
- 5) Lack of response to ATC question about *endurance* and imprecise responses to other questions.
- 6) The time difference between the departure aerodrome and destination aerodrome (6 hours) and a long flight time (more than 10 hours).

¹ All times in the Report are in UTC

- 7) The occurrence took place in the last phase of a long flight when probably tiredness was already felt and the crew's perception may have been reduced.
- 8) Acting the crew under time pressure due to the low fuel reserve.
- 9) Willingness to land at the destination to avoid flight to the alternate aerodrome.

PKBWL did not propose any safety recommendation after the investigation.

1. FACTUAL INFORMATION

1.1. History of the flight

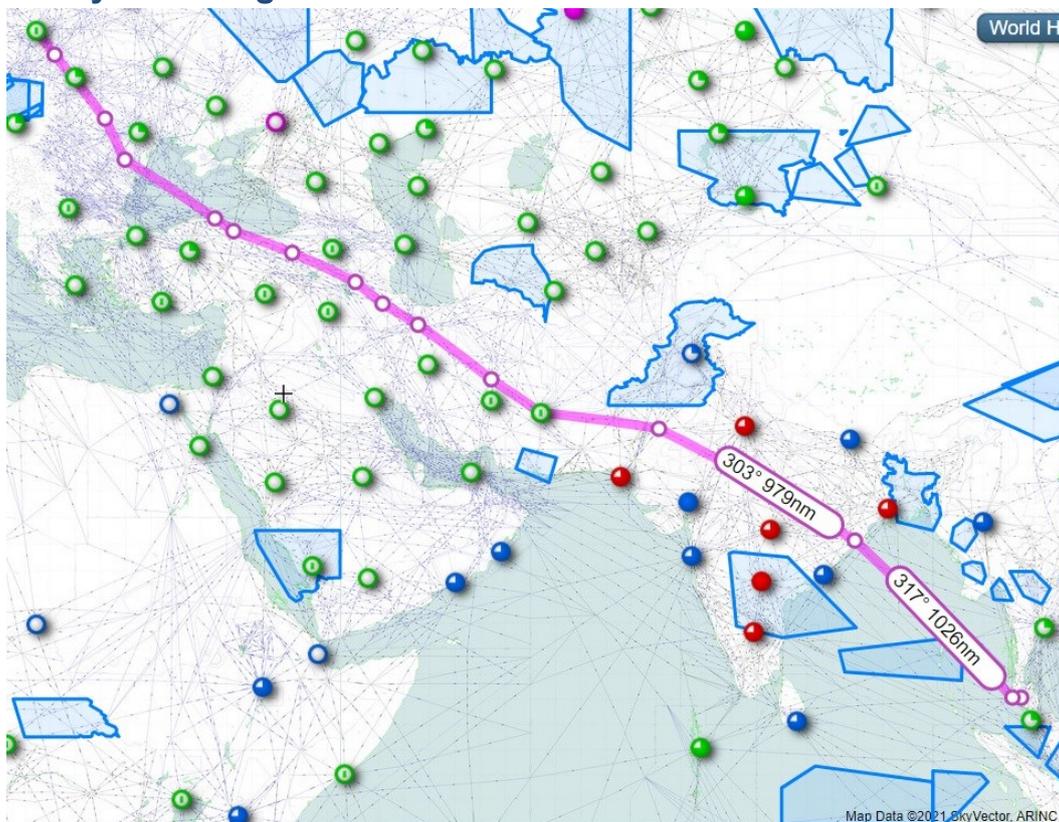


Fig. 1 Flight TVP7617 – visualization of the flight path from VTSG to EPWA.

[source: <https://skyvector.com/>]

The departure of Airbus A-330-200, registration C-GTSL for the flight from VTSG to EPWA (flight TVS7617) was planned on 16 March 2018 at 00:40 hrs. The airplane was operated by Air Transat airline and was leased to Smartwings airline. The flight crew consisted of 3 pilots (augmented crew).

MTOM of the airplane was 233,000 kg. To avoid exceeding MTOM, it was necessary to leave 1700 kg of passengers' luggage at the airport of departure. As a result of the correction, ATOM for departure from VTGS was 232,907 kg, and the airplane was refueled with the minimum quantity of fuel necessary to perform the flight.

The plane departed from the VTGS airport at 03:30 hrs with a delay of 2 h and 50 min, which was caused by an attempt to fix the APU fault. Finally, the plane was allowed to depart with BULK Lower Deck Cargo heating System inoperative (in accordance with MEL, ATA 21-43-02) and APU inoperative, based on MEL, ATA 49-10-01A *Power Plant APU INOP. APU neither deactivated nor removed.*

The calculations of the fuel necessary for the flight were based on the original flight plan departure at 00:40 hrs. According to that plan, the estimated block time (from off-block time at VTGS to on-block time at EPWA) was 11 h and 55 min, and the estimated fuel quantity after landing was to be 8 tones.

The flight to EPWA was uneventful, however, the flight crew noticed, that the headwind speed on cruising level was higher than entered in the flight plan.

When approaching Greece, the crew recalculated the necessary fuel for the flight to EPWA plus the required fuel reserve and concluded that there was enough fuel to safely reach the airport of destination.

In the Polish airspace - in the flight to EPWA from the south-eastern sector, at 15:10:18 hrs, the flight crew were informed about the configuration of the airport for landing ("N - November", RWY in use: 11).

Two minutes later, the flight crew asked ATC to coordinate a shorter approach route to the airport. In response ATC informed the crew about the expected delay due to weather conditions at EPWA and ordered to reduce the flight speed to a *minimum clean*. At that time, ATC was not able to provide the time of expected delay due to snow blizzard at EPWA and impossibility to assess the time needed to clear the runway. However, ATC did not explain to the crew why he did not specify the delay time.

The crew of the flight TVP7617 reported: *minimum fuel*². ATC asked for confirmation of declaration of emergency. The flight crew denied and at the same time informed that they were reducing the flight speed.

Two minutes later, ATC asked the crew twice to confirm *endurance* (total fuel quantity expressed in the flight time). The crew did not respond, but asked for confirmation of the expected delay. The ATC asked the again about *endurance* and again received no response from the crew. Then the crew received instruction to descend and the new frequency of the next air traffic control area (130.875 MHz).

Upon initial contact with ATC on the new frequency at 15:18:26 hrs, the flight crew was asked fourth time about the current *endurance* and responded in a manner incomprehensible to the ATC. Therefore, the controller informed the flight crew that many aircraft were holding in the vicinity of EPWA due to the snow removal from the runway and asked whether the crew had any other information or requests except the requirement to land as soon as it possible. The crew asked about the expected delay without responding to the ATC question. The ATC informed the crew that they were the thirteenth airplane in the landing order and ordered further descent to FL 250.

At 15:23:57 hrs the flight crew reported *minimum fuel*. The ATC asked again whether the crew was declaring an emergency (*Do you declare emergency?*). The crew replied shortly: *not yet*. The ATC asked the crew again for *endurance*.

At 15:24:26 hrs the crew sent a partially incomprehensible message with a readable ending: *1-5-5-4 (15:54)*. To confirm his understanding, the ATC, asked if the current *endurance* was 30 minutes. The crew did not respond to the ATC question, but at 15:24:55 hrs, they stated: *no fuel for holding*. The ATC acknowledged the message and ordered to descend to FL 140.

At 15:28:17 hrs the flight crew were instructed to change frequency to 128.800 MHz (Warsaw Approach - WAW APP). Upon initial contact with WAW APP, the flight crew

² **Minimum fuel** - the term used to describe a situation in which an aircraft's fuel supply has reached a state where the flight is committed to land at a specific aerodrome and no additional delay can be accepted, ICAO, *Procedures for Air Navigation Services (PANS) - Air Traffic Management (Doc 4444)*, 16th Edition, 2016.

received clearance to descend to FL 100, and then further arrival instructions (including partial shortening of the arrival time).

