BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile

www.bea.aero

INVESTIGATION REPORT

Serious incident to the Airbus A340-313 registered F-GLZO on 19 August 2017 at Bogotá El Dorado airport (Colombia)

Time	01:16[1]
Operator	Air France
Type of flight	Commercial air transport
Persons on board	Captain (PM), first officer 1 (PF), first officer 2 (relief pilot), 7 cabin crew, 219 passengers
This is a courtesy translation by the BEA of the Final Report on the Safety Investigation. As accurate as the translation may be, the original text in French is the work of reference.	
Erratum: A modification with respect to the flight number has been made to this report. This translation of the report supersedes the previous translation (December 2019).	

[1] Except where otherwise indicated, the times in this report are in Coordinated Universal Time (UTC). The local time at Bogotá is obtained by subtracting five hours from the UTC time. Thus the event occurred at 20:16 local time, at night.

Windshear during rotation for take-off

The BEA was informed of this event by the operator, following the writing of a report by the captain of this flight. The data and preliminary results from the flight analysis supplied by Air France and Airbus led the BEA to classify this event as a serious incident.

In accordance with the standards and recommended practices in Annex 13 to the Convention on International Civil Aviation (ICAO), the BEA informed the Colombian safety investigation authority (GRIAA[2]) of this serious incident, Colombia being the State of Occurrence. The BEA also requested that the GRIAA delegate the investigation to them. This delegation proposal was accepted by the GRIAA who then designated an accredited representative.

[2] Grupo de Investigación de Accidentes Aéreos.

The BEA has produced an animation showing the aeroplane on its path and the main flight instruments. It is available on the BEA's Youtube channel.
https://www.youtube.com/watch?v=Io3Pnla_Tnw

1 - HISTORY OF THE FLIGHT

1.1 Flight preparation

The flight crew composed of a captain and two first officers met in the operations room to prepare flight AF429 bound for Paris – Charles-de-Gaulle.

The general context of the flight was usual for this airport: on account of the altitude and temperature conditions, the runway length is restrictive in terms of take-off performance and thus in terms of the planned payload (see section 2.2). In these conditions, the performance of the A340-300 is sensitive to changes in the wind, temperature and runway condition[(3)].

[(3)] The orders of magnitude used by the pilots provided for a variation in the wind speed of 1 kt or in the outside temperature of 1 °C equivalent to a variation in the maximum take-off weight of one tonne, which is confirmed by the performance calculations for the conditions of the day.

While preparing the flight, the weather conditions and the appearance of a rain shower meant that all the luggage and fuel required for the flight could not be carried. The aircraft weight would have exceeded the maximum allowable weight by four tonnes which corresponded to all the passenger luggage. The crew asked for the advice of the operator's OCC[(4)] who recommended that the crew waited for the conditions to improve.

[(4)] Operations Control Centre.

Apart from the payload problem, the particular risks identified by the crew during the briefing were:

- the temperature restriction on one of the engines which could lead the crew to applying the engine failure procedure in the event of a warning;
- changes in the wind before take-off which could affect performance and reduce the margins with respect to take-off distances and minimum obstacle clearance heights;
- the presence of high ground near the airport which required reinforced monitoring of the flight path by the crew.

The improvement in the weather conditions, notably the decrease in the outside air temperature from 18 °C to 15 °C finally allowed the crew to undertake the flight carrying all of the planned payload.

1.2 Holding at holding position of runway 13R

The aeroplane arrived at the holding position of runway 13R at 00:51[(5)]. After holding for around ten minutes, the crew shut down two engines. At the same time, the controller asked the crew if they could take off with a storm present at the airport, the crew replied that it was not possible. A discussion then took place in Spanish between the controller and the crew of an Avianca flight (Avianca9257K): the controller specified that from his position, he could not see the storm and the crew of flight Avianca9257K agreed to take-off. The crew of flight AF429, not being Spanish speakers, were not able to follow these exchanges.

[(5)] In total, the crew remained parked for 24 min at the holding position of runway 13R.

A minute later, in the absence of instructions from the controller, the crew, still at the holding position, asked the controller for an explanation.The latter then cleared them to line up for runway 13R. The crew replied that they had to restart the engines which had been shut down earlier.

When asked by the controller, the crew of flight Avianca9257K reported the presence of rain at the end of the runway without any other weather phenomenon. This conversation took place in Spanish. The captain of flight AF429 said that the crew monitored the path of the aeroplanes taking off on the Navigation Display (ND): none of the previous aircraft had altered its heading immediately after take-off which could have indicated the presence of a storm.

