BEA
Bureau d'Enquêtes et d'Analyses
pour la sécurité de l'aviation civile
www.bea.aero
@BEA_Aero

INVESTIGATION REPORT

Accident to the KUBICEK BB45Z registered F-HOAX

on 7 July 2019
at Puimoisson (Alpes-de-Haute-Provence)

Time	Around 07:15[1]
Operator	B2O Passager du Vent
Type of flight	Sightseeing, commercial
Persons on board	Pilot and six passengers
Consequences and damage	One passenger severely injured, two passengers injured

This is a courtesy translation by the BEA of the Final Report on the Safety Investigation published in November 2020. As accurate as the translation may be, the original text in French is the work of reference.

[1] Unless otherwise stated, all times given in this report are in local time.

Emergency landing at high speed in a field, near a storm

1 - HISTORY OF THE FLIGHT

Note: The following information is principally based on statements from the pilot and passengers, and photographs taken by the passengers.

Having checked the meteorological information at around 04:30, the pilot travelled to the planned take-off location situated in a field near Puimoisson aerodrome (Alpes-de-Haute-Provence) to take six passengers on a commercial sightseeing flight. Three other hot air balloons[2] were also scheduled to take off from the same location. After inflating the hot air balloon, the pilot took off after two other balloons at 05:50 (point ❶ on the flight path in figure 1) and repeated the safety instructions to the passengers.

[2] They were present for a similar flight organised by two other companies and by a private balloonist.

Pushed along by a north-northeasterly wind of 10 to 15 km/h, the hot air balloon travelled in a southwesterly direction. The pilot followed the Riez valley at low height and low speed (around 7 km/h) to take advantage of the mountain breeze at the bottom of the valley. The first two hot air balloons climbed and headed in a southerly direction, pushed along by a wind from the north. After around one flight hour, the F-HOAX hot air balloon was practically stationary over Riez (point ❷). It was overtaken by the last hot air balloon in the group that started descending to land in a field located to the west of the village. The pilot of the F-HOAX hot air balloon also started descent to land in the same field. The hot air balloon remained immobile for nearly ten minutes, ten metres above the ground over an area not suitable for landing. While the other hot air balloon landed, the F-HOAX pilot regained height to find some wind[3].

[3] The lack of surface wind made it necessary to climb to find air flows.

RÉPUBLIQUE FRANÇAISE
Liberté
Égalité
Fraternité

The hot air balloon then began to fly in a northeasterly direction and rapidly picked up speed to reach around 50 km/h. Observing that the balloon was travelling towards a dark and ominous-looking cloud mass located over Puimoisson, the pilot decided to abort the flight and look for a field to make an emergency landing.

He flew over several fields which had power lines traversing his flight path. He oriented the balloon to position one of the longer sides of the basket facing the direction of travel. After several minutes, he identified a field free of obstacles and suitable for landing. Prior to landing, he repeated the safety instructions, turned off the pilot lights and landed at high speed in a cultivated field. One of the long sides of the basket struck the ground hard a first time. The basket then bounced travelling a further 145 metres, rotated 180° and flew over a bush and an embankment. On its second contact with the ground, the basket bounced again before turning onto its side five metres further on. It was then dragged a distance of around thirty metres through one-metre high grass. The pilot pulled on the rapid deflation line, the basket came to a stop and the occupants evacuated the basket. Following retrieval by the support team and when loading the hot air balloon into the retrieve vehicle, a passenger complained of pains in her right foot and reported being unable to walk. She suffered fractures to her tibia, fibula, right ankle and ribs. A second passenger suffered a twisted ankle and another had a suspected cracked rib.

The flight to Riez had taken just over one hour. The return flight, up to the emergency landing, approximately two kilometres from the take-off point, took around ten minutes.

