FINAL REPORT

Of the
Safety investigation
Of the accident occurred at Craiova Airport

OPERATOR Carpatair
AIRCRAFT SAAB 2000
REGISTRATION YR-SBK
DATE AND TIME 13.02.2012/ 09:08UTC/11:08 LT
LOCATION Craiova Airport (LRCV / CRA)

A 13-08
Data 25.11.2013
AKNOWLEDGEMENT

This REPORT presents data, analysis, conclusions and recommendations concerning the civil aviation safety, issued by the Civil Aviation Safety Investigation Commission appointed by the General Director of the Civil Aviation Safety Investigation and Analysis Center.

The flight safety investigation was conducted in accordance with the provisions of the Government Ordinance No. 51/1999 concerning the technical investigation of civil aviation accidents and incident, approved with amendments and additions by Law No. 794/2001, of the REGULATION (EU) No. 996/2010 of the European Parliament and of the Council from 20 October 2010 on the investigation and prevention of accidents and incidents occurred in civil aviation and repealing Directive 94/56/EC and the provisions of Annex 13 to the Convention on International Civil Aviation signed at Chicago on 7 December 1944.

The sole objective of civil aviation safety investigation is preventing the occurrence of accidents and incidents, by effective determination of causes and circumstances that led to this occurrence and establishing the necessary recommendations for civil aviation safety and it HAS NOT THE PURPOSE of finding guilty, individual or collective responsibilities.

As a consequence, the use of this REPORT for other purposes than preventing the occurrence of accidents and incidents might generate misinterpretations.
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SYNOPSIS

CLASSIFICATION: Accident

Operator: Carpatair
Aircraft: SAAB 2000
Registration: YR-SBK
Date and time: 13.02.2012/ 09:08 UTC/ 11:08 LT
Location: Craiova Airport (LRCV / CRA)

1 PRELIMINARY INFORMATION

1.1 History of the incident

On 13.02.2012, the aircraft SAAB 2000 registered YR-SBK was scheduled to make a passengers flight on the route Craiova - Timisoara.

The aircraft was parked at Craiova Airport. The aircraft was prepared for the flight and, after the passengers boarding, it rolled on the taxiway B and, then, on the runway in order to align and to take off from the runway 09. The taking-off conditions were with low to medium snow, the taking-off surface being covered with a layer of dry snow. After the successive snow runway removal actions, in the lateral areas of the declared runway, including the line of the bright light marking lamps, there were snow accumulations of about 1 m.

The aircraft was aligned on the runway in order to takeoff and, after getting the approval, it began the roll in order to takeoff. During the roll the aircraft deviated laterally to the right side, it hit the snow bank with the right engine propeller, formed after removing the snow from the runway, and it went out in the runway strip almost 20m.

After the aircraft stopped, the crew proceeded to the emergency evacuation of persons on board, according to the specific procedures. The captain informed TWR and requested emergency assistance.

The persons on board left the aircraft through the emergency exists.

1.2 Victims

<table>
<thead>
<tr>
<th>Injuries</th>
<th>Crew</th>
<th>Passengers</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fatal</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Serious</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Minor</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>None</td>
<td>2 pilots + 2 air hostess</td>
<td>51</td>
<td>-</td>
</tr>
<tr>
<td>TOTAL</td>
<td>4</td>
<td>51</td>
<td>-</td>
</tr>
</tbody>
</table>
1.3 Damage to the aircraft

The following damage to the aircraft was found:

1. The front fuselage:
   1.1. The landing gear doors - distorted and deformed;
   1.2. The front landing gear compartment - the shear web walls have been buckled on both sides due to high loads transferred via the nose landing gear;
   1.3. Forward part of the hydraulic cove has been subjected to some scratching and tearing.