At 15:38:45 hrs the flight crew was instructed to change the frequency to 129.375 MHz - Warszawa Director (WAW DIR). After contacting WAW DIR, the flight crew received clearance to descend to 4000 ft and instruction to fully complete the remaining part of the STAR procedure.

Prior to reaching the IRLUT waypoint, the flight crew were instructed to turn left to the heading of 140° and received clearance to approach RWY 11 according to ILS.

At 15:49:27 hrs, when fully stabilized according to ILS 11, the flight crew was instructed to establish communication with EPWA TWR on the 118.300 MHz frequency.

At 15:52:54 hrs the flight crew of flight TVS7617 received clearance to land on RWY 11. After touchdown at 15:54:15 hrs the flight crew were instructed to enter TWY N (November) and establish communication with the ground controller (GND) on 121.900 MHz.

1.2. Injuries to persons

Injuries	Crew	Passengers	Others	Total
Fatal	-	-	-	
Serious	-	-	-	
Minor	-	-	-	
None	14	339	0	353

1.3. Damage to aircraft

None

1.4. Other damage

None

1.5. Personnel information (crew data)

1.5.1. Captain (CPT)

Pilot, male, aged 58, holder of ATPL(A) valid for unlimited time with ratings including EA33 (A-330), no data about validity of ratings. The operator sent only a copy of page no 3 of the pilot's license.

Aero-medical certificate: Class 1 with limitation – *glasses must be available*, date of expiration: 01 Nov 2018.

Language proficiency:	No data;
Total flight time:	No data;
Flight time on A-330:	No data;
Flight time as Pilot-in-Command:	No data;
Line check:	No data;
Flight time on A-330 over the last 30 days prior to the occurrence:	No data.

1.5.2. First Officer (FO1)

Pilot, male, aged 58, holder of ATPL(A) valid for unlimited time with ratings including EA33 (A-330), no data about validity of ratings. The operator sent only a copy of page no 3 of the pilot's license.

Aero-medical certificate: Class 1 with limitation – *glasses must be worn*, date of expiration: 01 May 2018.

Language proficiency:	No data;
Total flight time:	No data;
Flight time on A-330:	No data;
Flight time as Pilot-in-Command:	No data;
Line check:	No data;
Flight time on A-330 over the last 30 days prior to the occurrence:	No data.

1.5.3. First Officer (FO2)

Pilot, male, aged 32, holder of ATPL(A) valid for unlimited time with ratings including EA33 (A-330), no data about validity of ratings. The operator sent only a copy of page no 3 of the pilot's license.

Aero-medical certificate: Class 1 with limitation - *glasses or contact lenses must be worn*, date of expiration: 01 Aug 2018.

Language proficiency:	No data;
Total flight time:	No data;
Flight time on A-330:	No data;
Flight time as Pilot-in-Command:	No data;
Line check:	No data;
Flight time on A-330 over the last 30 days prior to the occurrence:	No data.

1.6. Aircraft information

1.6.1. General information.

Airbus A330-300 registration C-GTSL is a transport airplane equipped with two Rolls-Royce RB211 Trent 772B-60 engines. The airplane was produced in 2001, serial number 701. The airplane was registered in the Canadian Civil Aircraft Register. It was used by the Canadian operator Air Transat, leased in the "wet lease" formula to the operator: Travel Service Poland. On the day of the incident, the airplane was configured in the variant of 343 seats, MTOM – 233,000 kg, ATOM – 232,907 kg.



Fig. 2 A-330-200, C-GTSL of Air Transat.

[source: <https://i.pinimg.com/originals/6f/35/e8/6f35e8fea605b3c691855844954e7b68.jpg>]

1.7. Meteorological information

Weather conditions on 16 March 2018.

Based on the data from the operational flight plan issued on 15 March 2018 at 21:15 hrs, the expected arrival at EPWA was to take place at 12:35 hrs. Due to the delay of departure and longer flight, the airplane landed in Warsaw at 15:53 hrs. The weather conditions at the time of actual arrival on the airport of destination (EPWA) and alternate airport (LKPR) are presented below.

EPWA - airport of destination:

METAR from 15:30		
SA	16/03/2018 15:30->	METAR EPWA 161530Z 06015KT 2300 -SN DRSN SCT010 BKN023 M02/M03 Q1008 R11/52//95 TEMPO 1000 SN BKN008=
SA	16/03/2018 16:00->	METAR EPWA 161600Z 06013KT 2100 -SN DRSN FEW010 BKN022 M02/M04 Q1008 R11/52//95 TEMPO 1100 SN DRSN BKN010=

Source: <https://www.ogimet.com/index.phtml.en>, access 09.04.2021

- 16:00 hrs;
- Wind from the direction of 060°, speed 13 kt;
- Visibility 2100 m;
- Light snowfall;
- Light blizzard;
- Cloud cover 0/8 - 2/8, cloud base 1000 ft;
- Cloud cover (second layer) 5/8 - 7/8, cloud base 2200 ft;
- Temperature (-) 2°C;
- Dew point temperature (-) 4°C;
- QNH 1008 hPa;

- Runway covered with wet snow, runway coverage 11% - 25%, good braking conditions;
- Temporarily, visibility may be reduced to 1100 m with snowfall and light blizzard and cloud cover 5/8 - 7/8 at cloud base 1000 ft.

LKPR - alternate airport:

- 16:00 hrs;
- Wind from the direction of 010°, speed 8 kt;
- General visibility 3000 m;
- Visibility towards south-east 1400 m;
- RVR 24, 2000 m unchanged;
- RVR 30, 1900 m, unchanged;
- Mist;
- Cloud cover 1/8 - 2/8, cloud base 100 ft;
- Cloud cover 5/8 - 7/8, cloud base 200 ft;
- Cloud cover 8/8, cloud base 400 ft;
- Temperature +2°C;
- Dew point temperature +1°C;
- Pressure 1001 hPa;
- Without expected significant changes.

METAR from 15:30 (source: <https://www.ogimet.com/index.phtml.en>). From 15:00 hrs to 16:30 hrs SPECI (Special Weather Report - issued in case of significant changes in weather conditions in relation to the previously issued METAR) was issued. The report issued at 16:19 hrs noted a decrease in overall visibility to 2000 m, light rain and a decrease in the cloud base of 8/8 to 200 ft. It should be noted that reports from 17:00 hrs and 17:30 hrs included precipitation data: snow and rain with temperatures: +1°C and 0°C.

METAR/SPECI from LKPR, Praha / Ruzyne (Czech Republic) .		
SA	16/03/2018 15:00->	METAR LKPR 161500Z 02008KT 3500 BR BKN002 OVC003 03/03 Q1001 NOSIG=
SP	16/03/2018 15:09->	<i>SPECI LKPR 161509Z 02007KT 2800 1000SE R24/P2000N R30/1600D BR FEW001 OVC002 03/02 Q1001 RMK REG QNH 0996=</i>
SA	16/03/2018 15:30->	METAR LKPR 161530Z 36008KT 330V030 2500 0800SE R24/P2000N R30/1000U BR BCFG FEW001 BKN002 OVC004 03/02 Q1001 TEMPO 1200 -RA BR=
SA	16/03/2018 16:00->	METAR LKPR 161600Z 01008KT 3000 1400SE R24/P2000N R30/1900N BR FEW001 BKN002 OVC004 02/01 Q1001 NOSIG=
SP	16/03/2018 16:19->	<i>SPECI LKPR 161619Z 01008KT 2000 -RA BR SCT001 OVC002 02/01 Q1001 RMK REG QNH 0996=</i>
SA	16/03/2018 16:30->	METAR LKPR 161630Z 01009KT 2000 -RA BR BKN001 OVC002 02/01 Q1001 TEMPO 1200 -RA BR=
SP	16/03/2018 16:38->	<i>SPECI LKPR 161638Z 01009KT 2300 -RA BR SCT001 OVC002 02/01 Q1001 RMK REG QNH 0996=</i>

SA 16/03/2018 METAR LKPR 161700Z 01007KT 2800 -RA BR SCT001 OVC002
17:00-> 01/00 Q1002 TEMPO -RASN=

SA 16/03/2018 METAR COR LKPR 161730Z 36008KT 320V020 3000 -RASN BR
17:30-> SCT001 OVC002 00/M00 Q1002 TEMPO 1500 RASN BR BKN001=

Source: <https://www.ogimet.com/index.phtml.en>, access 10.04.2021.

large TAF from LKPR, Praha / Ruzyne (Czech Republic).