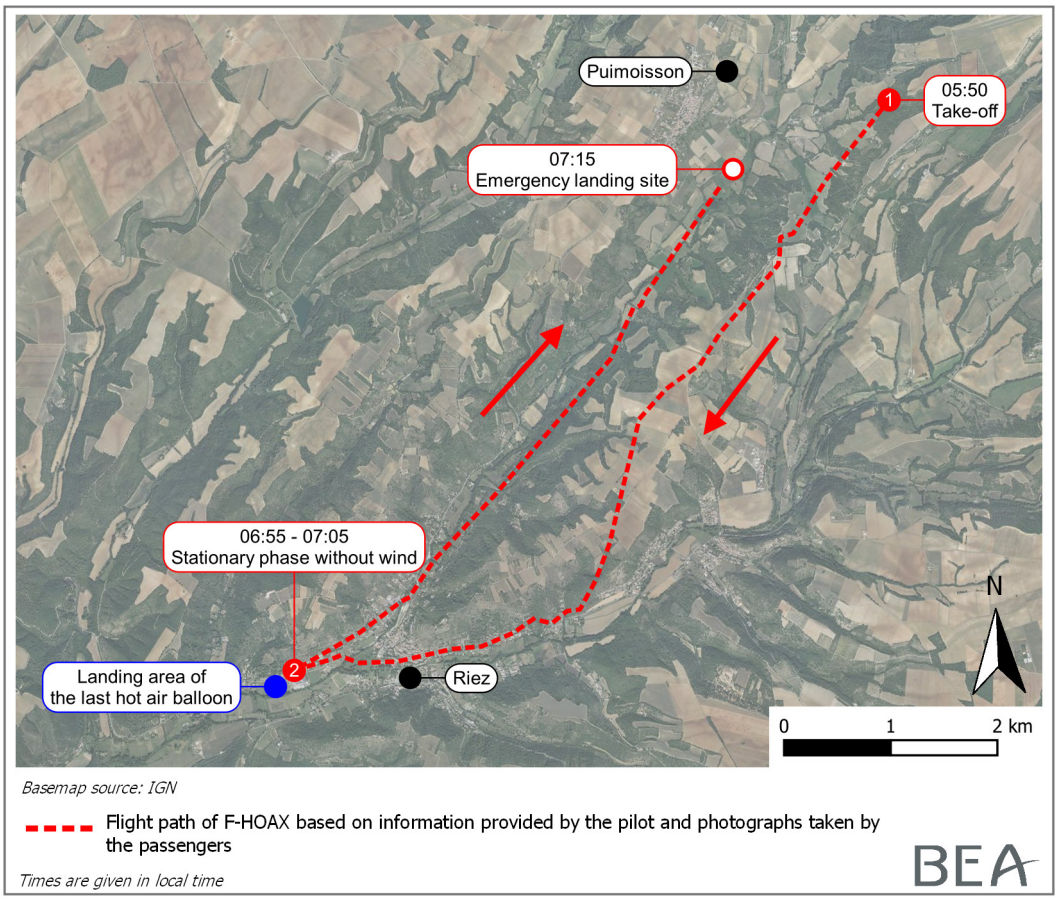

Figure 1: Approximate flight path of the hot air balloon

2 - ADDITIONAL INFORMATION

2.1 Pilot information

The pilot held a free balloon pilot licence issued in 2002 and an instructor rating obtained in 2005. The pilot last underwent a proficiency check in March 2019 and his most recent check flight was in April 2019. He had logged 687 ascents including 52 in the last three months. In the previous month, he had logged 24 ascents including 9 on type. He was issued with an air carrier operating licence and an air operator's certificate (AOC) in July 2017, allowing him to transport passengers.

2.2 Aircraft information

2.2.1 General

The balloon flight manual indicates that the maximum surface wind speed must not exceed 14.6 kt (27 km/h) for landing and that flying is not permitted if higher wind speeds are forecast.

It specifies that the balloon should not be flown if there is storm activity in the area, ahead of an approaching frontal system, or in the vicinity of severe meteorological phenomena (turbulence, thermal uplift, wave phenomena, etc.).

2.2.2 Basket information

The hot air balloon was equipped with a Lindstrand BA-12-A-001-type rattan rectangular[4] basket, with a "*T-shape*" partition creating three separate compartments. The lateral compartment transported the pilot, four gas cylinders and the control lines. The front and the rear compartments each transported three passengers respectively. The bottom of the basket was fitted with a 25 mm-thick high-density, shock-absorbing foam mat and the rattan walls were padded with foam. The upper frame of the basket was clad with dense foam covered with leather. Rope handles were incorporated in the basket work inside the basket for passengers to hold.

[4] Dimensions 125 cm x 185 cm.

2.3 Meteorological information

2.3.1 Meteorological information available before and during the flight

The pilot declared that the France SIGWX chart had not been available[5] when he prepared the flight at 04:30[6]. There is no representative METAR close to Puimoisson. The Avignon[7] TAF had been amended several times during the night. The TAF available at 04:30 had indicated a development of storm cells from 16:00 only.

