



## Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents from 17<sup>th</sup> December 2014 (OSITI), as of 1<sup>st</sup> February 2015 (SR 742.161) was carried out with regards to the following serious incident. This report was prepared to ensure that lessons can be learned from the incident in question.

|                           |   |                 |                                |       |
|---------------------------|---|-----------------|--------------------------------|-------|
| <b>Aircraft</b>           | AVRO 146-RJ100  | HB-IYT          |                                |       |
| <b>Operator</b>           | Swiss Global Air Lines AG, Malzgasse 15, 4052 Basel, Switzerland  |                 |                                |       |
| <b>Owner</b>              | Triangle Regional Aircraft Leasing Limited, 1 Bishop Square, St Albans Road West, Hatfield, Hertfordshire, AL10 9NE, United Kingdom               |                 |                                |       |
| <hr/>                     |   |                 |                                |       |
| <b>Pilot</b>              | Swiss citizen, born 1977  |                 |                                |       |
| <b>Licence</b>            | European Aviation Safety Agency (EASA) airline transport pilot licence aeroplane (ATPL(A)), issued by the Federal Office of Civil Aviation (FOCA) |                 |                                |       |
| <b>Flying hours</b>       | <b>Total</b>  | 3189 h          | <b>During the last 90 days</b> | 137 h |
|                           | <b>On the accident type</b>   | 3189 h          | <b>During the last 90 days</b> | 137 h |
| <hr/>                     |   |                 |                                |       |
| <b>Co-pilot</b>           | German citizen, born 1988   |                 |                                |       |
| <b>Licence</b>            | EASA commercial pilot licence aeroplane (CPL(A)), issued by the FOCA  |                 |                                |       |
| <b>Flying hours</b>       | <b>Total</b>  | 476 h           | <b>During the last 90 days</b> | 98 h  |
|                           | <b>On the accident type</b>   | 476 h           | <b>During the last 90 days</b> | 98 h  |
| <hr/>                     |   |                 |                                |       |
| <b>Location</b>           | Luxembourg Airport (ELLX)   |                 |                                |       |
| <b>Coordinates</b>        | ---   | <b>Altitude</b> | ---                            |       |
| <b>Date and time</b>      | 21 <sup>th</sup> July 2016, 16:30 UTC   |                 |                                |       |
| <hr/>                     |   |                 |                                |       |
| <b>Type of operation</b>  | Commercial  |                 |                                |       |
| <b>Flight rules</b>       | Instrument flight rules (IFR)   |                 |                                |       |
| <b>Flight phase</b>       | Landing   |                 |                                |       |
| <b>Type of accident</b>   | Hard landing  |                 |                                |       |
| <b>Point of departure</b> | Zurich Airport (LSZH)   |                 |                                |       |
| <b>Destination</b>        | Luxembourg Airport (ELLX)   |                 |                                |       |
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| <b>Injuries to persons</b> | <b>Crew</b> | <b>Passengers</b> | <b>Third parties</b> |
|----------------------------|-------------|-------------------|----------------------|
| Minor                      | 0           | 0                 | 0                    |
| None                       | 4           | 66                | n/a                  |
| <b>Damage to aircraft</b>  | Undamaged   |                   |                      |
| <b>Third-party damage</b>  | None        |                   |                      |