TAF AMD LKPR 161535Z 1615/1718 35008KT 5000 -RA BR
BKN013

FT 16/03/2018 TEMPO 1615/1620 3000 -RA BR BKN007
15:35-> PROB30 TEMPO 1615/1618 1100 RA BKN002
BECMG 1620/1622 07012KT 8000 -SN BKN020
TEMPO 1622/1710 2500 SN BKN010
TEMPO 1707/1718 07018G30KT=

FT 16/03/2018 TAF LKPR 161700Z 1618/1800 01008KT 4000 -RASN BR
17:00-> SCT004 BKN007 TEMPO 1618/1620 2000 -RASN BR SCT002
BKN004
BECMG 1620/1622 05012KT 6000 -SN BKN015
TEMPO 1622/1710 2500 SN BKN009
TEMPO 1707/1800 07018G30KT=

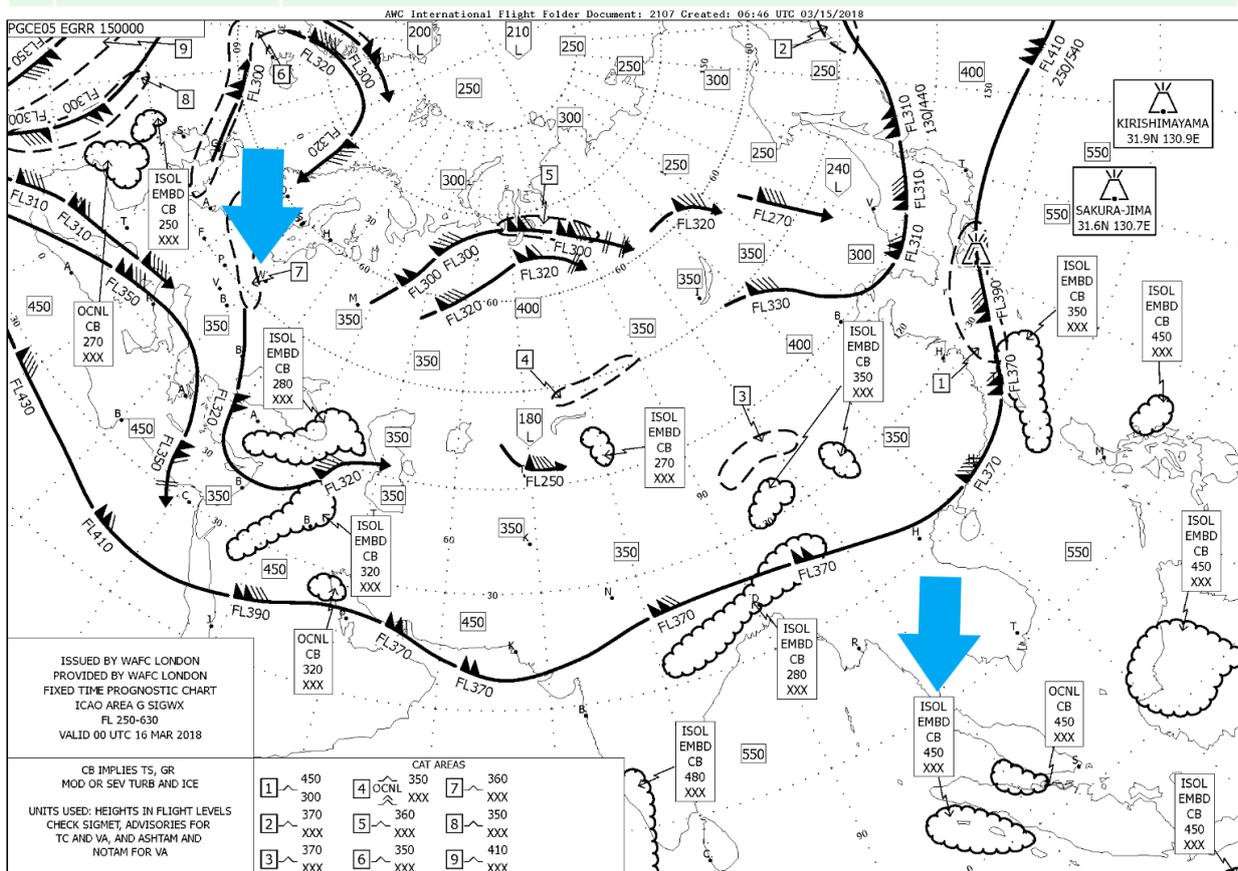


Fig. 3 Significant Weather Chart - Forecast Map issued with validation dated as of 16 March 2018 at 00:00 hrs. The blue arrow marks the departure aerodrome in Krabi (lower right corner of the map) and the destination aerodrome in Warsaw (upper left corner).

[source: <http://www.aviationwxchartsarchive.com/product/sigwx/>]

The current Forecast Map (Fig. 4) and the flight route, taking into account the curvature of the Earth, shows the initial part of the route to the west coast of India was without

significant weather phenomena. In the area of the border with Pakistan, there was a jet stream that ran from Africa from FL 430, descending eastwards to FL 370. In the area of the flight route, winds blowing at a speed of 100 to 120 kt in the direction opposite to the direction of the flight were recorded. In the vicinity of the Aegean Sea, the map shows another two jet streams on FL 320 and FL 350 blowing from north to south (opposite to the direction of flight). Clear Area Turbulence (marked with number 7 (Fig. 3)) was in the vicinity of EPWA and to the south from FL 360 to an undefined lower value. The tropopause level along the entire route oscillated from FL 350 to FL 450.