2. Cabin section
   2.1. R/H side Some sort of debris has created a hole including a damaged landing light. A depressed area including delaminated zone is also noted on this side. L/H side: This side has two areas of significant delaminations caused by external pressure. Eroded zone is noticed on the composite part;
2.2. The fuselage-wing fairing: The access doors to the battery compartment on the L/H side are deformed as a result of external pressure;

2.3. The L/H cabin side panel between stations 800-838 is overall depressed due to external pressure from the outside. The outer skin (in circumferential direction) from stringer SL 1522 to SL 1516 is deformed including that the internal stringers are also distorted. Significant steps are note where the stringers are attached to the skin. The internal frame at station 814 is distorted at stringer location SL.1517;

3. Left engine assembly:
   3.1. All propeller blades separated from hub;
   3.2. Some damage on spinner;
   3.3. Engine and engine compartment and mountings had no noticeable damage

4. Right engine assembly:
   4.1. Large crack/tear in lower cowl skin, extending approximately 500 mm long;
   4.2. Fuel leak in landing gear bay;
   4.3. Aft landing gear door was broken and associated rods were ruptured;
   4.4. All propeller blades separated from hub in pieces of various sizes. Some damage on spinner as a result of propeller blade separations. Forward lower outboard engine mount damaged from impact with air inlet. Forward lower inboard engine mount damaged from impact with air inlet. Forward upper inboard engine mount, screw between sandwich/elastomer installations broken. Aft upper inboard engine mount – main bolt sheared off and mount broken. Aft upper outboard engine mount – sagging but not broken in piece;
4.5. Right nacelle: Wing inspection light cracked. Aft landing gear door damaged and associated rods were ruptured. Nacelle skin aft (locally) of aft landing gear door damaged from contact with door. Fairing at WS 150.8 for Flap fitting 2 damaged. MLG outboard door damaged and cracked. Nacelle skin above MLG door bent locally (lower portion) after contact with door. MLG outboard door middle fitting cracked and broken. Outboard MLG door telescopic rod broken. MLG outboard door idler housing assy. broken. Inboard fwd cowl damaged on several places; 

4.6. Air inlet: Flange between lower and mid duct damage from contact with torque tube fitting; 

4.7. Aft section of engine installation: Pre-cooler air outlet tube damaged at two locations; 

4.8. Harness installations: Generator harness – several clamps moved out of position. Green harness installation moved out of position at several locations. Green harness chafed thru insulation after contact with Inboard nacelle longeron. Internal damage to Green, Red and Blue harnesses and connections likely to forces causing large engine movement during propeller impact.

After analyzing the noticed damage, the manufacturer pointed that, from the technical point of view, the aircraft can be repaired.
1.4 Other damage

It is not applicable.

1.5 Crew information

Command crew:

<table>
<thead>
<tr>
<th>Pilot (commander)</th>
<th>Male, 43 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>License</td>
<td>Spain, ATPL, issued at 06.09.2007, available until 30.04.2012</td>
</tr>
<tr>
<td>Flight experience</td>
<td>6623:24 flight hours</td>
</tr>
<tr>
<td>Total IFR</td>
<td>4618:22 flight hours</td>
</tr>
<tr>
<td>Total for night</td>
<td>3376:27 flight hours</td>
</tr>
<tr>
<td>Total hours as a commander pilot</td>
<td>4044:11</td>
</tr>
<tr>
<td>Medical certificate</td>
<td>Available until 12.03.2014</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Copilot</th>
<th>Male, 29 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>License</td>
<td>Romania, CPL, issued at 29.08.2008</td>
</tr>
<tr>
<td>Flight experience out of which</td>
<td>700 flight hours</td>
</tr>
<tr>
<td>On helicopter</td>
<td>50 flight hours</td>
</tr>
<tr>
<td>at SSAvC</td>
<td>250 flight hours</td>
</tr>
<tr>
<td>Medical certificate</td>
<td>Available until 25.09.2016</td>
</tr>
</tbody>
</table>
Cabin crew

<table>
<thead>
<tr>
<th>Head of the cabin</th>
<th>Female, 32 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical certificate</td>
<td>Available until 17.09.2012</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air hostess</th>
<th>Female,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical certificate</td>
<td>Available until 13.07.2012</td>
</tr>
</tbody>
</table>

Obs. A third flight attendant, who was not in service, and who traveled from Timișoara with a ticket, was transported in the cockpit on the folding seat designed for the inspectors. The respective attendant, also licensed for the aircraft SAAB 2000, worked to help her colleagues in order to ensure the passengers’ evacuation.