At 01:09, i.e. around 18 min after arriving at the holding position of runway 13R, the crew informed the controller that they were ready for take-off. The controller acknowledged and asked them to hold. Around two minutes later, the crew, not having been cleared to line up, called the controller back to express their incomprehension. They then obtained clearance to line up on runway 13R behind flight Avianca9831.

The crew of this flight, on completion of the take-off, reported quite heavy rain on the last quarter of the runway to the controller. This communication was in Spanish and was not relayed in English by the controller. Around 45 s later, i.e. 24 min after arriving at the holding position of runway 13R, the crew of flight AF429 were cleared for take-off. The captain mentioned in his statement that the wind sock indicated zero wind at the time of take-off.

1.3 Take-off

At 01:15:53, the crew applied thrust on brakes and then set the thrust levers to TOGA[6], in accordance with the operator's operational instructions for Bogotá. The flaps were in position 3. At this moment, the anemometer at the threshold of runway 13R measured wind from 211° at 1 kt.

During the take-off run, the available data does not allow the wind on the longitudinal axis of the aeroplane to be estimated before the aeroplane reached a calibrated airspeed of around 110 kt. Between 110 kt and 138 kt, corresponding to the rotation speed (VR) for this flight, the longitudinal wind speed increased and changed from a headwind of 3 kt to 11 kt.

At 138 kt, the PF initiated the rotation with a stick input of around three-quarters of the deflection. Between the start of the rotation and the moment when the main landing gear left the ground, the longitudinal wind changed from a headwind of 11 kt to a tailwind of 12 kt and the calibrated airspeed decreased by 6 kt.

After lift-off, the tailwind continued to gain in strength and reached 25 kt. The wind on the vertical axis of the aeroplane also gained in strength and reached a downdraft speed of 4 kt. The pitch attitude remained between 11° and 13° and the calibrated airspeed decreased until reaching a minimum of 128 kt.

At this moment, i.e. six seconds after the aeroplane had left the ground, the FMGEC[7] detected a windshear leading to a red "WINDSHEAR" reactive message being displayed for 15 seconds on the Primary Flight Display (PFD) and the "WINDSHEAR" audio warning being repeated three times. The calibrated airspeed was then 128 kt, i.e. 13 kt below the lowest selectable speed (VLS). The height remained stable at around 5 ft although the PF continued to apply the nose-up input and the pitch was at 13°. The crew left the thrust levers at TOGA and did not change the configuration of the aeroplane. The angle of attack increased until the angle of attack protection, "Alpha Prot"[8] was activated.

The angle of attack protection remained active for four seconds. The tailwind speed then started to decrease while the calibrated airspeed and the rate of climb increased.

The runway threshold was overflown at a height of 58 ft, more than the 35 ft required by the regulations. The referenced obstacles in the take-off funnel were also overflown with a sufficient margin.

[6] Take-Off Go Around.

[7] Flight Management Guidance and Envelope Computer

[8] When the aeroplane's angle of attack exceeds a threshold called "Alpha Prot", the elevator and trimmable horizontal stabilizer controls enter a protection mode where the angle of attack is proportional to side stick deflection. This allows the pilot to directly act on the angle of attack rather than on the load factor as is the case in a normal situation (also refer to the BEA report on the serious incident to an Airbus A340 registered F-GLZU and operated by Air France on 22 July 2017 at Bogotá, cf. section 2.2).

[9] V2 is the calibrated airspeed at which the aircraft may safely be climbed with one engine inoperative. During take-off, this speed must be reached at a height of 35 ft at the latest. It is calculated for each flight according to the conditions of the day.

Twenty-one seconds after lift-off, the WINDSHEAR warning stopped. The height was then 193 ft and the pitch was 13° and decreasing. Five seconds later, at a height of 258 ft, the calibrated airspeed reached V2[9] i.e. 145 kt.

On leaving the frequency, the crew declared the windshear to the controller who acknowledged. Around 30 s later, the next crew to take-off on runway 13R asked the controller for clearance to hold their position for three minutes because of the windshear.

The crew of flight AF429 continued climbing, avoiding several storms and continued the flight without any further incident to destination.

