



Arab Republic of Egypt
Ministry of Civil Aviation
Aircraft Accident Investigation

Final Report

Concerning

Air Balloon Burning and falling Accident

While on a touristic trip

At the Western Side of Luxor city, Egypt

On 26th February 2013

Registration SU-283

Operated by Egyptian Airship and Balloon Company

Cairo December, 2013

Foreword

This report includes the conclusion reached by the Accident Investigation Committee concerning the conditions and the causes leading to the accident. The investigation took place, and the report has been issued in accordance with Annex 13 to the Convention on International Civil Aviation ICAO, signed by the world states including Arab Republic of Egypt, in addition to the regulation (ECAR part 801) issued by the Egyptian Civil Aviation Authority

Based on Annex 13, ECAR part 801 regulations, the investigation has not been conducted so as to apportion blame, nor to assess individual or collective responsibility. The sole objective is to draw lessons from this occurrence which may help to prevent future accidents.

Consequently, the use of this report for any purpose other than for the prevention of future accidents could lead to erroneous interpretations.

The final report was issued in Arabic language and then translated to English language. It should be beard in mind that in case of any conflict between both versions, the Arabic version shall supersede.

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Glossary

| | |
|------------|---|
| A/C | Aircraft |
| ATC | Air Traffic Control |
| Capt | Captain |
| CMRDI | Central Metallurgical R& D Institute. |
| CRM | Crew Resource Management |
| CPL | Commercial Pilot License |
| DIR AAI | Directorate Aircraft Accident Investigation |
| ECAA | Egyptian Civil Aviation Authority |
| FDS | Fast Deflection System |
| FAA | Federal Aviation Administration |
| FM | Flight Manual |
| GPS | Global Positioning System. |
| ICAO | International Civil Aviation Organization. |
| MCA | Ministry of Civil Aviation |
| (MCA- AAI) | Ministry of Civil Aviation, Aircrafts Accidents Investigation |
| MPD | Maintenance Planning Data |
| NTRA | National Telecommunication Regulatory Authority |
| PDC | Pre Departure Check |
| PFI | Pre Flight Inspection |
| TEMA | Tubular Exchangers Manufacturers Association |
| TSN | Time since New |
| UTC | Universal Time Coordinate |
| VHF | Very High Frequency |

Synopsis

- Date of the accident: 26 February, 2013
- Time of the accident: 05:00 UTC
- Accident Location: N 25° 40.626' (Latitude), E 32° 35.967' (Longitude)
(Crash took place in agriculture land at the Western Side of Luxor city)
- Balloon Mission: Touristic flight
- Balloon Information:
 - Registration: SU-283, Egypt
 - Type: ULTRAMAGIC N425
- Injuries to persons: 19 fatalities (Balloon passengers)
- Owner and Operator: (Egyptian Airship and Balloon, Sky Cruise)
- Balloon Damage: The balloon was completely damaged
- States participating in the Investigation: Spain, representing manufacturer State

Information about the Investigation Procedure:

- Just after the accident occurrence, the Egyptian Ministry of Civil Aviation was immediately notified. A Go-Team including the Minister of Civil Aviation, Head of “Directorate of Aircraft Accident Investigation” (DIR AAI¹) and a group of specialists from the DIR AAI immediately moved to the accident site at Luxor city.
- The status of the balloon damage, other damages, was viewed by the team. Several photos were taken to thoroughly show the different events. In addition, several photos were taken to show the accident influences on the cultivated fields at Luxor city.
- The Minister of Civil Aviation has issued the ministerial decree Number 147/2013 dated 26/2/2013, concerning the formation and assignments of the accident investigation team.
- Several video clips could be acquired by the Go team that was made by some observers and witnesses for the accident in addition to a professional photographer.
- Several meetings have been made by the Go team with several responsible officials including:
 - Luxor governor.
 - D.A. (District Attorney)
 - Police officials
- Several meetings have been made by the Go team with the eye witnesses. A list of the eye witness’s names and information was developed for the purpose of further inquiries as applicable.
- A visit was made by the Go-team to the hospital where the captain was receiving his medical care. A complete statement was obtained from the captain.
- Plan for the accident investigation was developed by the investigation team, based on ICAO Annex 13 (Aircrafts accidents and incidents investigation) and ECAR part 801 regulation issued by ECAA. The plan included the following main features:
 - Coordination with the internal relevant departments e.g. :