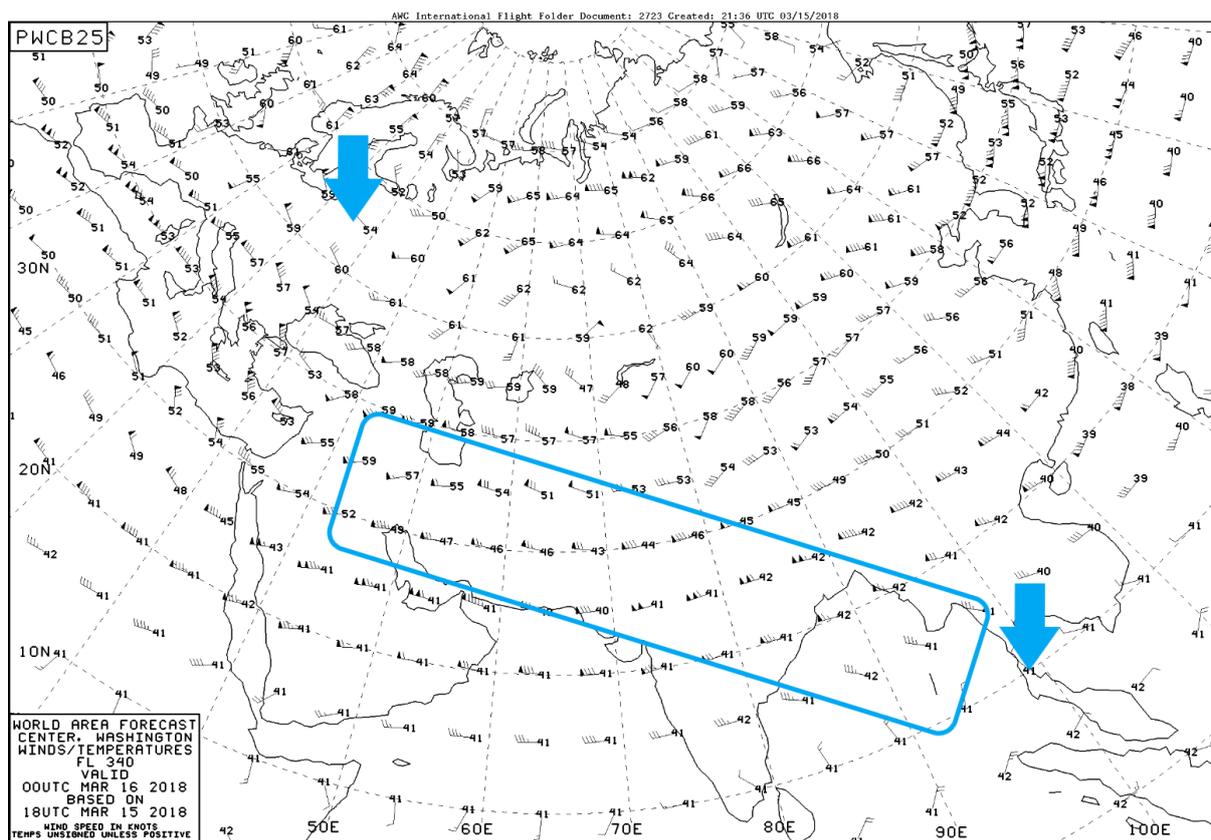


Fig. 4 Map of the Upper Winds on FL 340 based on data of 15 March 2018 at 18:00 hrs, valid for 16 March 2018 at 00:00 hrs. The blue arrows mark the departure aerodrome in Krabi (lower right corner) and the destination aerodrome in Warsaw (upper left corner).

Additionally, a blue rectangle defines the sector of the first part of the flight.

[source: <http://www.aviationwxchartsarchive.com/product/sigwx>]

The flight records show that after take-off, the airplane reached the cruising altitude of FL 340 and flew at this altitude for about an hour. Then the altitude was changed to FL 360 and the flight was continued at that altitude for 4 h and 45 min.

As part of the investigation, the meteorological conditions at the cruising level were analysed. In the map of the Upper Winds (Fig. 4) on FL 340, the sector in blue represents the first part of the flight. On a north-westerly direction of the flight, the airplane was flying upwind, which was blowing at a speed of 50 to 130 kt. The ambient temperature was in the range of -4°C to -59°C .

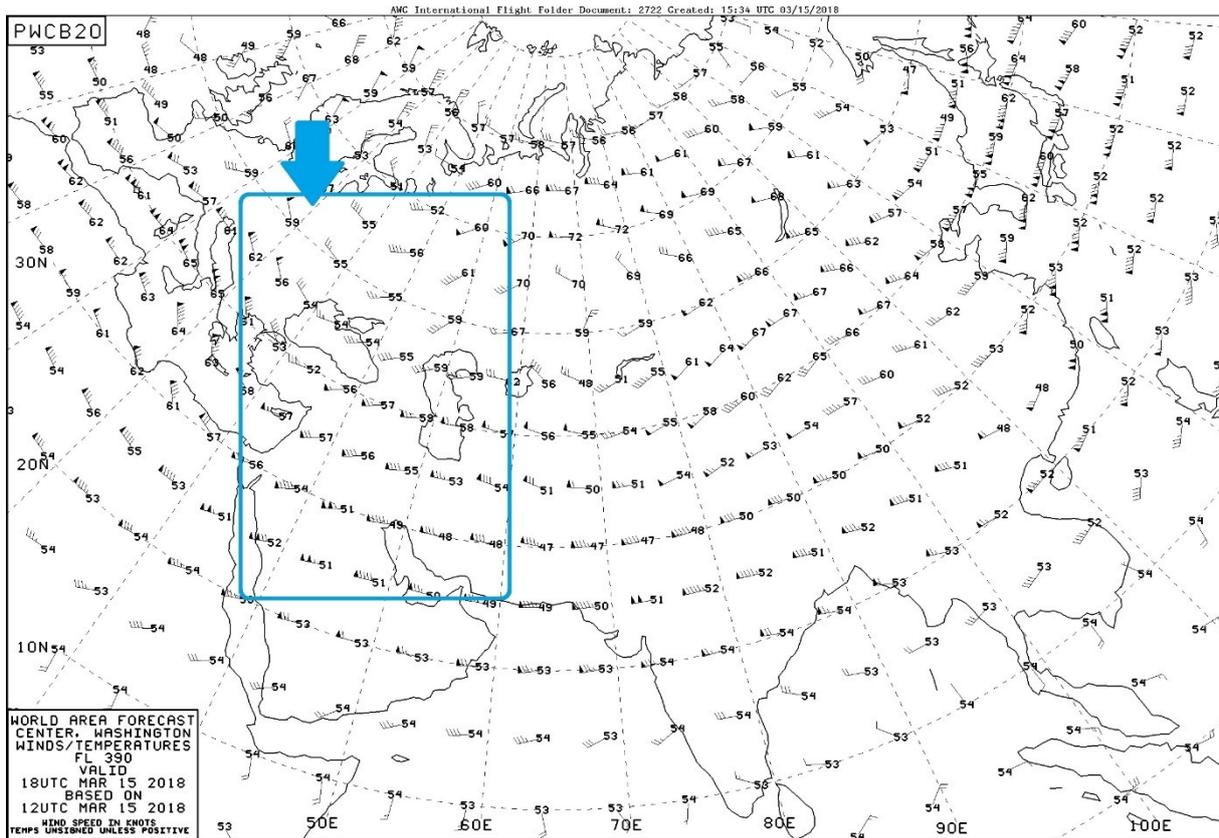


Fig. 5 Map of the Upper Winds on FL 390 based on data of 15 March 2018 at 18:00 hrs, valid for 16 March 2018 at 00:00 hrs. The blue arrow marks the destination aerodrome in Warsaw (upper left corner). Additionally, a blue rectangle marks the sector of the second part of the flight.

[source: <http://www.aviationwxchartsarchive.com/product/sigwx>]

The flight records show that at 10:47 hrs (7 h and 7 min after take-off from Krabi) the airplane reached FL 380. 35 minutes later, at 11:22 hrs, the airplane reached the maximum flight level of FL 400. Total airtime during the flight from Krabi to Warsaw was 12 h and 13 min. In the map of the Upper Winds on FL 390, (Fig. 5), the sector marked in blue represents the second part of the flight. In the initial phase of the flight in this sector, the airplane was flying in the north-north-west (NNW) direction with the wind blowing from the left side. The direction of the wind changed in the second part of the sector to headwind. The wind speed in this phase of the flight was in the range from 45 to 120 kt. The ambient temperature was -52°C to -63°C .

