الهيئة العامة للطيران المدني
GENERAL CIVIL AVIATION AUTHORITY

United Arab Emirates

Air Accident Investigation Sector

Accident

— Summary Report —

AAIS Case Nº AIFN/0006/2019

Balloon Hard Landing

Operator:	Balloon Adventures Emirates LLC
Make and Model:	UltraMagic N-500
Nationality and Registration:	United Arab Emirates, A6-BOY
Place of Occurrence:	Dubai
State of Occurrence:	The United Arab Emirates
Date of Occurrence:	6 April 2019, 0240 UTC

Investigation Objective

The Investigation was performed by the Air Accident Investigation Sector (AAIS) pursuant to the UAE *Federal Act No. 20 of 1991*, promulgating the *Civil Aviation Law, Chapter VII- Aircraft Accidents*, *Article 48*. It is in compliance with the *Civil Aviation Regulations (CARs), Part VI Chapter 3*, in conformity with *Annex 13 to the Convention on International Civil Aviation*, and in adherence to the *Air Accidents and Incidents Investigation Manual*.

The sole objective of this Investigation is to prevent aircraft accidents and incidents. It is not the purpose of the Investigation to apportion blame or determine liability.

This Summary Report is made public at:

http://www.gcaa.gov.ae/en/epublication/pages/investigationReport.aspx

Investigation Process

The Accident involved an Ultra Magic Balloon, registration A6-BOY, and was notified to the AAIS Duty Investigator by phone to the Hotline Number (+971 50 641 4667).

After the Initial/On-Site Investigation phase, the occurrence was classified as an “Accident”.

The scope of this Investigation is limited to the events leading up to the occurrence; no in-depth analysis of non-contributing factors was undertaken.

Notes:

1. Whenever the following words are mentioned in this Report with first capital letter, they shall mean the following:
   - (Accident) The accident that is the subject of this Summary Report
   - (Aircraft) The aircraft involved in this accident
   - (Balloon) the balloon involved in this accident
   - (Investigation) The investigation into the circumstances of this accident
   - (Operator) Balloon Adventures Emirates LLC
   - (Pilot) The pilot of the accident balloon
   - (Report) This accident Summary Report.
2. Photos and figures used in this Report are taken from different sources and are adjusted from the original for the sole purpose to improve the clarity of the Report. Modifications to images used in this Report are limited to cropping, magnification, file compression, or enhancement of colour, brightness, contrast, or addition of text boxes, arrows, or lines.
3. This Summary Report is structured using the relevant headings as depicted in the *Annex 13* Final Report format.

Factual Information

History of the Accident

On 6 April 2019, at approximately 0530 United Arab Emirates (UAE) local time (LT), an Ultra-Magic N-500 Balloon, registration mark A6-BOY, operated by Balloon Adventures Emirates LLC, ascended to operate a commercial sightseeing flight from Marqab to Hatta Road, Dubai. The Balloon was the third in a formation flight of four balloons. There were 23 persons on-board, comprising the Pilot and 22 passengers.

The basket accommodation included a pilot compartment and four passenger compartments. Six passengers occupied each of the two aft compartments and there were five passengers in each of the forward compartments.

The Pilot reported for duty at approximately 0510 LT. The Pilot and the balloon formation lead pilot traveled together to the launch site. The flight lead pilot obtained the weather conditions for the takeoff from Dubai air traffic control (ATC) during the journey. On arrival at the launch site, the Pilot also checked the weather conditions at the launch site weather station.

The weather conditions were good. The wind speed was about three knots with a moderate temperature of 27ºC. The Pilot decided that conditions were suitable for the flight. The lead pilot reviews these weather data to determine if the weather falls within balloon limitations for departure. For the landing, the lead pilot reviews nearby airports' weather stations such as Dubai International Airport, Al Maktoum International Airport, and Al Ain International Airport to have a general idea about the weather during landing time; these airports are between 120 to 200 kilometers away from the landing site.

At the site, the Pilot provided a five-minute safety briefing to the passengers before they boarded the Balloon. The briefing included launch and landing precautions, and various other safety requirements. The briefing highlighted the importance of wearing the safety harness during the flight and explained how to connect the harness to the floor anchor point in the basket. For the landing, the briefing referred to the 'landing position' in which the passengers must keep their backs to the direction of flight, their knees bent at an angle of about 45 degrees, and they must stand side by side in a shoulder-to-shoulder position while holding the rope handles in the basket with both hands.

After the passengers boarded the basket, the Pilot performed a safety check while the passengers were wearing their safety harnesses. He confirmed that the passengers had latched their harnesses correctly.

The Balloon was cold inflated by the ground crew. The Pilot then started to hot inflate the Balloon envelope with the assistance of the ground crew.