¹ Directorate Aircraft Accident Investigation

- ECAA.
- D.A. (District Attorney)
- Police Department.
- Airports company
- Forensic medicine
- General Organization for Aviation Meteorology
- Luxor airport Air Traffic Control tower
- Luxor airport operation.
- Civil Defense department.
- Arab Industrial Organization
- Coordination with the external relevant entities (as per annex 13), e.g. State of manufacturer
- Examination of relevant parts, areas, e.g.:
 - Balloon wreckage and parts
 - Areas of take off and landing
 - The detailed track of the flight
 - The deceased and injured bodies
 - Sugar cane fields
- Collecting all relevant available factual information using all available resources e.g.:
 - Balloon technical information (manufacturer, operator,)
 - Manufacturer, operator standards and procedures.
 - Operator exposition manual
 - Witness
 - Wreckage examination
 - Medical reports
 - Video clips documenting the accident
 - Balloon operation documents
 - Balloon maintenance documents
 - Meteorological reports.
 - Metallurgical reports
- Obtaining assistance from specialized technical entities e.g. Central Metallurgical R& D Institute (CMRDI), through sending relevant

parts for thorough inspection and examination.

- Developing factual information report
- Based on the facts included in the factual information report, analysis would be made using the most rational means. Different scenarios should be considered. Scenario (s) that seems to be inconsistent with the accident events will be excluded. Scenario (s) that seems to be consistent with the accident events will be adopted.
- Reaching the probable cause (s) for the accident in addition to the contributing factors leading to the accident.
- Issuing the necessary safety recommendations to enhance balloons flight safety level, and to increase immunity against accidents, in addition to avoiding such accidents in future.

1 - FACTUAL INFORMATION

1 - FACTUAL INFORMATION

1.1 History of Flight

- On February 26, 2013, and at almost 05:10 local time, the balloon operator relevant personnel started transferring the balloon parts from the company store (located at “Al Rawageh” village, “Al Karanah” west side of Luxor city) to the departure site at the western side of Luxor. The balloon type is “Ultramagic N425”, owned and operated by “Egyptian Airship and Balloon- Sky Cruise” company and registered as SU-283.
- At almost 05:30 local time same day, the company relevant personnel, upon their arrival to the departure site, started preparing the balloon parts for its mission (touristic flight). They were waiting for the passengers, coming from the eastern side of Luxor on Nile boats.
- At almost 06:15 local time, the balloon started its take off from the balloon departure site, under the command ship of balloon captain, [REDACTED] [REDACTED] Twenty (20) passengers were on board of the balloon of different nationalities.
- The balloon continued climbing and flying over the monuments area at the western side of Luxor city using the wind action effects (related on wind speed and direction at different levels) for horizontal movements. Vertical movements control was made through the control of the burners by the balloon captain.
- The balloon flew for more than 35 minutes. Communication was established between the ground crew and the balloon captain, using radio means. Ground crew was inquired from the balloon captain about the location for landing. The captain acknowledged that the landing site will be west of the water canal located at the area of “Hager El Dabeyya” at “Alkarana”, Luxor city
- Upon crossing the water canal, the captain asked the ground crew to be prepared to receive the Drop Line rope to start the balloon landing procedure on a free land before the sugar cane fields.
- The ground crew started holding the rope to complete the landing procedure. At about 3 meters height for the balloon basket over the ground, fire originated in the balloon causing a major injury for the captain. The

captain left the balloon basket to the ground, followed by one of the passengers.