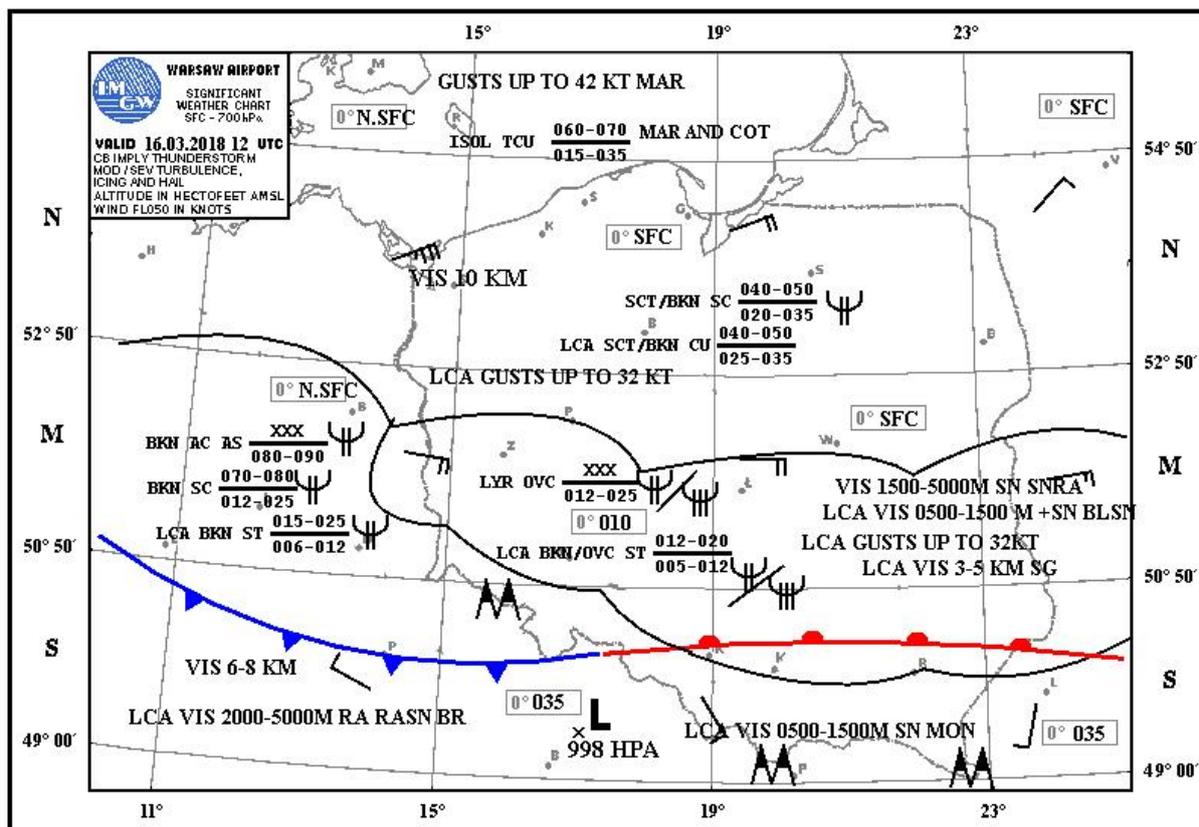


Fig. 6 Significant Weather Chart for the area of Poland, valid as of 16 March 2018, at 12:00 hrs.
[source: IMGW]

Based on the Significant Weather Chart, the meteorological conditions in the arrival sector to EPWA are presented. The warm front is visible in the south-eastern part of the area (aircraft arrival zone).

In the central part of Poland, zones of moderate and heavy icing were visible. Forecast visibility was from 1500 to 5000 m with snowfall and snowfall with rain. Locally, decrease in visibility was possible from 500 to 1500 m with heavy snowfall and blizzard. Wind gusts were up to 32 kt with granular snowfall. Expected temperature at ground level was 0°C.

1.8. Aids to navigation

The flight crew completed a standard ILS approach to RWY 11. ILS was working properly.

1.9. Communications

Radio communication was carried out with standard means of communication of the aircraft was equipped. All recordings of communication between the airplane and ATC in the Polish airspace were available for the Investigation Team. Communication in both directions was clear and readable.

1.10. Aerodrome information

Warsaw Chopin Airport is certified and prepared to accept all aircraft up to the reference code letter 4E. The airport operator allows the operation of aircraft with a higher reference code letter (B-748, A-380, C-5B Galaxy, An-124) in accordance with the procedure described in the Airport Operational Manual (INOP). VFR and IFR operations

are permitted according to ILS categories I, II and III and LVTO at RVR not less than 125 m. It is allowed to perform take-offs from intermediate distances, in accordance with the published declared distances in AIP Poland and INOP. Apron management service is provided by the airport operator. Rescue and firefighting services – category 9.

1.11. Flight recorders

Investigation Team had no access to CVR and FDR.

1.12. Wreckage and impact information

Not applicable.

1.13. Medical and pathological information

Not applicable.

1.14. Fire

Fire did not occur.

1.15. Survival aspects

Not applicable.

1.16. Tests and research

Not performed.

1.17. Organizational and management information

The Duty Officer of Warsaw Chopin Airport was informed by the TWR when the C-GTSL approaching Warsaw requested coordination of a shorter approach route to the airport due to the low fuel quantity. Due to the lack of a declaration of emergency, no measures were taken at that stage.

1.18. Additional information

Minimum quantity of fuel – according to the flight plan printed at 21:15 hrs (which foreseen LKPR as alternate aerodrome) - was 78,900 kg. The quantity of the calculated fuel expressed in the units of the flight time (*endurance*), was 13 hrs and 38 min. According to the document *Aircraft Journey Log*, actually the airplane was refueled with 79,200 kg of fuel, i.e. 300 kg more than in the abovementioned flight plan, providing for departure time at 00:40 hrs.

MTOM of the aircraft was 233,000 kg, while ATOM 232,907 kg, so ATOM was only 93 kg less than MTOM.

The scheduled flight time was 11 h 55 min³. Based on the flight plan, the airtime was set at 12 h 5 min⁴. According to the entry in the logbook, the actual flight time was 12 h 39 min⁵.

On 7 July 2022 the Draft Final Report was sent for comments to: EASA, TSB Canada (State of Operator), BEA France (State of Manufacture) Air Transat airline, Warsaw Chopin Airport and PANSA (Poland).

³ Planned flight time based on the flight schedule

⁴ Airtime based on OFP 1/10 (Fig. 7 - blue box) generated on 03/15/2021 at 21:15 hrs.

⁵ Actual flight time based on the document *Aircraft Journey Log* (Fig. 8 - blue box) from 03.16.2021.

BAE comments were accepted, Air Transat airline comments were partially accepted and the content of the Final Report was amended accordingly.

1.19. Useful or effective investigation techniques

Standard investigation techniques were applied.

2. ANALYSIS

2.1 General

The Report was developed based on analysis of the collected material and the statements of the flight crew members.

2.2 Flight operations

During the preparation for the flight, the flight crew was informed about an APU defect and possible delay in departure. The total delay was 2 h and 50 min. The airplane took off on 16 March 2018 at 03:30 hrs. The flight crew stated that the flight route was changed at the three different waypoints due to deteriorating weather conditions on route, in the airport of destination and alternate airport.