TAF AMD LFMV 070216Z 0703/0803 VRB05KT ***CAVOK TEMPO 0703/0707 BKN014 BECMG 07/10 07/12 34012KT TEMPO 0714/0717 SHRA SCT060TCU*** *BECMG 0721/0723 VRB05KT=*

[5] The chart is published every three hours from 06:00 to 21:00 UTC and made available two hours before its validity period.

[6] 02:30 UTC.

[7] Avignon is located at approximately 58 NM to the west of the flight departure point.

The Avignon TAF had been amended again at 05:35 to indicate the anticipated development of the storm cell from 05:00. According to Météo-France, the complex and ever-changing nature of the cloud system involved in the occurrence had made it difficult to accurately determine its development in time and space. The pilots had been unaware of this amendment prior to take-off as they had been busy readying the hot air balloons and explaining the safety instructions to the passengers.

TAF AMD LFMV 070335Z 0703/0803 VRB05KT ***CAVOK TEMPO 0703/0706 VRB 15G30KT 3000 TSRA SCT040CB TEMPO 0703/0707 BKN014*** *BECMG 07/10 07/12 34012KT TEMPO 0715/0718 SHRA SCT060TCU BECMG 0721/0723 VRB05KT=*

A first SIGMET[8] valid between 04:00 and 06:00 had announced the presence of stationary storm cells:

LFMM SIGMET 1 VALID 070200/070400 LFPWLFMM
MARSEILLE FIR/UIR ***EMBD TS OBS***[9] *WI N4315 E00230 - N4430 E00245 - N4430 E00330 - N4315 E00330 - N4315 E00230 TOP FL380* ***STNR***[10] *NC=*

A second SIGMET, valid between 06:00 and 08:00 had then been issued, indicating that the storm cells were moving at 25 kt. The SIGMETS had not been consulted.

LFMM SIGMET 2 VALID 070400/070600 LFPWLFMM
MARSEILLE FIR/UIR ***EMBD TS FCST***[11] *WI N4330 E00330 - N4445 E00330 - N4445 E00445 - N4330 E00445 - N4330 E00330 TOP FL350* ***MOV E 25KT***[12] *NC=*

At 21:00, the evening before the flight, one of the other pilots had asked a retired Météo-France forecaster to study the fine-mesh forecasts of the Météo-France AROME model with him for the intended flight sector as he considered them inconsistent. The retired forecaster had stated that the predictions seemed unreliable.

Around 04:30 in the morning, before travelling to the take-off site, the pilot of the F-HOAX hot air balloon said that he had not consulted the SIGMET messages but that he had looked at the forecast fields of the AROME model with the other pilot on the Aeroweb[13] website and had also consulted the Meteoblue and Météociel websites. He had deemed the forecasts to be perfect between 06:00 and 08:00: northerly surface wind of less than 5 kt, northwesterly wind of 10 kt at 850 kPa (height of 1457 m), no clouds forecast for the planned route. They had not consulted the infrared images showing cloud mass developments. Upon arrival at the site, the pilot had consulted the radar image on the Radar60 app on his smartphone and explained that precipitation had been visible in the Arles and Nîmes sector. The pilots had deemed the situation to be acceptable to perform the flight given the distance of this phenomena from where they were[14].

[8] SIGMET (SIGnificant METeorological Information) is a message sent to aircraft in flight to notify pilots of very hazardous and organised, observed and/or forecast meteorological phenomena. It is available at least four hours prior to its validity period.

[9] Embedded thunderstorms in cloud layer observed and persistence forecast.

[10] Stationary.

[11] Embedded thunderstorms in cloud layer forecast and persistence forecast.

[12] Moving eastwards at 25 kt. This value is only an approximation for the validity period of the SIGMET.

[13] According to Météo-France, digital weather forecast models attempt to represent the atmosphere as accurately as possible but should never be considered to be a perfect representation. The model may include inaccuracies in the representation of phenomena in space and time.

[14] At just over 100 km to the west of the take-off point.

Prior to take-off, they released a helium balloon to evaluate the air mass. The surrounding skies were clear and only a few clouds were visible in the distance. The air was completely still. In flight, the pilot listened to the frequency of the Moustiers and Oraison[15] beacons located at a distance of between 10 and 20 km from the take-off point. These announced zero wind. One of the passengers explained that the sky was clear on the outward leg towards Riez but had looked heavy in the distance to the right[16]. They also explained that, on the return leg, towards Puimoisson, the sky had been black and ominous-looking.