At approximately 0530 LT, the Balloon was launched into conditions of an approximate three-knot wind speed and a temperature of 27ºC. The Balloon was third in a sequence of four in the formation flight. The flight proceeded uneventfully. The formation flight lead pilot communicated with Dubai Approach Control on 122.5 MHz using a portable VHF radio set. He requested clearance for the formation to climbing to a maximum altitude of 4,000 feet. The controller approved this request.

The Pilot climbed the Balloon to 4,000 feet, and the flight continued normally. As per the Pilot's statement, , he conducted a passenger safety briefing before the landing phase, and the passengers were correctly positioned for the landing.

As the Balloon commenced its approach to the landing site, the wind speed was 16 knots. During approach, the wind suddenly shifted through approximately 90 degrees and was now coming from a southeast. Four minutes before landing, the wind speed dropped to eight knots, and during the final approach, the wind speed increased again to 17 knots. The Pilot started to use the red line fast deflation system (FDS) to get the Balloon on the ground by removing the excessive hot air from the envelope. The Balloon floated over several obstacles and did not touch down in the planned flat area. Instead, it continued flying close to the ground, a corner of the basket contacted the tip of a dune, and the basket was tipped onto its side. (Figure 1)

The basket then touched down on the uphill side of a second dune, which stopped its further movement. This abrupt contact of the basket with the dune during the touchdown phase resulted in passengers coming into sudden contact with each other, which caused injuries to three passengers. The passengers disembarked from the basket independently without assistance. The three injured passengers were transported to the nearest hospital, and following preliminary medical tests, two passengers who had experienced minor injuries were released immediately. One passenger who was seriously injured was hospitalized.

Figure 1. Balloon launch and landing location

Injuries to Persons

There were 23 people on-board. Because of the Accident, two passengers experienced minor injuries, and one passenger suffered serious injuries and was hospitalized.

Damage to Aircraft

The Balloon suffered damage to the envelope and the basket.

Personnel Information

The Pilot had been employed by the Operator since September 2017. He was scheduled to operate one flight only on the day of the Accident. As per the Operator's policy, each pilot can perform only one flight per day.

According to his statement, the Pilot first flew balloons when he was 15 years old in India, and he has been flying commercial balloon flights since 1992. From 2006, he was employed as a full-time balloon pilot. In 2012, he moved to Kenya and made his career as a line pilot. From 2014 to 2017, he held the position of balloon chief pilot in the company he was employed by at the time. In addition, the Pilot held a valid balloon commercial pilot license issued by the General Civil Aviation Authority of the United Arab Emirates (GCAA).

Aircraft Information

The Ultramagic N-500 balloon type was initially certified in accordance with the requirements of la Dirección General de Aviación Civil (DGAC) of Spain following 14 CFR Part 31 corresponding to Manned Hot Air Balloons Part 31, Amdt. 4, of 14 October 1980.

The Balloon configuration was:

- Envelope, type N-500 (volume 14,415 cubic meter)
- Quadruple burners, type MK21
- Basket, type C14.

The Balloon had not suffered any technical failure and was airworthy when dispatched for the flight.

Burners

The burner is the engine of the hot air balloon, which converts the fuel (liquid propane) stored in the fuel cylinders into heat energy. This energy is used to heat the air inside the balloon envelope and provide the means of inflation and altitude control during flight. The MK-21 Quadruple type burners (figure 2) were used to inflate the Balloon envelope to provide lift.

An 'on-off' main blast valve mounted below the burners, which is within easy reach of the Pilot, controls the burners.

Envelope

The N-500 type envelope was manufactured from a high resistance polyamide fabric reinforced by several polyester load tapes. The tapes transmit load forces via stainless steel cables to the load frame. The lowest part of the envelope was made of heat resistant Nomex. (Figure 3)

Figure 2. Burners

The envelope had the following specifications:

- Volume: 14,000 cubic meter
- Total height: 31.2 meters
- Weight: 360 kilograms
- Diameter at the equator: 35.5 meters
- Diameter at the mouth: 4 meters
- Parachute diameter: 7.5 meters with FDS.

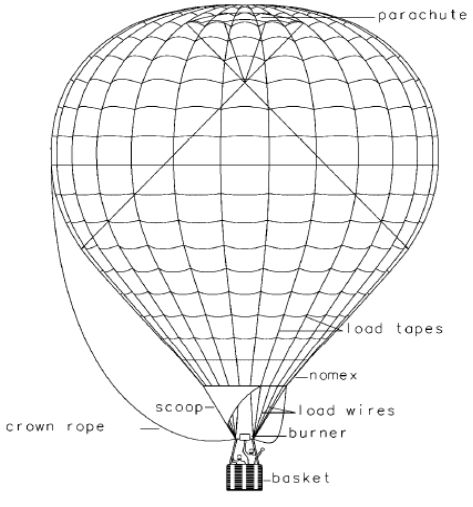

Figure 3. Description of the Balloon envelope

Balloon basket

The Balloon was equipped with a C14 type basket divided into five partitioned compartments (figure 4). The passengers were accommodated in four compartments, with the Pilot and the fuel

cylinders being accommodated in a separate compartment. A maximum of six passengers could be accommodated in each compartment.