1.6 Aircraft information

<table>
<thead>
<tr>
<th>Aircraft type</th>
<th>SAAB 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft manufacturer</td>
<td>SAAB Aircraft AB, Sweden</td>
</tr>
<tr>
<td>Fabrication number (MSN)</td>
<td>033</td>
</tr>
<tr>
<td>Engine</td>
<td>2 x Allison 2100 A</td>
</tr>
<tr>
<td>State and registration mark</td>
<td>Romania, YR-SBK</td>
</tr>
</tbody>
</table>
1.7 Meteorological information

According to SNOWTAM from METAR starting with 10.30 LT (08.30 UTV) the runway in service 09 was covered, in a percentage of 51 – 100%, with dry snow with the thickness of 2 cm and with an average braking coefficient. The weather conditions were

- wind from the direction 060° with 8 kts (4 m/s),
- visibility of 500 m, snow and freezing fog,
- covered sky 5/8 – 7/8 at 200 ft and covered 8/8 at 400 ft.,
- outside temperature -7°C,
- dew point temperature -8°C,
- QNH 1016 mbar

According to subsequent determinations of the incident at, 13.51 LT, the braking evaluation, according to the classification from RACR – PETA, was from acceptable to mediocre, code 2 – code 3.

1.8 Navigation Aids

The navigation aids functioned normally.

1.9 Communication

The communication aids functioned normally.

1.10 Aerodrome Data

Craiova Airport is certified by AACR through the certificate no. 09/2010 issued at 24.05.2011.

The aerodrome has a concreted runway with the operational width of 45 m, the width of the concreted surface being of 60 m. The lamps for the luminous buoyage of the runway edge are mounted at the edge of the runway, corresponding to the width of 45 m. The declared length of the runway is of 2500 m.
Before the flight, the last snow removal of was started 12.02.2012 at 17.00 until 13.02.2012 local time 08:00. This operation had as purpose to ensure the minimum conditions in order to operate the flight of Carpatair, taking off on 13.02.2012.

At the end of the snow removal operations the runway was contaminated with dry snow, the lateral buoyage lamps not being visible.
The airport does not have its own means and removes the snow through contracted services.

1.11 Flight recorders

The aircraft is provided with flight recorders.

The records of the cockpit conversations, both between the crew and TWR Craiova, were downloaded and copied; the conversations between the flight crew members but also the announcements to passengers.

There were also downloaded the recordings of the aircraft parameters.

The air traffic services also provided to the investigation commission records of the conversations between TWR Craiova and the aircraft crew.

1.12 Wrack and impact information

Not applicable.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

Not applicable.

1.15 Survival information

As built, the aircraft is not equipped with emergency evacuation ramps. The doors height to the ground is reduced and there are not required special evacuation facilities. The stairs are not used for emergency evacuation.
1.16 Tests and research

Not applicable.

1.17 Management and organization information

Craiova Airport provides the snow removal activities based on contracts with commercial companies which have the necessary equipment.

1.18 Additional information

Not applicable.

1.19 Investigation techniques

Not applicable.
2 Analysis

According to the information submitted to the crew, the weather conditions and the runway state were within the minimum standards set by the company for operating the aircraft type SAAB 2000.

Based on the analyzed information it wasn’t identified any aircraft failure that might have led to the occurrence of this incident.