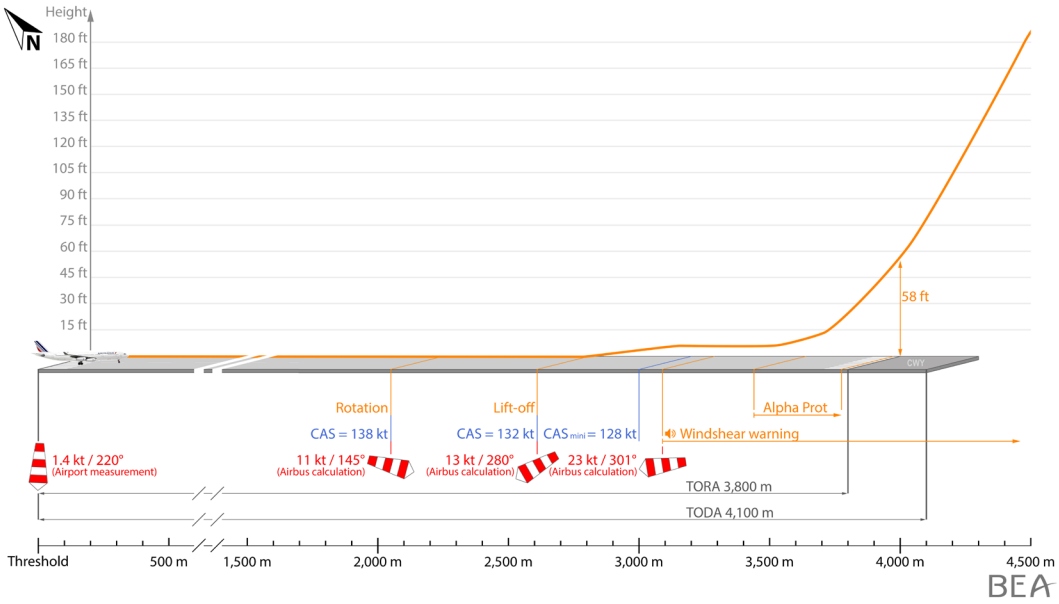

Figure 1: path of F-GLZO

The activation of the angle of attack protection close to the ground along with the restrictive character of Bogotá airport for operation of the A340-300 justified the BEA classing this event as a serious incident.

2 - ADDITIONAL INFORMATION

2.1 Bogotá El Dorado airport

Bogotá El Dorado airport is situated at an altitude of 8,360 ft and has two parallel runways: runway 13L/31R and runway 13R/31L. Runway 13R from which the crew took off, has the following characteristics:

- length: 3,800 m; take-off run length available: 3,800 m;
- overrun: 60 m; acceleration-stop length available: 3,860 m;
- clearway: 300 m; take-off length available: 4,100 m.

Given these characteristics, the payload is often restricted on the A340-300 at Bogotá. On other types of long-haul aeroplanes, the payload is reduced to such an extent that the airport cannot be used as a commercial destination.

2.2 Operational take-off performance

When preparing the flight, the crew must calculate the take-off performance of the aeroplane in order to:

- determine the maximum weight at which the aeroplane can take-off while complying with all the regulatory margins (take-off distance, acceleration-stop distance, obstacle clearance margin, minimum climb gradient, etc.);
- calculate the take-off speeds V1, VR and V2.

Following the abnormally long take-off involving an Air France A340 registered F-GLZU on 11 March 2017 at Bogotá[10], the operator had introduced a precautionary measure intended to increase the take-off safety margins for flights carried out on the A340-300. This measure, in force at the time of the event, resulted in the restriction of the aeroplane's take-off weight.

[10] https://www.bea.aero/en/investigation-reports/notified-events/detail/event/serious-incident-to-the-airbus-a340-registered-f-glzu-operated-by-air-france-on-11032017-at-bogota/

On the day of the event, the aeroplane was "runway-limited" which means that the maximum weight was restricted by the aeroplane's take-off distance, taking into account the precautionary measures applied by the operator. In the present case, it was the calculated take-off distances with one engine inoperative which were restrictive.

2.3 Wind speed at take-off

Calculated wind speed

Both Airbus and the BEA calculated the wind speed at the time of take-off based on the recorded data (Figure 2).