The basket was fabricated from woven willow and cane on a marine plywood base. Various openings were woven in to accommodate step holes and strap holes for cylinders.

The basket was connected to the load frame by five stainless steel cables that passed down the basket sides and through and under the base. These cables were continuous and ran in pairs.

The size of the basket was 1.7 x 4.5 meters, and the maximum landing weight was 3,712 kg.

There were five passengers in each of the forward passenger compartments and six in each of the aft compartments of the basket during the Accident

Figure 4. The basket

Maintenance

According to the Balloon technical log, all maintenance tasks had been carried out in accordance with the maintenance program and there were no reported significant technical defects prior to the Accident.

Meteorological Information

The Operator had no weather installations at their landing sites. Therefore, a holistic weather check was done by the lead pilot on the flight day. The Pilot checked all the weather data at the time of landing of three airports which are: Dubai International Airport (OMDB), Al Maktoum International Airport (OMDW), and Al Ain International Airport (OMAL) which are 120 to 200 kilometres away from the landing site.

Aids to Navigation

The Balloon was equipped with a portable global positioning system (GPS), a tablet that had the required applications installed, a transponder, and a Flytec 3040 Altimeter, all of which were operating normally.

Communications

The Balloon was equipped with a portable VHF radio and a mobile phone. The mobile phone was only used for communication when the Balloon was on the ground.

Aerodrome Information

The Balloon ascended from the Operator's base located in the desert area of Marqab, Dubai, as shown (figure 1).

Flight Recorders

Both the portable GPS, and the tablet had the capability to record flight data.

Wreckage and Impact Information

The Balloon was damaged but intact following the Accident.

Medical and Pathological Information

Before the flight, all of the passengers signed the Operator's terms and conditions for the Balloon flight, which included a declaration that they were physically and emotionally fit. The terms and conditions declaration form also included a "not to have" list:

- Serious Heart problem
- Serious knee and backbone surgery/problem
- Phobia in height
- Pregnant lady
- Disabilities covering:
  - Mental health and emotional disabilities
  - Physical disabilities covering impairments.

Because of the Accident, three out of the 23 occupants were injured. Two passengers received minor injuries and were discharged immediately after medical check-up. One passenger was

seriously injured and was hospitalized for five days.

Fire

There was no sign of fire.

Survival Aspects

During the landing phase, the wind speed decreased from 16 knots to eight knots and then increased to 17 knots. During touchdown, the wind direction changed through 90 degrees, and the basket contacted the tip of a sand dune instead of touching down in the intended nearby flat area. While the passengers had adopted the correct landing position just before the touchdown, the abrupt movement of the basket, due to the contact with the tip of a sand dune, caused the passengers to come into sudden contact with those passengers in close proximity to them.

Organizational and Management Information

The Operator's air operator certificate (AOC) was issued by the GCAA in 2005. The AOC certified the Operator to operate flights as a 'private operator' providing passenger service.

At the time of the Accident, Balloon Adventures Emirates (BAE) operated eight balloons of the Ultra-Magic N-500 type.

Training

All required training for the Pilot was provided as per the Operator's *Operations Manual*.

Safety Management System

The Operator used a safety management system (SMS) accepted by GCAA on 28 March 2019. The organization had fully implemented all aspects of its SMS.

The SMS utilized a comprehensive database system to record safety occurrences, internal safety investigations and safety recommendations.

Additional Information

Balloon flying operations in the United Arab Emirates

In the United Arab Emirates, balloon-flying operations are limited because of seasonal variations due to high ambient temperatures, density altitude considerations, and localized and regional variations in wind speed and direction. Normally, the balloon-flying season commences in September and ends in June, dependent on the weather and flying conditions.

UAE national standards of manned ballooning operations

Part IV, Section E of the *Civil Aviation Regulations – Special Purpose Operations*, prescribes the requirements for manned ballooning operations.

The requirements for visual reference for balloon operations are provided in *CAR* Part IV Section E, Sub-Section 2.9 – *Visual Reference*:

> "2.9 VISUAL REFERENCE:
>
> No person may operate a balloon on free flight operations except with visual reference with the surface, clear of cloud, with a minimum cloud ceiling of 1000 feet above ground level, and a minimum visibility of 3 kilometres."

