

Hard landing, nacelle tip-over and bounce, ejection of a passenger

⁽¹⁾Unless otherwise specified, the times in this report are expressed in Universal Time Coordinated (UTC).

Aircraft	Cameron Balloons Z-750 balloon registered F-HDJH
Date and time	19 August 2012 at approximately 18 h 30 ⁽¹⁾
Operator	Air Magic, SARL Flying Circus
Place	Feings (41)
Type of flight	Non-scheduled public transport of passengers
Persons on board	Pilot, flight attendant, 32 passengers
Consequences and damage	Death of one passenger

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.

1 - HISTORY OF THE FLIGHT

The pilot planned a flight of about one hour with 32 passengers and one flight attendant. He explained that before takeoff, he estimated the wind to be about 10 knots from the west. He added that the landing safety instructions had been shown to the passengers before the flight by a demonstrator.

After about fifty minutes of flight, the pilot looked for a landing area and asked the flight attendant to repeat the landing safety instructions. The pilot estimated that the wind speed was about 8 kt. During the approach, he noticed that the balloon's descent speed was increasing. A few moments before touch down, he asked the passengers to take up landing positions. At about two meters above ground level, he warned the passengers a hard impact was imminent. He used the rapid deflation system (RDS) in order to deflate the balloon envelope and land.

Upon landing, the nacelle hit the ground a first time, then tipped forward. It took off again and hit the ground again. Dragged by the envelope of the balloon, the nacelle travelled about 25 meters lying on its side. One passenger was thrown out and was struck by the nacelle. It took off again for about 40 meters before stopping 70 meters after the first contact with the ground.

2 - ADDITIONAL INFORMATION

2.1 Information on Operations

On the day of the accident, the Air Magic Company held an air transport certificate (CTA) issued by the DSAC in accordance with the Decree of 4 January 2011. It performed its flights according to the instructions contained in the Operations Manual.

The regulation stipulates that the pilot-in-command is responsible for giving safety instructions to passengers, including those concerning callouts and the practical demonstration of the landing position.

The operations manual specifies that the safety instructions, including those relating to the landing phase, are to be the subject of a demonstration for passengers on boarding the aircraft and are to be repeated in flight. They are detailed in the section on "*briefing before boarding*" and "*normal procedures*".

The "*before boarding*" briefing describes the approach and landing procedures. It indicates that about five to ten minutes before landing, the passengers must stow their belongings (film camera, camera, etc.), hold onto a grip and not let go without having received an invitation to do so "*including when the balloon has landed*". The briefing then states that a few moments before landing and when invited to do so, passengers must adopt the recommended position⁽²⁾. These oral instructions are accompanied by a demonstration.

The "*normal procedures*" in the operations manual repeat the briefing instructions. During the flight, the information must be given to the passengers sufficiently early to allow them enough time to prepare; silence may be requested on board so that everyone can hear.

2.2 Personnel Information

The pilot had accumulated 1,123 flying hours in hot air balloons as pilot-in-command. He had owned the Z-750 since 21 July 2012. He had accumulated 50 flying hours on board during 36 ascents including 3 h 50 during 3 ascents in the last 24 hours.

He was accompanied by a flight attendant. His presence is required as soon as a capacity of 20 passengers is reached. His role is to assist the pilot to ensure the safety of passengers during the flight. He is trained in the operating procedures established by the company.

2.3 Meteorological Conditions

The pilot had all the meteorological information necessary to complete the flight in his flight dossier.

The meteorological conditions estimated by Météo France in the region of Feings were a temperature of 28 ° C and a wind profile estimated at 18 h 00 as follows:

Altitude	Take-off site Rilly-sur-Loire	Landing site Feings
10 m	290° 10 kt	260° 5 kt
20 m	290° 12 kt	260° 7 kt
50 m	290° 13 kt	260° 8 kt
100 m	290° 14 kt	260° 10 kt

2.4 Aircraft Information

The Cameron Balloons Z-750 envelope has a volume of 21,238 m³ and its nacelle is certified in accordance with CS31-HB.

⁽²⁾Squatting position at the bottom of the compartment, with their buttocks touching neither their heels nor the floor, securely holding the handles and their backs away from the rear wall.