2.3.2 Meteorological conditions estimated by Météo-France

The conditions estimated after the accident by Météo-France on the hot air balloon's path up to the site of the accident were as follows (refer to Figure 1): at 05:40, 20 km visibility, clear skies between Puimoisson and Riez, wind from the north-east less than 10 kt in the area immediately around Puimoisson aerodrome. Intensifying storm cells were present to the north-east of Nîmes[17] and were moving eastwards. The main cell was moving at an average speed of around 25 kt. Around 06:30, the sky very quickly became overcast. An arcus[18] type cloud had reached Riez generating new storm cells on the hot air balloon's flight path and an air flow from the south-west of 30 to 35 kt. This altered the conditions, creating severe turbulence. Precipitation, initially moderate then becoming heavier, reached the location of the accident approximately ten minutes after the hot air balloon had landed.

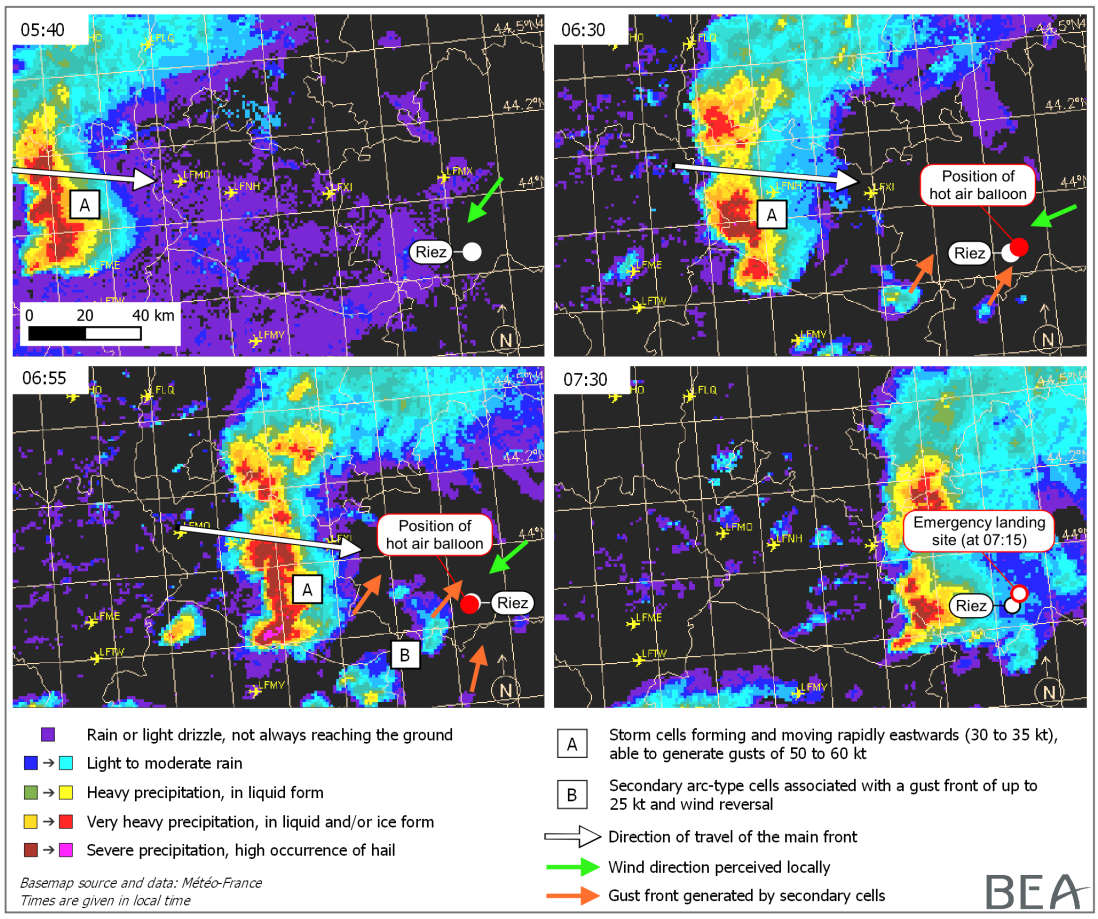

Figure 2: Maps showing radar reflectivity during the hot air balloon's flight

[15] Some hang gliding and paragliding sites are equipped with weather stations or "*weather beacons*". Information is available on the FFVL frequency in VHF (143,9875 MHz) or by phoning 0825 150 289. These beacons transmit every twenty minutes, giving the wind direction, the average force and the strongest gust during the last twenty minutes.

[16] To the west.

[17] This corresponds to the precipitation between Arles and Avignon mentioned by the pilots.