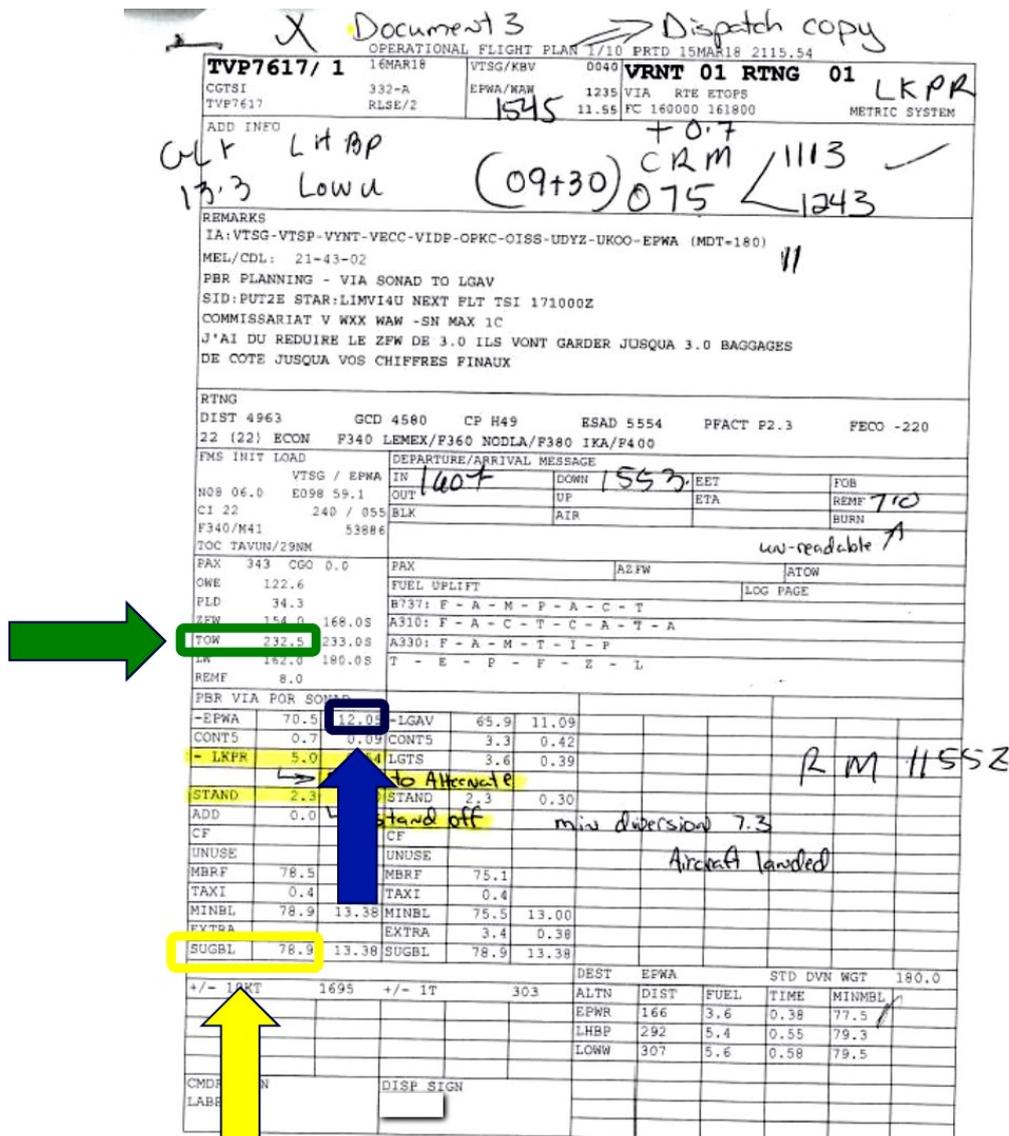


Fig. 7 Operational Flight Plan 1/10 (OFP 1/10).

The flight documents, including *Operational Flight Plan 1/10 (OFP 1/10)*, printed on 15 March 2018 at 21:15 hrs (Fig. 7), show the expected airplane masses for individual assumptions, as well as fuel quantity that was required to perform the flight on the VTGS-EPWA route.

The initial loading sheet assumed 343 passengers on board. According to the document (Fig. 8): *Aircraft Journey Log Subcontract 255394* there were 339 persons on board (336 + 3 Infants⁶). According to the assumptions of OFP 1/10, the minimum suggested fuel mass, that also included fuel for the flight to the alternate airport in Prague, was 78.9 tons (Fig. 7 - in the yellow box). According to the documentation of the flight, the airplane was refuelled to 79.2 tons. Such fuel quantity allowed for a flight to two alternate airports: Prague and Wrocław.

OFP 1/10 includes two other alternate airports: Budapest and Vienna, however, considering the last two airports, the minimum quantity of fuel for the departure should have been: 79.3 tons and 79.5 tons.

It is important to note, that OFP 1/10 was based on weather forecast with assumption that the take-off would take place at 00:40 hrs.

Document 1

transat AIRCRAFT JOURNEY LOG SUBCONTRACT 255394

APPROACH defect no. ETOPS (Min) defect no. 1208647 RVSM defect no. CA Status Sign: Date: 16 MAR 2018 REG: C-GTSL

STATUS: 120 VR FL: Y N CA/FC/LC no. 7350333 Time (u) 03:30 Type A330

FLT	FROM	TO	PILOT FLYING	OUT	UP	DOWN	IN	AIR	TIME	NAUTICAL MILES	Etops	PASSENGERS	WEIGHT	BAGGAGE	PERG
1	KBV	WAW	✓	0330	0340	1553	1609	1713	1239	4463	N/A	336	2736	219	416
TOTAL									1239						

NUMBER OF CYCLES	TOTAL AIR TIME	HOURS	MIN
TO THIS FLIGHT	11324	72	354
TO THIS FLIGHT	01	17	12

FUEL SLIPS no.	TOTAL FUEL UP LIFT	FUEL DENSITY	STATION	RAMP FUEL	TOTAL WEIGHT OF AIRCRAFT AT TAKE OFF
017733	1673	0.721	KBV	7200	232907

Fuel remaining at gate 7400kg
4.800 MIN DEVERSION 7300kg
FIT plan - reclear 7.400kg

lower deck compartment heat
APU

Compass Reading: 313 ND: 314 ND: 314

A/C Defects log

S/n	Code	Signature	ACA/FC/LC no.
1208648 C			AA51261
1208649 C			
1208649 D			
1208649 D			
1208649 C			

Check Performed: SERVICE, TRANSIT

S/n: WAW

Fig. 8 Aircraft Journey Log Subcontract 255394

The analyzed records show that the planned airtime, based on OFP 1/10, was 12 h 5 min (blue box in Fig. 7). The actual total flight time according to the onboard documentation was 12 h 39 min (blue box in Fig. 8).

⁶ Children younger than two years old

The planned take-off mass - according to OFP 1/10 - was 232,500 kg (Fig. 7 - marked with a green box), while the actual take-off mass (ATOM) was 232,907 kg (green box in Fig. 8), so it was 407 kg more than declared in OFP 1/10.

An analysis of the crew's statements shows that they were aware that the headwind speed during the flight was higher than in the flight plan. When approaching Greece, the flight crew revised the remaining fuel using *reclear* procedure, which showed that they had a minimum fuel quantity to reach destination (EPWA), in compliance with all procedures for fuel management. Approximately 2 hours of flight time remained to land on EPWA.

The weather on Athens alternate airport (according to the *reclear* procedure) was as follows:

SA	16/03/2018 13:50-	METAR LGAV 161350Z 19013KT 9999 FEW030 17/05 Q1012
>		NOSIG=
SA	16/03/2018 14:20-	METAR LGAV 161420Z 20010KT 9999 FEW030 16/06 Q1013
>		NOSIG=

Source: www.ogimet.com, access 13.04.2021

Wind from the south, visibility over 10 km, cloud cover 1/8 - 2/8 with a cloud base of 3000 ft, temperature +16°C - +17°C, pressure 1013 – 1012 hPa.

The flight crew informed their operations center about minimum required fuel quantity. In response, the operations center informed that EPWA operator was informed about the situation and therefore no delay in the approach and landing procedure at EPWA was expected.