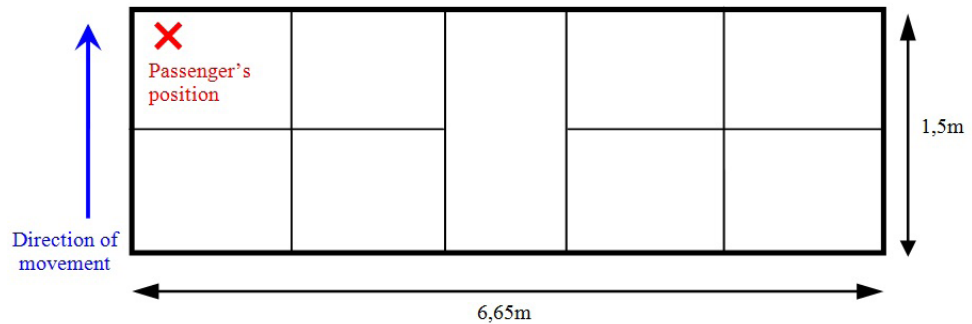
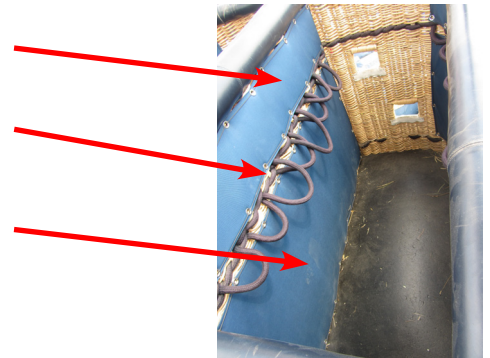


Diagram of basket

The nacelle is equipped with eight compartments of about 1 m², each accommodating four passengers⁽³⁾. Each compartment is equipped with:

- protective pads on the walls;
- handles for passengers to hold onto during the landing⁽⁴⁾;
- a carpet of high density foam covering the floor.



Nacelle similar to that of F-HDJH

The nacelle has a vertical speed indicator to control the vertical speed and a skid for landing. The envelope is equipped with a rapid deflation system (RDS).

The flight manual states that the maximum descent speed is 4 m / s (approximately 800 ft / min) and the flight must not be undertaken if the "surface wind" exceeds 12 kt.

2.5 Interviews

Interviews with the passengers showed that the safety landing instructions were given before the flight and then recalled. They stated that the instructions were understood.

A number of passengers explained that the violence of the impact with the ground surprised them; some added that there was little space available in the compartments.

One passenger indicated that the victim, an elderly and corpulent person, needed assistance in order to board the nacelle.

A witness on the ground filmed the end of the flight from one of the following vehicles. The video shows the approach and landing until the nacelle comes to a stop.

Before the first impact with the ground, the balloon was travelling at a horizontal speed⁽⁵⁾ of 11 kt and at a vertical speed of 2 m / s (400 ft / min). The images also show that some passengers had only partially adopted the position required for landing.

On touchdown, the nacelle tilted 90° forward, then its left side took off to a height of approximately one meter before falling back to ground. The nacelle was then dragged along the ground, pulled by the envelope and pushed by the wind for about 25 meters at an average speed of 7 knots.

Note: The passenger was thrown out of the nacelle during this landing phase.

⁽³⁾AMC 31HB.59 (f): Each passenger must have a minimum area of 0.25 sq. m.

⁽⁴⁾AMC 31HB.59 (h).

⁽⁵⁾These speeds are averages calculated from the video images.

⁽⁶⁾62 events in all.

⁽⁷⁾28 events classified as hard landings.

⁽⁸⁾22 events classified as collisions with power lines.

2.6 Other information

Of all the accidents and serious incidents involving hot air balloons since 2000⁽⁶⁾, hard landings⁽⁷⁾, i.e. made when the vertical speed (heavy landing) or horizontal speed (fast landing) are considered high, represent 45% of the events, with 23% of the deaths and 65% of the injuries.

For comparison, collisions with power lines⁽⁸⁾ represent 37% of events with almost 70% of deaths and approximately 20% of injuries.