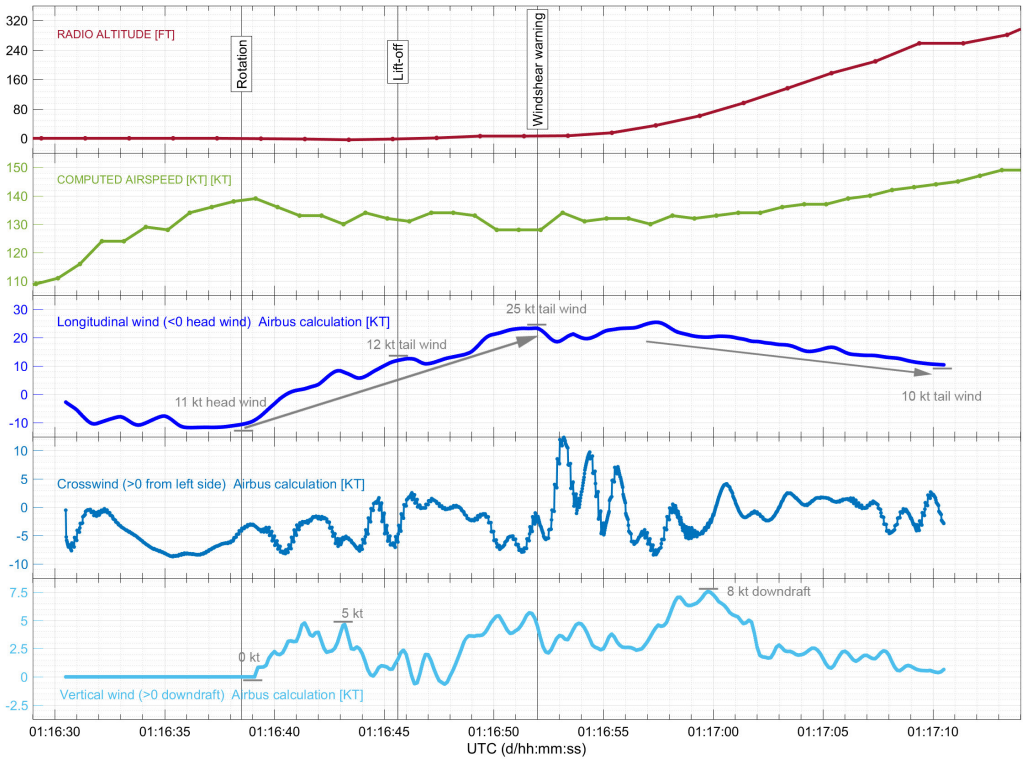

Figure 2: calculated wind speed

This wind speed was calculated in the body-fixed reference frame of the aeroplane and takes into account the ground effect and acceleration biases.

During the take-off run between 01:16:39 and 01:16:45, the longitudinal wind changed from a headwind speed of 9 kt to a tailwind speed of 12 kt. The vertical wind speed increased from 0 kt to a maximum downdraft speed of 5 kt.

After lift-off at 01:16:45, the longitudinal wind speed continued to increase until reaching a maximum tailwind speed of 25 kt, 12 s later. The vertical wind mostly remained a downdraft with a speed of around 4 kt. The crosswind varied rapidly between a right crosswind of 8 kt and a left crosswind of 13 kt.

From 01:16:57, i.e. 12 s after lift-off, the tailwind speed decreased from 25 kt to 10 kt in a period of 13 seconds. The downdraft speed reached a maximum of 8 kt before decreasing to 0 kt. The crosswind speed also dropped.

Wind measured on airport

The airport is equipped with anemometers at each of the four runway thresholds which measure the instantaneous wind every ten seconds. The wind data recorded by these anemometers in the ten minutes preceding the take-off show differences in terms of both speed and direction, between thresholds 13 and thresholds 31 (Figure 3). For runway 13R, in red on the graph, the wind speed was stable at around 2 kt and its direction varied from 360° to 210°.