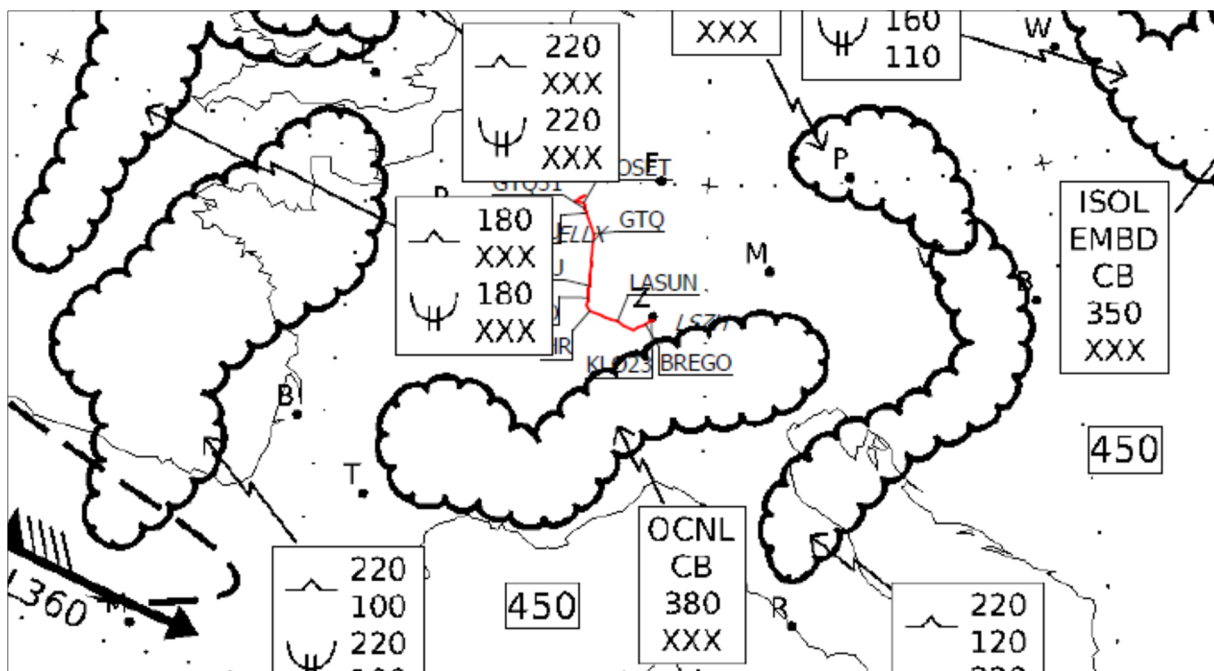
## Investigation

This serious incident was only reported to the Swiss Transportation Safety Investigation Board (STSB) several weeks after the event due to the unsatisfactory flow of information at the airline. Discussions with the safety investigation board of the Grand Duchy of Luxembourg ultimately resulted in the investigation being delegated to the STSB. Despite the delay, the high degree of cooperation from the flight crew and their open and honest statements meant that the incident could be effectively reconstructed. This openness has contributed to ensuring that lessons can be learned from this case for the prevention of further incidents. Besides the statements given by the flight crew, the reconstruction of the incident was based on a number of parameters from the flight data monitoring, recordings from air traffic control and comprehensive meteorological data.

## Background

An AVRO 146-RJ100 aircraft was designated for the scheduled flight from Zurich (LSZH) to Luxembourg (ELLX) with IATA flight number LX 758 on 21<sup>st</sup> July 2016. The flight plan envisaged a departure time of 15:25 UTC and a flight time of one hour. When preparing for the flight, the flight crew had, amongst other things, the following flight weather information from Luxembourg Airport available to them, which forecast light, transient showers from thunderstorm clouds for the time of the landing:

- METAR ELLX 211420Z 21003KT 160V270 9999 FEW035TCU 26/17 Q1016 NOSIG <sup>1</sup>
- TAF ELLX 211100Z 2112/2218 32008KT 9999 SCT030 TEMPO 2112/2120 -SHRA BKN025CB TEMPO 2201/2206 3500 BR SCT005 TEMPO 2209/2218 4500 TSRA SHRA SCT025CB



**Illustration:** Extract from the flight weather map used by the flight crew with the forecast for 18:00 UTC. The planned flight path from Zurich to Luxembourg was recorded in red.

Based on this information, the flight crew planned to carry extra fuel for 20 further minutes of flight time in addition to the minimum amount of fuel required by law. Brussels (EBBR) was

<sup>1</sup> For readers interested in further details, an aid to interpreting flight weather information is available (in German, French and Italian only) at the following location: [www.meteoschweiz.admin.ch](http://www.meteoschweiz.admin.ch) → *Service & Publikationen* → *Beratung und Service* → *Flugwetter*

designated as alternate airport, where no thunderstorm activity was to be expected according to the following flight weather forecast:

- TAF EBBR 211119Z 2112/2218 30006KT 9999 SCT040 PROB30 2203/2206 4000 BR

### History of the flight

The AVRO 146-RJ100 'Jumbolino' aircraft, registered as HB-IYT, took off from Zurich as per the flight plan at 15:33 UTC with radio call sign Swiss 78X. There were 66 passengers and 4 crew members on board the aircraft.

During the flight, the pilot, in his function as the pilot monitoring, made a handwritten note on the operational flight plan of the following ATIS<sup>2</sup> report from Luxembourg Airport with the identifier November (N), which still contained the observation of good weather for the airport at the time (15:50 UTC):

- ATIS N: 1550Z RW24 TL050 07001KT 050V140 9999 SCT039 26/17 Q1016 TEMPO TSRA SCT030CB

Subsequently, the flight crew prepared for an instrument approach to runway 24 at Luxembourg Airport. The ATIS was updated several times and in quick succession due to thunderstorm activity that was approaching from the south-west and increasing in intensity:<sup>3</sup>