It should be noted that when they involve flights open to a public unfamiliar with this activity (public transport, first flights, introductory flights and air shows), "hard landings" represent 20 out of 28 events. All the deaths and 72% of the injuries were observed during these 20 events. Finally, in 39% of the hard landings, the wind was a contributing factor.

3 - LESSONS LEARNED AND CONCLUSION

3.1 Compliance with Safety Instructions

The position to be taken during landing was shown to passengers. This presentation was given on the ground, accompanied by a demonstration. The same instructions were recalled in flight. However, the capacity of the passengers to apply them was not assessed before the flight. This is not required by the regulation.

The corpulence and physical strength of the passenger who was killed, and the cramped compartments in the nacelle probably did not make it possible for him to simultaneously squat and hold onto the handles before the impact with the ground.

3.2 Hard landing

The wind speed was close to the limit specified in the flight manual.

The large volume of the envelope, and the outdoor temperature, limited the effectiveness of the action of the pilot in controlling the vertical speed with the burners.

The action of the pilot on the RDS did not result in a sufficiently rapid deflation of the envelope, which, pushed by the wind, dragged the nacelle for 70 meters along the ground.

3.3 Causes

The late assimilation of the balloon's inertia with its particularly large volume and the wind speed probably contributed to the hard landing and rapid overturning of the nacelle.

Upon landing, it is unlikely that the passenger was able to adopt and maintain a position to protect himself at the time of impact with the ground.

The lack of identification of the vulnerability of the passenger as a risk factor rendered ineffective the safety measures taken at the time of landing.

4 - RECOMMENDATIONS

Note: In accordance with Article 17.3 of European Regulation (EU) 996/2010 of the European Parliament and Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation, a safety recommendation shall in no case create a presumption of blame or liability for an accident, a serious incident or an incident. The addressee of a safety recommendation shall inform the safety investigation authority which issued the recommendation of the actions taken or under consideration, under the conditions described in Article 18 of the aforementioned Regulation.

Landing safety instructions during flights with passengers

The investigation showed that despite the explanations and recall of the safety instructions to follow during landing, passengers may underestimate the potential consequences of a firm landing and only partially apply these rules.

Other authorities have already identified this safety problem:

- ❑ safety information bulletin EASA No.2012-13⁽⁹⁾ specifies that passengers making their first balloon flight may underestimate the consequences of a firm landing, which can cause bouncing, or even overturn the nacelle. This SIB provides that *"pilots and balloon operators are recommended to emphasise during the pre-flight information and pre-landing briefing about firm landings, particularly to flying passengers who are unfamiliar with firm landings"*;
- ❑ *"balloon notice" 1/2007* of the CAA⁽¹⁰⁾, cited by the SIB of the EASA recommends that *"prior to hot inflation, all passengers should board the basket and simultaneously practise the body position they should adopt on landing"*.

This accident shows that this information was not sufficiently taken into account.

Decision 2014/015/R of the EASA published on 24 April 2014 provides in subsection AMC2 CAT.OP.NMPA.120⁽¹¹⁾ that passengers adopt the required position before landing. This text does not require a check before the flight that passengers are able to adopt this position.

Consequently, the BEA recommends that:

- **EASA ensure that the risks specified in SIB No. 2012-13 are duly taken into account in future regulations on air operations applicable to commercial balloon flights. [Recommendation FRAN-2014-008]**

Pending the establishment of the future regulation, the BEA recommends that:

- **The DGAC ensure that before each flight, balloons operators check the capacity of passengers to simultaneously adopt the landing position. [Recommendation FRAN-2014-009]**

⁽⁹⁾http://ad.easa.europa.eu/blob/SIB_201213_Basket_padding.pdf/SIB_2012-13_1.

⁽¹⁰⁾<http://www.caa.co.uk/docs/33/BAL200701.pdf>.

⁽¹¹⁾[http://easa.europa.eu/system/files/dfu/Annex to ED Decision 2014-015-R - Part-CAT_0.pdf](http://easa.europa.eu/system/files/dfu/Annex%20to%20ED%20Decision%202014-015-R-Part-CAT_0.pdf).