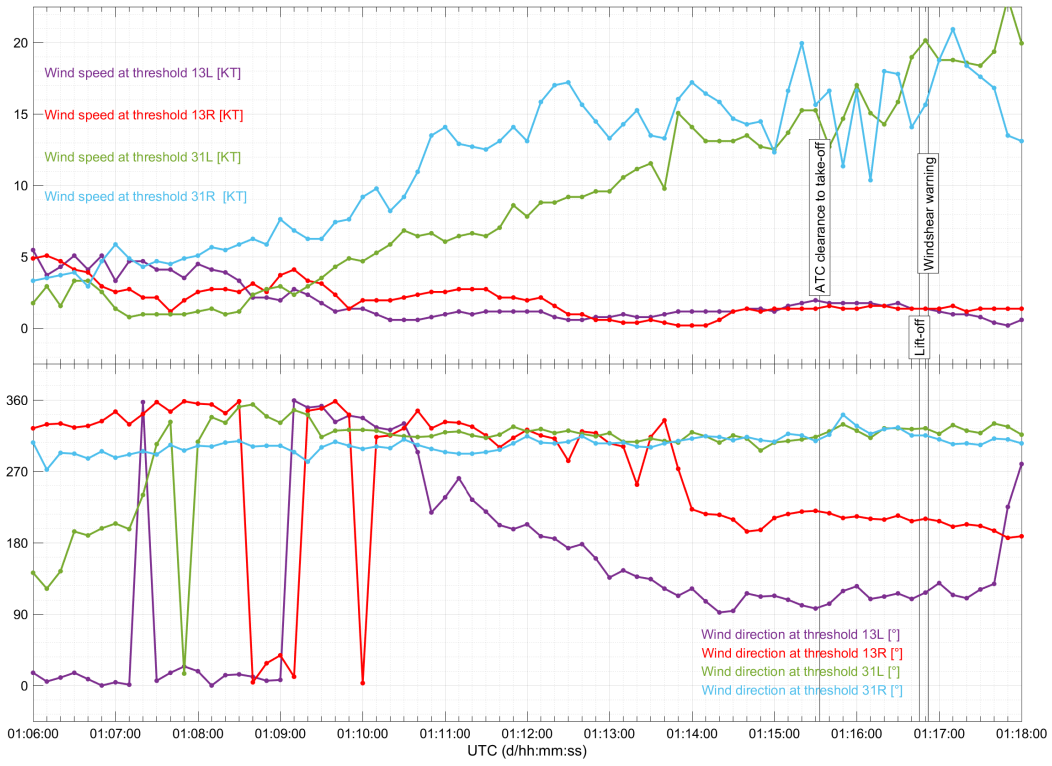

Figure 3: wind at four QFU in the ten minutes before take-off

At the time of the take-off clearance, the wind measured at the four runway thresholds was the following:

Runway threshold	Wind speed (kt)	Direction (°)
13R	1.4	220
13L	2.0	97
31R	15.6	308
31L	15.3	313

The differences in terms of direction and strength between the four runway thresholds persisted for around 13 minutes covering the take-off period. Such differences could alert flight crews and controllers of the possible presence of windshear.

2.4 Weather information available to crew

The METAR weather report dated 20:00 UTC in the crew's flight file indicated the following information:

- wind from 310° at 12 kt;
- visibility above 10 km;
- a few towering cumulus clouds (TCU) based at 1700 ft, scattered clouds based at 2,000 ft;
- temperature 20 °C, dew point 12 °C;
- QNH 1023;
- recent storms and presence of towering cumulus in the north-east of the airport.

The TAF weather forecast in the crew's flight file indicated the following:

- forecasts valid from 18 August at 18:00 to 19 August at 18:00;
- temporarily between 18:00 and 20:00, visibility 7,000 m, presence of storms and rain, scattered cumulonimbus based at 1,500 ft and 1,700 ft;
- temporarily between 01:00 and 05:00, visibility 6,000 m, presence of drizzle and rain, broken cloud layer based at 1,500 ft with presence of cumulonimbus, scattered clouds based at 7,000 ft.

In addition, in the flight preparation room, crews had a tablet providing the wind measured at the four runway thresholds in real time (Figure 4).

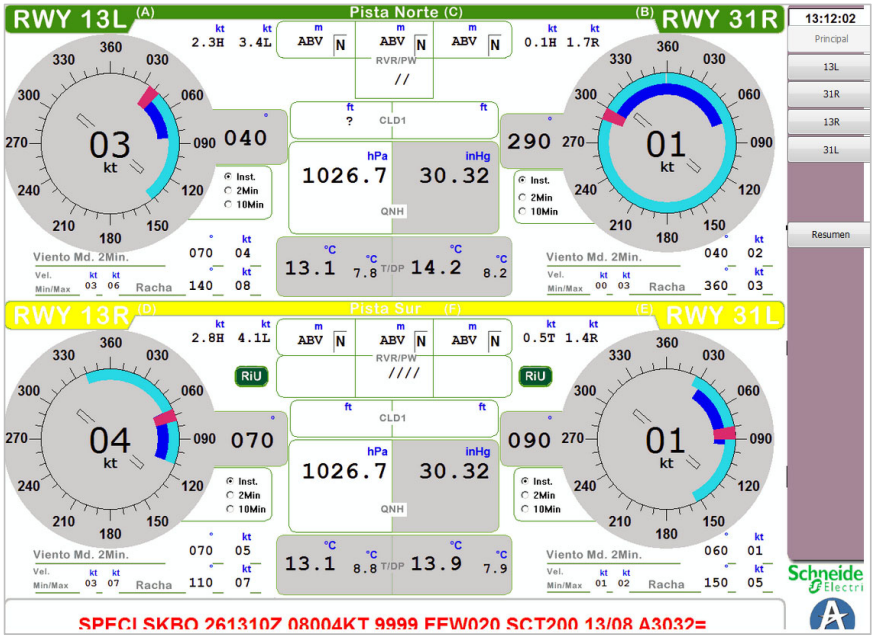

Figure 4: example of screenshot of tool providing the wind at the four runway thresholds at Bogotá airport

On the other hand, in the cockpit, the pilots no longer had this information in real time and relied on the controller to provide them with it[(11)].

(11) This point was the subject of a measure taken by Air France following the event (see section 3.3).