Analysis

The Investigation collected data from various sources for the purpose of determining the causes and contributing factors that led to the Accident.

This Section of the Report explains the contribution of each investigation aspect to the Accident.

Weather Information at Landing Sites

The Operator used the weather data generated by three surrounding airports before commencing the flight. This weather review is performed to determine how the weather will look like at the planned landing site. There were no weather stations available next to the landing sites.

The Investigation believes that the lack of live weather information at the landing sites affects the Pilot's planning for descent, approach and landing. Having the exact weather information before determining the landing area is directly related to landing area suitability. This is also important for pilot awareness of unexpected weather conditions that affect the balloon's landing capability, such as low visibility conditions, which can form risks.

Part IV Section E of the Civil Aviation Regulations – Special Purpose Operations- Visual Reference, requirement needs to be met for ballooning operations. Exact and timely weather information needs to be available for pilots to meet such a requirement at all times.

The Investigation believes that the lack of weather information at the landing site creates uncertainty and reduces the pilot's situational awareness during the approach and landing. Using the weather information of the nearby airports will not reflect the exact weather conditions on the landing site. Weather data from the three airports from which the lead pilot used their data for landing at the landing site are between 120 to 200 kilometers away from the landing site of Hatta.

Therefore, the Investigation believes that relying on the weather data of these three different airports will not necessarily reflect the actual weather in the landing area. The Investigation sees that having another mean of weather aid that may transmit the latest weather conditions at the designated landing site will be more effective in increasing the situational awareness of the pilots.

Prolonged Burner Use

Due to continuous wind change throughout the approach, the Pilot's controllability was affected. Accordingly, he attempted to recover control by adding hot air to the Balloon by using burners. He was aiming at decreasing the rate of descent in these gusty conditions. However, if used for a long time, this technique can lead to excessive hot air in the envelope, which would lead to the float of the Balloon after touchdown.

The Investigation believes the bounce of the Balloon was likely due to having excessive hot air in the envelope. This excessive air led to the Balloon floating over the sand dunes beyond the specified landing spot. However, the Investigation believes that the Pilot's action was to control the Balloon during these gusty conditions.

Conclusions

General

From the evidence available, the following findings, causes and contributing factors were made with respect to this Accident. These shall not be read as apportioning blame or liability to any particular organization or individual.

To serve the objective of this Investigation, the following sections are included in the conclusions heading:

Findings

Findings relevant to the Balloon

(a) The Balloon was certified, equipped, and maintained in accordance with the requirements of the *Civil Aviation Regulations*.

(b) The Balloon was airworthy when dispatched for the flight.

(c) The Balloon maintenance records did not reveal any evidence of pre-existing mechanical anomaly that could have contributed to the occurrence.

(d) The Balloon sustained damage to the envelope and the basket.

Findings relevant to the Pilot

(a) The Pilot held a GCAA issued commercial pilot license (balloon). He was qualified for the flight in accordance with the requirements of the *Civil Aviation Regulations (CAR)* of United Arab Emirates.

(b) The total balloon flying experience of the Pilot was 2,412 hours.

(c) As per the Operator's policy, the Pilot operated one flight per day. He had not engaged in, or been affected by, any abnormal activities during his rest time. There was no evidence that fatigue was a contributing factor to the Accident.

Findings relevant to the Operator

(a) The Operator was issued an air operator certificate (AOC) issued by the GCAA under *CAR PART IV – Special Purpose Operations Section E - Ballooning Regulations.*

(b) The take-off site of the Operator has weather installment for providing weather information, whereas the landing sites were not equipped with such installations.

(c) The Operator's lead pilot uses the weather data of OMDB, OMDW, and OMAL to determine the weather in the landing site.

Causes

The Air Accident Investigation Sector determines that the cause of the Accident was the rapid wind shift and wind speed changes prior to touchdown followed by an uncontrollable Balloon

condition caused by a corner of the basket contacting a dune just before touchdown.

Contributing Factors to the Accident

The Air Accident Investigation Sector identifies the following contributing factors to the Accident:

(a) The Pilot action using the red line at the descent was too slow, which led to the basket hitting the tip of a sand dune instead of touching down in the intended flat area prior.

(b) The captain did not align the basket with the landing direction, and the basket touched down with its corner of the short side.

Safety Recommendations

The Air Accident Investigation Sector recommends that Balloon Adventure Emirates—

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Conduct a feasibility study of having an automated weather station that transmits data in a timely manner to aid the pilot's decision-making/preparation for landing in a specific landing area. This will ensure that pilots situational awareness is enhanced.

This Report is issued by:

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