- ATIS O: 1603Z RW24 TL050 12002KT 070V150 9999 -TSRA BKN037CB 26/18 Q1016 TEMPO TSRA SCT030CB
- ATIS P: 1606Z RW24 TL050 14002KT 080V170 2000 TSRA BKN035CB 26/19 Q1016 TEMPO TSRA SCT030CB

At 16:07:14 UTC, the flight crew received clearance for an instrument approach to runway 24. Half a minute later, the ATIS report with the identifier Quebec (Q) was broadcast for the first time, which showed a heavy thunderstorm with rain over the airport:

- ATIS Q: 1608Z RW24 TL050 16002KT 080V210 1000 R24/P2000/P2000/1100 +TSRA SCT012 BKN035CB 25/18 Q1016 TEMPO TSRA SCT030CB

At 16:08:35 UTC, air traffic control relayed the following information to the flight crew, "Swiss 78X just for information, we have a heavy shower now overhead the field. If you want to hold and wait just let me know, otherwise report established." Shortly afterwards, air traffic control defined the situation more precisely by stating, "It's pretty heavy rain now with very bad visibility, with a little bit of hail in there."

Based on the information from air traffic control, the pilot decided to abort the approach and enter the Diekirch holding pattern. The ATIS was subsequently updated once more and, from the report with the identifier Sierra (S), also showed particularly strong gusts of wind combined with very poor visibility in addition to the storm activity:

- ATIS R: 1612Z RW24 TL050 18002KT 100V220 800 R24/P2000/P2000/1400 +TSRA FEW012 BKN035CB 25/19 Q1016 TEMPO TSRA SCT030CB
- ATIS S: 1619Z RW24 TL050 25029KT 140V270 MIN01KT MAX50KT 3000 R24/400/800/900 TSRA FEW011 BKN036CB 18/16 Q1017 TEMPO TSRA SCT030CB

At 16:19:40 UTC, the pilot informed air traffic control that he could only stay in the holding pattern for another five minutes before he would have to fly to the diversion airport, Brussels. Subsequently, air traffic control suggested an approach to runway 06 at 16:21:42 UTC, "[...] the wind is on runway 06, and as the west is better than the east, I can offer you 06 if you want

<sup>2</sup> ATIS: Automatic Terminal Information System. Automatic information broadcast on an aircraft radio frequency.

<sup>3</sup> It was no longer possible to ascertain which additional ATIS reports the flight crew listened to after the identifier N, because the recordings from the cockpit voice recorder were no longer available.

to try.” Moments later they added, “[...] but for the time being, as the CB [thunderstorm cloud] just passed, the wind changed a bit, so it’s 060 degrees 14, below the CB.”

The flight crew agreed with the suggestion and requested radar vectoring for an approach to runway 06. This request was granted without delay at 16:22:33 UTC. The pilot took over the role of pilot flying. Shortly afterwards, the ATIS was updated once again:

- ATIS T: 1624Z RW06 TL050 25029KT 140V270 MIN01KT MAX50KT 3000 R06/900/800/400 TSRA FEW011 BKN036CB 18/16 Q1017 TEMPO TSRA BKN030CB

At 16:24:55 UTC, air traffic control informed another aircraft of a surface wind from 060 degrees at 6 kt. At 16:26:48 UTC, the flight crew received the approach clearance for the instrument approach to runway 06. From 16:26:53 UTC, the ATIS report with the identifier Uniform (U) was broadcast, which showed a wind that had turned to the east and an ongoing moderate thunderstorm with rain as well as poor visibility towards the end of the runway:

- ATIS U: 1627Z RW06 TL050 08013KT 040V100 6000 R06/P2000/2000/1000 TSRA FEW006 BKN022CB 18/15 Q1017 TEMPO TSRA BKN030CB

Throughout the entire final approach, the flight crew had the runway in sight. Due to highly variable winds and turbulence, the pilot decided to carry out the final approach without the autopilot. At 16:28:55 UTC, the landing clearance was issued and, at the same time, wind direction and force were provided as 130 degrees and 6 kt respectively. Immediately afterwards, the following ATIS report was broadcast, which indicated a renewed intensification of the thunderstorm activity:

- ATIS V: 1629Z RW06 TL050 09011KT 040V130 MIN07KT MAX21KT 3000 R06/P2000/P2000/1200 +TSRA FEW006 BKN022CB 18/15 Q1017 TEMPO TSRA BKN030CB

During the short final approach, visibility increasingly deteriorated due to heavy precipitation. At the minimum for the instrument approach, at an altitude of 200 ft above the runway, visual references were still good enough to continue the approach. However, shortly before touchdown – at approximately 50 ft above the runway – visibility deteriorated to such an extent that it was no longer possible to perform the landing in a controlled manner by visual references. At 16:30:00 UTC, the aircraft made a hard landing on the runway. No passengers or crew members were hurt and as a hard landing check showed, the aircraft remained undamaged.