[18] Type of low roll-shaped or arc-shaped cloud extended over a horizontal plane, appearing during a storm and located directly in front of the line of precipitation (rain, hail or snow). This dark and ominous-looking arc is generally associated with cumulonimbus, and more rarely with cumulus. This was a complex and fully mature system, which evolved in a non-linear manner. It was distorted in space and in time, and precipitation located to the east side of the main cell formed and spread more rapidly eastwards.

[19] Published by Cépaduès, 2nd edition August 2002.

The "*Manuel de pilotage des montgolfières*"[19] (Hot air balloon flying manual) states that the pilot should remember that the meteorological forecast gives the average weather for a much larger area than that being flown over. As such, the pilot must understand the forecast and interpret it in terms of the local aerology. To do this, theoretical knowledge and knowledge of the site are major advantages. An understanding of the general situation enables the pilot to make the best decisions, especially in marginal situations.

2.4 Witness statements

2.4.1 Passengers

According to four passengers, the pilots had discussed the meteorological conditions prior to take-off. One of the passengers said that the pilots had explained that the flight would maybe not last long. During the flight, the F-HOAX pilot explained that turbulence had been forecast but not within the hour and that they would have time to land before this.

2.4.2 Pilot of the F-HOAX hot air balloon

He explained that he was used to taking off from this site that they use frequently. He indicated that he had not spoken on the phone with a Météo-France forecaster before take-off as the sky had been perfectly clear over Valensole Plateau located to the west, with only a few clouds in the distance. After the accident, he learned that other hot air balloon pilots had cancelled their flights, near Forcalquier and Roussillon (further west) due to storms.

At the time of the emergency landing, he explained that he had reminded passengers of the safety instructions again without, however, specifying whether they should face towards or with their backs to the impact. This was because when he had checked the position adopted by the passengers in the compartments, he had observed that none of them had their heads above the rim of the basket, therefore deducing that they had their legs bent. At the time, his main concerns had been the orientation of the basket and the landing procedures. He indicated that the hot air balloon had been slowed down by the first contact with the ground and that the second contact had been much harder as the balloon had lost a lot of air and lift.

2.4.3 Pilot of one of the other hot air balloons

He indicated that, prior to the flight, each passenger had received a confirmation email specifying in particular that they should wear secure footwear, such as trainers or walking boots.

He stated that when the passengers had arrived at the take-off site, he had been called over by the pilot of the F-HOAX balloon who was refusing to allow a passenger to board due to her footwear. She had told them that her sandals were proper hiking sandals suitable for sports.

He explained that visibility to the west had been difficult to assess. Before take-off, the pilots had been aware of adverse weather conditions arriving from the west but had thought them to be stationary as indicated by the Météo-France forecasts. They did not consult the aeroweb website again as they had already made the decision to take off and were busy readying the hot air balloons.

2.5 Medical information

The passenger notably suffered a double ankle fracture due to a valgus collapse caused, at the joint, by the rapid shift of the body's weight sideways when the basket first made contact with the ground. The straps on her footwear (Figure 3) did not support her ankle when it was subject to a sudden load on impact.

Figure 3: Model of sandals worn by the passenger who was severely injured

2.6 Information about operator procedures

2.6.1 Interpretation of the meteorological file information

The company's operations manual indicates that pilots must compile a weather file containing the following information: SIGWX, WINTEM, METAR, TAF, AIRMET[20], SIGMET. This file can be supplemented by a telephone call to an aeronautics forecaster.

Given the information collected and observations made, the pilot must analyse the general situation and the observed or forecast phenomena. He must collect the expected conditions for the flight zone, from departure to arrival, and then study the feasibility of the flight. Forecast conditions can lead him to change some operational options (choice of take-off site, duration of flight, earlier or later flight, flight altitudes, etc.).

2.6.2 Limitations for take-off

The operations manual specifies that flight is not permitted in storm conditions, with surface winds stronger than 15 kt, if there are TCU[21], CB[22] or in the event of the creation of a tuba.

2.6.3 Abnormal and emergency procedures of the operator

The company's operations manual specifies that in a rapid landing due principally to the acceleration of the surface wind speed, the basket can violently tip over on impact, with occupants being thrown out of the basket. The occupants must adopt a low position (knees well bent) **with their back or shoulders against the wall of the basket**, **their back facing the direction of travel where possible**, their head not protruding above the rim of the basket and holding firmly onto the rope handles[23].