After the repeated snow removal from the runway, in order to maintain its state of operability, there resulted snow accumulations, which have been compacted.

As a result of the deviation from the runway axis, to the right, during take-off, the engine no.2 (R/H) propeller blades touched the accumulated and compacted snow, were broken, losing the trust on engine no. 2 which generated a sudden turning to the right, the aircraft continuing to move almost perpendicular to the runway axis. Successively, the aircraft came into contact with the snow accumulation, with the right main landing gear leg, with the nose landing gear leg, then with the engine no. 1 (L/H) propeller blades, causing their rupture, ending with the left main landing gear leg. The asymmetry of the traction generated by successive blades ruptures of the two propellers could not be countered by the crew in due time. The aircraft stopped at almost 30 m laterally right side on the runway strip.

Taking into consideration the indications from Chap. 7 of the ICAO Doc 9137, Part II, the snow from the runway was not removed appropriately, the lighting lamps being covered with snow, and the snow removal was not homogenous all over the runway surface. Furthermore there were no positions markers of the runway side lamps required by Romanian civil aeronautical regulation RACR-AD-PETA, section 5.5.4.11 - 5.5.4.3 and ICAO Doc 9137 Part II.

The lack of markers, in front of runway side lamps, determined that the lateral delimitation of the runway through snow removal not to be rectilinear and parallel to the runway axis. The aircraft crew, who was not seeing the runway axle markings (covered by a thin snow layer), assumed, wrongly, that the snow accumulations (banks) represent two lines parallel with the runway axis.

The captain changed the takeoff procedure in the moment when the aircraft was aligned for take-off, trying to adapt it to the existing conditions. The captain actually established new tasks for the copilot, an operating mode that both were not familiar with. The flight recorders data show the existence, during the take-off
process, of a short interval when both pilots read, simultaneously, the board indicators, successively announcing the reaching of the \( V_1 \) speed.

It is considered that none of the pilots could any longer maintain the take-off direction in relation to the chosen reference, in the given conditions (the time for adapting the sight, from inside the cabin to outside being longer than the one the crew had available at the moment). The take-off heading was kept until the proximity of \( V_1 \), when the direction was lost, probably lacking reference points. The deviation to the right was accentuated by entering a runway section covered with 5-7 cm thick compacted snow, generating a differential braking on the landing gear wheels. This determined the impact with the snow banks, initially with the right propeller blades and left engine and the aircraft’ exit from the runway.

The people onboard, the passengers and the crew members, left the aircraft according to the applicable emergency procedure for this aircraft type, jumping into the snow. The height, from which they jumped into the snow, leaving the aircraft, was 50 – 70 cm, depending on the emergency exit they used.

3 CONCLUSIONS

3.1 Findings

The civil aviation safety investigation commission found the following:

(1) The snow was not removed appropriately from the runway on the declared width and the runway edges were not marked in front of the runway side lamps, that were not visible.

(2) The aircraft flight crew wrongly choose the reference to maintain the take-off direction and it didn't assessed appropriately the take-off conditions (the runway state and weather conditions).
3.2 Causes of the occurrence

1. Human error generated by following facts:

   1.1. The take-off conditions exceeded the training level of the crew.
   1.2. The changing of the take-off procedure, without previous training.

2. Favorable cause: inappropriate runway snow removal.

4 RECOMMENDATION

(1) Romanian CAA will take action in order to impose the mandatory full implementation of the provisions of ICAO Doc. OACI 9137 Part II Ch. 7, 8 and 9 on all the certified aerodromes.

(2) CARPATAIR will analyze how the crew acted during take-off, establishing and applying specific simulator training.

(3) CARPATAIR will review the take-off procedure in similar conditions to this occurrence and it will retrain the personnel.

Note: The documents and the analysis objects used for the elaboration of the Flight Safety Investigation Report on are confidential and they are stored and archived at the Civil Aviation Safety Investigation and Analysis Center, according to the legal provisions.