The flight crew planned their actions based on the weather forecast assuming departure at 00:40 hrs. Due to the delay of departure from the VTSG by 2 h and 50 min, the weather conditions on EPWA were different than the conditions that the flight crew got acquainted with.

Significant Weather Chart (Fig. 6) show that in the south-eastern part of the area (aircraft arrival zone), the warm front prevailed. In the central part of Poland, zones of moderate and heavy icing prevailed. Forecast visibility was from 1500 to 5000 m with snowfall and snowfall with rain. Locally, decrease in visibility was possible that from 500 to 1500 m with heavy snowfall and blizzard. Wind gusts were 32 kt with granular snowfall. Expected temperature at ground level was 0°C. The METAR meteorological information from the Warsaw airport at 4:00 p.m. confirmed the data from the forecast map:

- 16:00 hrs:
- Wind from the direction of 060°, speed 13 kt;
- Visibility 2100 m;
- Light snowfall;
- Light blizzard;
- Cloud cover 0/8 - 2/8, cloud base 1000 ft;
- Cloud cover (second layer) 5/8 - 7/8, cloud base 2200 ft;
- Temperature -2°C;

- Dew point temperature - 4°C;
- QNH 1008 hPa;
- RWY covered with wet snow, runway coverage 11% - 25%, good braking action;
- Temporarily, visibility may be reduced to 1100 m with snowfall and light blizzard and cloud cover 5/8 - 7/8 at cloud base 1000 ft.

It is obvious that in such weather conditions formation of icing on the runway may occur, which in turn may result in a lack of friction during landing roll, and this may lead to the runway excursion.

On the basis of the radio correspondence between the crew and the air traffic controllers, it was found that during the descent towards EPWA the crew was informed about snow clearing action on the runway, which always temporarily closes RWY in use and generates delays in approaching to landing.

Air traffic control, in order to prevent the excessive intensification of traffic in the area of an airport, usually orders reducing the speed of approaching aircraft and at the same time informs about the causes of such situation. Based on the data obtained from their operations center, C-GTSL flight crew was surprised by that situation. Therefore, they asked ATC for approach clearance without delay, at the same time reporting: *MINIMUM FUEL*.

In the past the term *MINIMUM FUEL* had different meanings for different aircraft operators and in different parts of the world. Until 2012, there was no dedicated phraseology to be used when it has been determined that an aircraft would land with less than minimum quantity of fuel (except for the declaration of a MAYDAY) as well as there was no dedicated phraseology to be used when it has been determined that an aircraft may land with less fuel than permitted reserve if any delay, not already notified, would occur.

Since 15 November 2012, amendments to both *ICAO Annex 6 Part I* and the *Procedures for Air Navigation Services – Air Traffic Management (PANS-ATM)* Doc 4444 have been in effect. They state: *In circumstances where an aircraft has declared minimum fuel or is experiencing an emergency or in any other situation wherein the safety of the aircraft is not assured, the type of emergency and/or the circumstances experienced by the aircraft shall be reported by the transferring unit to the accepting unit and any other ATS unit that may be concerned with the flight and to the associated rescue coordination centres, if necessary*⁷.

The declaration of *MINIMUM FUEL* informs ATC that, for a specific aerodrome of intended landing, the aircraft has sufficient fuel quantity to follow the cleared routing, execute an arrival and approach procedure and land with the required fuel reserve. However, there is little or no extra fuel on board and any change to the existing clearance could result in landing with final reserve fuel less than planned. In such a case, rerouting to an alternate airport is usually not taken into account, except for cases, where arriving and landing at the scheduled airport involves a significant extension of the flight time.

⁷ ICAO, *Procedures for Air Navigation Services (PANS) - Air Traffic Management (Doc 4444)*, 16th Edition, 2016.

MINIMUM FUEL is not a declaration granting any special treatment by ATC, i.e. it is not an emergency situation, but merely an information which, could lead some operators to require from their pilot's declaration of PAN PAN⁸. However, controllers should bear in mind that an emergency may arise if any additional delay occurs.

Air traffic controllers are not required to ensure priority to the crews who have indicated or suggested that they are becoming short of fuel or have used the phraseology *MINIMUM FUEL*. The term *MINIMUM FUEL* indicates that a pilot, intending to land at a specific aerodrome, calculated that any change to the existing clearance might result in landing with less fuel than the planned final reserve.

Air traffic Controllers should also take into account that a particular State and/or aircraft operator's procedure may or may not require the use of *MINIMUM FUEL* term and that PAN PAN remains a universally recommended term of declaring any urgency, which requires assistance, and which, if declared due to low fuel would require landing priority. Controllers should also recognise that PAN PAN or MAYDAY MAYDAY⁹ declaration resulted from low fuel may not necessarily contain the fuel-specific phraseology suggested in PANS-ATM - the pilot may declare a standard urgency or emergency first and only once it has been acknowledged, explain that the problem is low fuel and a priority corresponding to the declaration is required.

When a pilot declares *MINIMUM FUEL*, an air traffic controller confirms to the pilot the expected delay (expressed in minutes). After that time a pilot may expect to be vectored to an approach.

When making a decision, an air traffic controller should take into account:

- Low fuel quantity, which limit the range and endurance of the aircraft;
- Expected arrival delay (e.g. due to weather), which may result in a diversion before critical fuel quantity has been reached;
- Fuel problems, such as a leak, fuel contamination or fuel depletion, could result in engine failure or forced landing;
- The scope of assistance to be provided in situations where the level of fuel is minimal.

However, if, at any time, the remaining usable fuel quantity suggests a need for traffic priority in order to ensure a safe landing, the pilot should declare MAYDAY FUEL and report estimated endurance in minutes.

The pilot-in-command shall declare *MAYDAY FUEL*, when the calculated usable fuel predicted to be available upon landing at the nearest aerodrome where a safe landing

⁸ Urgency situation: a situation where it is necessary to ensure the safety of an aircraft or a vehicle, or someone on board or in sight but not requiring immediate assistance, ICAO Annex 10 to the Convention on International Civil Aviation, Aviation Communications, 2020., pp. 5-26.

⁹ Hazardous situation: a situation where there is a threat of serious and / or imminent danger and it is necessary to provide immediate assistance, ICAO, Annex 10 ..., op. cit. pp. 5-26.

can be made is less than the planned final reserve fuel. Declaration of *MINIMUM FUEL* is an explicit statement that priority handling by ATC is both required and expected¹⁰.

During the investigated incident, the air traffic control was informed about *MINIMUM FUEL*. That meant that the flight crew had enough fuel to reach EPWA. At the same time, it meant that any delay in arrival could cause the pilots to declare emergency. The air traffic controllers, who wanted to clarify the situation, asked the pilots about their intentions regarding declaration of emergency, what, according to *Annex 6 of ICAO Air Traffic Management (PANS-ATM) Doc 4444*, would give the TVP7617 priority for landing.

The flight crew consistently refused to declare emergency. Additionally, air traffic controllers asked for *ENDURANCE*, which represents total available fuel quantity expressed by the remaining flight time.

The pilots did not respond to the repeated questions of air traffic controllers. The pilots, who took off with almost three-hour delay, having been on the plane for nearly twelve hours, encountered a situation that surprised them. Several hours earlier, while analyzing the situation near Athens during the *reclear* procedure, they had been reassured by their operations department that they would be cleared to land without delay, making them confident that the minimum fuel they had on board would allow them to land safely at the destination. An additional factor that generated a stressful situation was the time pressure which resulted from the low quantity of fuel on board, and thus the crew had less time to analyze the situation and make decisions.

Stress is a bodily response to a stimulus that disturbs or interferes with the “normal” physiological equilibrium of a person and, in the context of aviation, refers to a state of physical, mental or emotional strain due to some external or internal stimulus¹¹.