### Evaluation of the flight data

The flight data recordings showed a stable final approach to runway 06. The landing flare was initiated slightly too early, with the result that it passed over the runway threshold at a radar height of 65 ft and with a sink rate of approximately 300 ft per minute. The headwind component over the runway threshold was 5 kt and then gradually decreased until it turned into a tailwind component of 3 kt shortly before touchdown. The aircraft touched down 678 m after the runway threshold with a vertical acceleration of 2.66 g.

### Weather information

Shortly before 16:00 UTC, storm cells formed in the south-west and south-east of Luxembourg and were moving only slowly towards Rhineland-Palatinate. In addition, a storm cell just to the east of Luxembourg began to produce rainfall. From 16:05 UTC, the intensity of the precipitation on the south-west and north-east flanks of this cell increased, while the storm system remained almost stationary.

The three main cells in the Luxembourg area interacted through their outflows, whereby daughter cells spontaneously formed, causing new precipitation centres. One such daughter cell was located over the threshold of runway 06 at the time of the landing. It was developing both vertically and laterally and led to levels of precipitation intensity from 25 to 35 mm/h accompanied by minimal lightning activity.

Specific indices and the low lightning rate suggest that wet microbursts<sup>4</sup> were able to spontaneously develop. The Wet Microburst Severity Index (WMSI) – calculated based on model data – reached a value of 18 at 15:00 UTC and a value of 15 at 18:00 UTC. According to the National Oceanic and Atmospheric Administration (NOAA), wet microbursts are less probable where WMSI values are less than 10, however gusts of radial wind up to 35 kt are to be expected when values are between 10 and 50.

### Further clarification

The training and training records of the flight crew were examined. In the process it became apparent that there was nothing of note in the flight crew's history.

### Conclusions

The flight weather forecasts on which the flight preparation was based did not present the prospect of any thunderstorm activity for Luxembourg, but rather only light, transient showers. Weather that would allow unproblematic flying was forecast for the alternate airport, Brussels. Against this backdrop, the flight crew's decision to carry extra fuel for 20 further minutes of flight time is understandable, but it meant that there was relatively little time available to assess the situation when weather conditions developed differently than expected.

However, the same flight weather forecasts also included information on the presence of thunderstorm clouds (CBs) at Luxembourg Airport. This incident shows once again that the forecasting of thunderstorm activity for a given place and a given time is inherently fraught with great uncertainty. For the flight preparation phase, this means that when expecting thunderstorm clouds, you must also expect corresponding weather phenomena.

Aborting the first approach due to the unexpected thunderstorm activity over Luxembourg Airport was appropriate for the situation and safety-conscious. The fuel supply was sufficient to enable subsequent entry into a holding pattern and a reassessment of the situation.

The second approach was made at the suggestion of air traffic control, shortly after the pilot had informed them that he could only stay in the holding pattern for another five minutes due to the amount of fuel available. Subsequently, by the time that LX 758 was landing, the storm that was only moving slowly away to the east had not yet moved as far away from the airport as air traffic control had obviously expected. The spontaneous formation of a daughter cell over the threshold of runway 06 contributed to this.

The fact that the fuel supply would have necessitated a diversion to Brussels in the event of a second go-around, that the pilot controlled the aircraft himself, manually, and that the runway was visible throughout the entire approach lead to the conclusion that the flight crew were focused on landing during the approach. As a result, at the end of the instrument approach they found themselves in a situation in which the weather conditions neither permitted a landing by visual flight rules, nor made a go-around seem favourable, because the flight path for the go-around would have led them through an active storm cell.

As a final point, it should be noted that maintaining flight operations at an airport where heavy thunderstorms with rain (+TSRA) are the prevalent weather conditions, as was the case at the time of the landing, involves fundamental risks which – as this serious incident shows – are often very difficult to assess.

In summary, the Swiss Transportation Safety Investigation Board has concluded that the serious incident under investigation is an event that is mainly attributable to individual judgements, which proved to be incorrect. There are no discernible systemic aspects that could in all probability result in such an incident being repeated. Based on article 45 of the Ordinance on the

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<sup>4</sup> Wet microbursts: Powerful downdraughts that develop suddenly in the area of a storm cell, accompanied by heavy precipitation. Microbursts produce powerful wind shears and therefore represent a particular danger to aircraft that are taking off and landing.

Safety Investigation of Transport Incidents (OSITI), the STSB will therefore not proceed with any further investigation work and concludes the investigation with this summary report.

Berne, 27 June 2017

Swiss Transportation Safety Investigation Board