When giving the take-off clearances preceding the departure of F-GLZO, the controller had said in Spanish to several crews:

- tailwind from 330° at 2 kt;
- tailwind from 350° at 3 kt;
- tailwind from 300° at 1 kt.

During the take-off clearance, the controller told the crew that the wind was calm. The crew did not ask for the wind at the two thresholds of the runway in service, this was not in the operator's instructions. A COMPANY NOTAM was in the process of being published by the operator, requesting crews to take into consideration the wind at the two thresholds of the runway in service (see section 3.3).

2.5 Predictive Windshear System

The aeroplane is equipped with a predictive windshear (PWS) and reactive windshear system. The reactive system mainly uses the aeroplane's angle of attack and the wind calculated by the aircraft while the predictive system analyses the weather radar echoes bounced back from water droplets in suspension in order to estimate air movements in front of the aeroplane.

The reactive system detected windshear at 01:16:51, i.e. six seconds after the aeroplane had left the ground.

The PWS is activated if windshear is detected in a radius of 5 NM in front of the aeroplane. The following conditions have to be met for this to happen:

- the danger must be situated in a cone of 30° each side of the aeroplane nose;
- water is present in the air in a form which has sufficient reflectivity (droplets, rainfall, etc.);
- the risk of windshear being present is sufficiently high (estimated risk based on a factor taking into account the wind calculated by the aircraft).

This system had been activated by the crew, in accordance with operating procedures. It did not detect the presence of windshear during the event. It was not possible to determine the cause of this non-detection as the parameters taken into account by the system were not recorded and it was not possible to determine the weather conditions with enough accuracy.

2.6 Airport windshear detection systems

Several types of ground systems detect the appearance of windshear close to an airport. They can use data from:

- anemometers placed in strategic positions on and around the airport; this is the case for Low-Level Windshear Alert Systems (LLWAS);
- Terminal Doppler Weather Radars (TDWR) which are, however, only capable of detecting windshear in the presence of sufficient humidity;
- Doppler Light Detection and Ranging (LIDAR) systems, capable of detecting windshear in dry air.

Some airports frequently exposed to windshear are equipped with one or more of these systems. In the United States, 40 airports are equipped with LLWAS and 46 with TDWR according to a 2010 study[12]. In Asia, Hong Kong, Taiwan and Singapore airports are also thus equipped. Bogotá El Dorado airport is not equipped with such systems.

[12] Robert G. Hallowell and John Y. N. Cho. Wind-Shear System Cost-Benefit Analysis. Lincoln Laboratory Journal Volume 18, Number 2, 2010.

2.7 Operational procedure in event of windshear

The operational procedure in the event of windshear at take-off (Figure 5) specifies the following actions which the crew must be able to perform from memory:

■ **Airborne - initial climb or landing:**

THR LEVERS AT TOGA	SET OR CONFIRM
AP (if engaged)	KEEP ON
SRS ORDERS	FOLLOW

If necessary, the flight crew may pull the sidestick fully back.

Note: *1. The autopilot disengages, if the angle of attack value goes above alpha prot.*
2. If the FD bars are not displayed, move toward an initial pitch attitude of 17.5 °. Then, if necessary to prevent a loss of altitude, increase the pitch attitude.

DO NOT CHANGE CONFIGURATION (SLATS/FLAPS, GEAR) UNTIL OUT OF WINDSHEAR.
CLOSELY MONITOR THE FLIGHT PATH AND THE SPEED.
SMOOTHLY RECOVER TO NORMAL CLIMB OUT OF WINDSHEAR.

Figure 5: excerpt from WINDSHEAR procedure (Airbus FCOM)

During the event, when the WINDSHEAR warning was activated:

- the thrust levers were at TOGA and stayed in this position;
- the autopilot was not engaged;
- the PF announced that he was following the FD bars, confirmed by the manufacturer's calculation of the pitch inputs;
- the captain called out that the configuration was to remain unchanged, which the recordings also confirmed.

2.8 Windshear at take-off statistics

- Bogotá airport air traffic control unit:
  According to the information provided by the GRIAA, there are no statistics available regarding the number of windshears per year at Bogotá nor equipment or specific procedures for detecting and managing these phenomena.

- Air France statistics:
  According to the Air France flight analysis data, there were 21 windshears at take-off or in climb-out at all the airports used, all fleets together, between 1 January 2015 and 19 August 2017, i.e. approximately 1 per 33 thousand flights (Figure 6). The windshear experienced the day of the event was both the greatest in terms of tailwind variation and occurred at the lowest height.