In case of a delay of several hours and a long flight, it was natural that the pilots were mentally and physically tired. An additional factor that had an impact on their performance was the weather conditions related to snowfall and the condition of the runway.

Working in such conditions (even as an augmented crew) was a big challenge. The pilots stated that when flying in Canadian airspace and according to their phraseology, the term *endurance* was almost non-existent and was not justified. However, it should be noted that during the basic training, each pilot learns to fill out the flight plan. This is the basic knowledge for any pilot. The term endurance is in the item 19 of the flight plan, which is given as an example in *ICAO Doc 4444*. In this item, the pilot enters the maximum time, the aircraft can spend in the air using the fuel on board. In an airplane like the A-330, such data is very easy to calculate. It is possible to calculate the current fuel quantity based on the initial quantity and consumption delivered by flow meters, or to enter the so-called holding at the last waypoint on arrival and the quantity of unusable

¹⁰ https://www.skybrary.aero/index.php/Fuel_Emergencies:_Guidance_for_Controller. Access: 14.04.2021.

¹¹ <https://www.skybrary.aero/index.php/Stress>, Access: 14.01.2021.

fuel to the computer. FMC will calculate the usable quantity of fuel and provide it in units of time.

The fact that three trained pilots of a large airplane were not able to provide such information to the air traffic controller is difficult to explain, and may indicate their tiredness after a long flight with several unexpected events.

It should also be noted that air traffic controllers were also under significant pressure. Such a situation occurred that due to the weather conditions the main airport of Poland, temporarily suspended operations what increased the density of air traffic dynamically, and in addition, one of the flight crews reported *MINIMUM FUEL*, which could escalate quickly and turn into emergency situation.

As a result of that situation, controllers in sectors worked under pressure, but finally they cleared the flight crew of TVP7617 to land without delay.

The efficient operation of the ground services, who quickly prepared the runway, as well as the work of air traffic controllers and the proper decisions which were taken, helped the crew to land uneventfully at the airport in Warsaw.

It should be noted that the crew landed with 7.4 tons of fuel, while the Minimum Diversion Fuel (minimum fuel reserve to reach an alternate airport) was 7.3 tons.

An important factor is the fact that the flight crew considered Prague (LKPR) as an alternate aerodrome. The plane landed in Warsaw at 15:53 hrs, therefore, in case of diversion to Prague, the landing would take place around 17:00 hrs.

Below is METAR for LKPR as of 17:00 hrs:

```
SA 16/03/2018      METAR LKPR 161700Z 01007KT 2800 -RA BR SCT001 OVC002  
17:00->          01/00 Q1002 TEMPO -RASN=
```

The above message shows that the 8/8 cloud base reached 200 ft, while the cloud base 5/8 - 7/8 reached 100 ft, with a visibility of 2800 m, with mist, light rainfall and temporary light snowfall. Such conditions correspond to the operational minimum of the ILS CAT I, however the lowering 5/8 - 7/8 cloud base could have been the basis for the implementation of LVP (*Low Visibility Procedures*) at the airport. An additional factor that could adversely affect the landing was snowfall, which was the cause of delays in Warsaw. In addition, the flight crew was aware that the flight to an alternate airport in Prague would disrupt the carrier's network.

Considering the above, the flight crew had grounds to assume that the flight to an alternate aerodrome may create additional risk. The deteriorating weather on LKPR could have had an impact on its operation. In addition, potential delays associated with the implementation of LVP (increased separations during approach to landing) could cause a delay in the approach. In order to avoid further complications, the crew focused on the task of landing on EPWA.

3. CONCLUSIONS

3.1. Findings

- 1) The flight crew consisted of three pilots: CPT and two FOs (augmented crew).
- 2) To avoid exceeding MTOM, it was necessary to leave 1700 kg of passengers' luggage on VTSG.
- 3) The airplane departed from VTSG with a delay of 2 h and 50 min.
- 4) Based on MEL, the airplane was allowed to fly with BULK Lower Deck Cargo heating System defect.
- 5) Based on MEL, the airplane was allowed to fly with Power Plant APU INOP. APU neither deactivated nor removed.
- 6) Planned airtime during the flight from VTSG to EPWA was 12 h and 5 min.
- 7) The actual flight time was 12 h 39 min.
- 8) According to OFP 1/10, the planned take-off mass was 232,500 kg.
- 9) The ATOW was 232,907 kg.
- 10) The fuel for the flight was calculated based on OFP 1/10, which was printed on 15 March 2018 at 21:45.
- 11) The actual time of departure was 16 March 2018 at 03:30 hrs.
- 12) During the flight, it was noted that the headwind speed was higher than assumed in the flight plan.
- 13) During the *recler* procedure over Greece, where the alternate aerodrome was Athens, the flight crew established that the fuel quantity was sufficient and compliant with the regulations for the flight to the destination.
- 14) The flight crew was informed by their operations center, that they could expect no delays in the approach and landing procedure at the destination, and that the airport operator knew the status of their flight, i.e. that they had minimum fuel.
- 15) During approach to the destination, the crew was informed about snowfall and the necessity to remove snow from the RWY and was instructed to reduce the speed.
- 16) Due to high density of the aerodrome traffic and closure of the runway, the controllers worked under increased stress and time pressure.
- 17) The crew requested coordination of a shorter approach route to the airport due to *MINIMUM FUEL*, while not declaring an emergency.
- 18) The crew did not respond to the repeated questions of ATC about *ENDURANCE* of the airplane.
- 19) The crew was informed that they were in 13th place in order for the landing approach.
- 20) The crew was tired from the long flight.
- 21) The crew was acting under time pressure.
- 22) After receiving information *MINIMUM FUEL* from the flight crew, ATC controllers were acting under stress.

- 23) Finally, EPWA APP interpreted *MINIMUM FUEL* declared by the C-GTSL crew in such a way that allowed them to land earlier.
- 24) The minimum fuel required after landing was calculated as of 7.3 tons.
- 25) The actual fuel quantity after landing at destination was 7.4 tons.
- 26) Duty officer of EPWA was informed by TWR controller about the lack of declaration of an emergency by the C-GTSL crew.

3.2. Causes of the incident and contributing factors:

- 1) The delay of departure by 2 h and 50 min.
- 2) Take-off with the minimum fuel required for the flight.
- 3) Change in weather conditions along the flight route resulting in increased fuel consumption.
- 4) Change in weather conditions at the destination requiring a delay in landing.
- 5) Lack of response to ATC question about *ENDURANCE* and imprecise responses to other questions.
- 6) The time difference between the departure aerodrome and destination aerodrome (6 hours) and a long flight time (more than 10 hours).
- 7) The occurrence took place in the last phase of a long flight when tiredness was already felt and the crew's perception may have been reduced.
- 8) Acting the crew under time pressure due to the low fuel reserve.
- 9) Willingness to land at the destination to avoid flight to the alternate aerodrome.

4. SAFETY RECOMMENDATIONS

In the Draft Final Report SCAAI recommended that the airline should conduct additional training for its crews covering standard phraseology regarding the declaration of urgencies related to the minimum fuel quantity, in accordance with *ICAO Annex 6, Part I* and the *Procedures for Air Navigation Services - Air Traffic Management (PANS-ATM) Doc 4444*.

In the comments to the Draft Final Report SCAAI was informed that during the 2019-2020 training sequence, Air Transat's Flight Operations Department conducted an awareness training on standard guidelines regarding Low Fuel situations and the importance of efficient communications with ATC with all of its flight crew members.

The SCAAI considers that the actions taken by the Operator are sufficient to prevent similar occurrences in the future, therefore decided to withdraw the formal safety recommendation formulated in the Draft Final Report.

THE END

Investigator-in-Charge

Signature on original

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