[20] AIRMETs are alphanumeric messages with a similar format to SIGMET messages, providing information about significant phenomena for flights below FL100 not indicated in the forecasts. AIRMETs are not encrypted in France but AIRMET phenomena and thresholds are taken into account in the France SIGWX.

[21] Tower cumulus. Significant convective clouds that develop when the air is humid and changeable.

[22] Cumulonimbus.

[23] In addition, these procedures are reviewed during proficiency check flights.

The pilot explained that he had had difficulty identifying a field suitable for an emergency landing due to the high speed at which the balloon was travelling and obstacles on the ground. He took time to orient the basket correctly in the direction of landing using the side panels, due to turbulence causing the balloon to turn around itself. The pilot gave the safety instructions before the flight and a second time when the hot air balloon started to travel in a northeasterly direction. The injured passenger said that she had understood just before landing that the pilot had asked her to face the direction of impact[24], keeping her legs flexible and body relaxed.

When the basket first made contact with the ground, the injured passenger, aged 71, had been holding the handles but facing the direction of travel of the balloon. It was only when the balloon had turned 180° after the first bounce that the passenger found herself with her back facing the direction of travel.

[24] According to the hot air balloon flight manual, the best position for passengers to adopt in the event of strong surface wind with risk of a drag landing, is to grip hold of the handles, have their knees bent and their back resting firmly against the basket and facing the direction of travel of the balloon.

3 - CONCLUSIONS

The conclusions are solely based on the information which came to the knowledge of the BEA during the investigation. They are not intended to apportion blame or liability.

Scenario

The pilots had consulted the meteorological data prior to travelling to the take-off site, but had not consulted the SIGMETs. They had a discussion at the site and made the decision to take off, planning to land before the arrival of the forecast adverse conditions. When the pilot did not manage to land, he regained height and the balloon was carried by the wind in a northeasterly direction. The wind force suddenly picked up creating strong turbulence. The pilot was unable to land immediately due to the speed of travel of the balloon and the presence of a number of obstacles on the ground. He was forced to make an emergency landing at high speed as soon as practicable. Concentrating on managing the emergency landing, the pilot reminded the passengers of some of the safety instructions just before the landing, omitting to tell them to position themselves with their backs facing the direction of impact. During the landing made in difficult conditions, a passenger was injured due to the violence of the impacts as the balloon bounced.

Contributing factors

The following factors may have contributed to the pilots' decision to take off in the presence of an approaching weather front:

- Difficulties encountered by Météo-France in estimating the speed of travel of the meteorological phenomenon that caused the conditions encountered.
- The erroneous assessment by the pilots of a stationary front.

The following factors very likely contributed to the passenger's injuries:

- The wearing of sandals that failed to provide sufficient ankle support.
- The "*facing the direction of travel*" position that she adopted inside the basket at the time of the emergency landing.

Safety lessons

Prior to undertaking a flight, it is essential to have the most up-to-date meteorological information, in particular concerning wind, turbulence and storms. In the event of doubt or if there is no internet access at the take-off site, a verbal report can be obtained from a Météo-France forecaster specialised in aeronautical meteorology by calling 08 99 70 12 15[25], to receive the latest meteorological information just prior to the start of the inflation operations.

[25] Service available 24/24.

Balloon flight may be perceived by unwary passengers as being an activity as such which holds little danger whereas experience shows that the risk is greater than the risk in commercial air transport to which the general public has become accustomed and that this activity is not without danger.

Since the accident, the wording "*passengers wearing unsuitable footwear will not be permitted to fly*" has been added by the company to the safety instructions sent to passengers along with their flight invitation.

The safety bulletin for hot air balloon pilots (1st issue 2018-2019) published by the Fédération française d'aérostation (FFAé) includes useful flight-related information. In particular, it specifies that the pilot must ensure that passengers are wearing the correct footwear and discuss any medical conditions with them prior to the flight. The FFAé indicated to the BEA that discussions are in progress concerning how to improve the awareness of people wanting to take a hot air balloon flight to ensure that they consider whether they are healthy enough to fly in a balloon. Some operators now use their own form and the federation recommends this practice.

In addition, in February 2018, the DGAC published a bulletin outlining the safety instructions regarding the setting up and the operation of hot air balloons[26]. Passengers must be told about the safety instructions on the ground even before the inflation operations begin and, to ensure that they each know how to apply these instructions correctly, must practice and demonstrate the position to adopt.

[26] https://www.ecologie.gouv.fr/sites/default/files/Consignes_securite_ballon.pdf