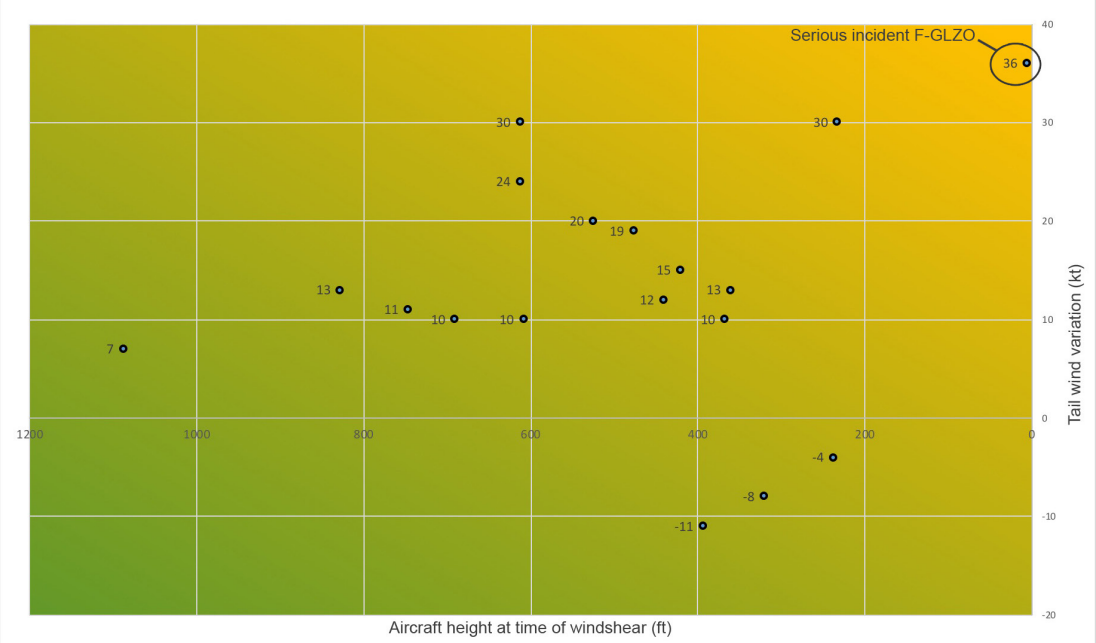

Figure 6 - Distribution of windshear in terms of ground height and strength

Air France also analysed the distribution of reactive WINDSHEAR warnings activated during the departure phases (take-off and climb-out) and arrival phases (approach and landing) per airport, between January 2015 and March 2018. This breakdown does not place Bogotá airport among the most exposed airports: in this period, only one WINDSHEAR warning was recorded at Bogotá, that of this serious incident.

Air France also checked for the number of windshears reported in the METAR messages over the last five years, for all the airports to which they fly. The most exposed airport has on average more than 100 days per year with at least one METAR message indicating the presence of windshear ("WS" in METAR message). At Bogotá airport, this figure is 15 days per year on average.

❒ National and European database

A search in the BEA database and the European Central Repository[13] was carried out to identify windshears at take-off involving aeroplanes with a maximum take-off weight of more than 5.7 t or carrying out commercial air transport flights, with no date limit. Among the 2,361 occurrences which met the search criteria there were:

- an accident to a DC9 registered XA-BCS at Mexico on 21 July 2004[14]. The information available on the NTSB site indicates windshear shortly after rotation leading to a loss of control and collision with the ground. A passenger sustained serious injury and the aeroplane was substantially damaged.
- two serious incidents, one to a BAE 146 during climb and one to an A340. The information collected in the latter event is, however, insufficient for it to be used in this investigation.

Amongst the 2,358 incidents, 11 concerned an A340. Of these 11 occurrences, five occurred in reality during the climb-out and six took place during the take-off or rotation.

None of these events occurred at Bogotá. Of the six events which took place during the take-off or rotation, only one included the activation of a reactive WINDSHEAR alarm and the description of the events given by the crews did not reveal any particular difficulty with managing this situation.

2.9 Precautionary measure taken by Air France

As indicated above, the consequence of the precautionary measure taken by Air France has been to restrict the aeroplane's take-off weight. Without this precautionary measure, the weight of the aeroplane could therefore have been greater. If windshear had occurred after V1, the aeroplane would have then been late in reaching VR.

It was not possible to quantify the additional distance that would have been required to reach VR and lift-off if the aeroplane's take-off weight had not been restricted by the precautionary measure.

However, not being able to reach VR before the end of the runway could have represented one of the undesired events for this serious incident if the precautionary measure had not been in force.

This measure taken by the operator to reduce the risk of a long take-off therefore also reduced the risks associated with windshear at take-off.

[13] The European Central Repository is a database managed by the European Commission designed to hold all the event reports collected in the Union. According to Regulation (EU) No 376/2014, "*Each Member State shall, in agreement with the Commission, update the European Central Repository by transferring to it all information relating to safety stored in the national databases.*"

[14] Information available at the following address: https://www.ntsb.gov/_layouts/ntsb.aviation/brief2.aspx?ev_id=20040722X01041&ntsbno=FTW04WA194&akey=1

3 - LESSONS LEARNED AND RECOMMENDATIONS

3.1 Management of risk of windshear at take-off: prevention-oriented strategy

Windshear, a headwind component changing to a tailwind component, associated with a downdraft wind gradient, as was the case in the event, results in a reduction in the air speed and lift. When such a phenomenon occurs shortly before or shortly after the rotation, the associated risks are the loss of control or collision with obstacles.

During this event, once the aeroplane had entered the windshear, as the thrust was already set to TOGA, the crew had little means available to them to restore safety margins and could only act on the aeroplane's pitch to prevent both stalling and collision with the ground or obstacles. In this case, the flight envelope protections, notably in angle of attack, leave the crew the possibility of applying a stick input up to full nose up deflection if necessary (refer to the procedure described in section 2.6).

The possible actions to limit the risks identified above therefore mainly take place before the aeroplane enters the windshear.

3.2 Assessment of windshear risk at Bogotá El Dorado airport

There are no statistics produced by the local authorities on the number of windshear occurrences per year at Bogotá El Dorado airport. At this airport, take-offs by long-haul aeroplanes often occur at the performance limit which may compound the consequences of a windshear at take-off. In addition, this airport is not equipped with equipment to detect these phenomena which are associated with multiple risks as described above. A statistical study of the windshear at Bogotá El Dorado airport would make it possible to decide if means are to be implemented to limit these risks.

Consequently, the BEA recommends that:

- **the Civil Aviation Authority of Colombia (Unidad Administrativa Especial de Aeronáutica Civil) assess the number of windshears per year at Bogotá El Dorado airport, their strength and the conditions conducive to their appearance.**
  [Recommendation FRAN 2019-035]
- **the Civil Aviation Authority of Colombia assess, according to the results of the abovementioned study, the relevance of equipping Bogotá El Dorado airport with systems designed to detect these phenomena and warn the air traffic control of them.**
  [Recommendation FRAN 2019-0036]

3.3 Wind data provided to crews by air traffic control

The crew's flight file did not contain any message indicating the presence of windshear. In addition, the Predictive Warning System (PWS) did not detect the windshear despite its strength, its location on the aeroplane's axis and the presence of rainfall. The crew therefore mainly relied on the information transmitted by the air traffic controllers for assessing the risk at the time of take-off.

The controllers had wind data at the four runway thresholds but did not give this to the crew in the take-off clearance. More generally, this information is not systematically communicated. The investigation showed that this data, indicating a continuing difference in wind speed and direction between thresholds 13 and thresholds 31, at the time of the event, was the only data which could have warned of a windshear risk.

Following this serious incident, Air France issued an operational directive with a COMPANY NOTAM requiring crews to ask the controller for the wind at the two thresholds of the runway used and to take into account the most unfavourable wind before take-off. This NOTAM was inserted in all the flight files to Bogotá on 25 August 2017, six days after the serious incident. In addition, the Air France crews now have the wind measured at the four runway thresholds in the cockpit via their PILOTPAD. This data could benefit all the operators operating at this airport.

Consequently, the BEA recommends that:

- **the Civil Aviation Authority of Colombia (Unidad Administrativa Especial de Aeronáutica Civil) ensure that a procedure is set up by the Bogotá air traffic control unit with the aim of supplying crews, in the take-off clearances, with the wind measured at the two thresholds of the runway in service when the weather situation is such that windshear is likely (in particular in the presence of storms, towering cumulus or cumulonimbus close to the airport) and that the Bogotá airport aeronautical information warns operators of the risk associated with these particular situations.**
  [Recommendation FRAN 2019-037]

3.4 Communication language with air traffic control

During the event, only the exchanges between the air traffic control and the crew of the Air France flight were in English, all the others were in Spanish. The controller asked Spanish-speaking crews several times for information on the weather situation encountered during the take-off.

Likewise, the controller cleared several crews for take-off shortly before the Air France flight and gave them the latest wind information each time. This information, transmitted in Spanish, could have been of interest to the crew of this serious incident.

Even if these exchanges did not mention the presence of windshear, the crew of the Air France flight did not have access to the information exchanged with the air traffic controller about the weather situation and the sequencing of the departures, which limited the crew's situational awareness.