- The captain was caught by fire. Some of the ground crew, in addition of some other persons that were in the vicinity of the accident site rushed towards the captain in an attempt to rescue him and extinguish the fire.
- The balloon continued climbing over the sugar cane fields. A number of passengers jumped from balloon to the ground inside the sugar cane fields, remaining there, affected by the fall.
- The balloon continued climbing crossing the area near a house of four stories and some of palm trees. The balloon was burning and still climbing. The balloon envelop was badly influenced and became like a thin piece of clothes, not capable of lifting the parts attached to it. The basket fell down with its content in a wheat field causing a rectangular pit of 2.2 m x 1.8 m size and 0.5 m depth.
- The accident resulted in the death of 19 people and complete damage of the balloon.

1.2 Injuries to persons:

| Injuries | Crew | Passengers | Others | Total |
|-------------|------|------------|--------|-------|
| Fatal | None | 19 | none | 19 |
| Serious | 1 | None | None | 1 |
| Minor/ None | None | 1 | None | 1 |

1.3 Damage to the balloon:

- The balloon has been completely destroyed as a result of the accident

1.4 Other Damages

- Damage in wheat agriculture fields of an area about 6 meter times 20 meters as a result of the final crash of the balloon.
- Some sugar cane fields have been adversely affected as a result of the fall of the deceased passengers before the final crash of the balloon.

1.5 Personnel Information

1.5.1 Balloon Captain:

A. Captain information:

- Name: [REDACTED]
- Gender: Male
- Nationality: Egyptian
- Age: 29 years
- Holding a balloon pilot commercial license issued by the Egyptian Civil Aviation Authority ECAA, on 12 April, 2006, renewed and valid from 22 January, 2013 to 31 July 2013 on Hot Air Balloon category “C”
- Went through medical examination on 1 October, 2012 and he was medically fit. Examination is valid up to 9 October, 2014
- He is authorized to perform PDC (Pre Departure Check) by the Egyptian Civil Aviation via temporary approval No 3045, issued on 12 September, 2012 and valid up to 23 December, 2013.
- Last Proficiency check was on 13 January, the result was “Satisfactory”
- Total number of flying hours on the balloon is 1012 hours and 55 minutes up to 13 February, 2013 (the date of his last balloon flight)
- Attended a CRM course (Crew Resource Management) approved by Egyptian Civil Aviation Authority.
- Attended CPL Ground Course approved by a pilot trainer on 13 February, 2012

B. Initial Captain Statement:

The chairman of the investigation team and two of the investigation team members moved to ‘Helmeyya Military Hospital for burning treatment’ in Cairo that received the balloon captain. The investigation group listened to the captain in bed in a very bad condition. Following is a summary of his statement:

- The Drop Line rope was previously positioned in one of its positions and was not positioned by him. Its position was not changed through the flight.
- At the beginning of the landing, he dropped the rope aft of the basket, and then he heard a loud sound of a fire flame. He felt that he was caught by the fire. He unconsciously fell down from the balloon to the ground.
- He did not notice any interference between the rope and any of the hoses. In addition he believes that the rope can not break the gas hose connecting the cylinder and the burner.
- He dropped the rope so as to be drawn to ground on the free land beside the sugar cane field and to avoid collision with cultivated area
- He acknowledged that he is well used to land in this area as the obstacles in this area are suitable for landing.
- He did not feel the smell of any gas, he did not hear any explosion sound of any part, all what he heard was the sound of a fire flame. He can not conclusively identify the source of the flame.
- He believes that the cylinder explosion is excluded as a cause of fire origination
- He thinks that the fire origination could be a result of defect of one of the hoses connecting the cylinder to the burner.
- He believes that the gas can not leak at the location of the connection between the hose and the cylinder as long as the hose is isolated from the cylinder because of the valve preventing that.
- He is not able to remember if he jumped to the ground before or after the English passenger that was the only survivor among the passengers
- He was badly injured by fire in his face and his left side (arm, leg)
- He acknowledged that he is 185 cm tall

C. Captain Statement 17 June, 2013

- The captain decided to land after the water canal, the ground crew was there waiting for him at the defined location after notifying

them about the landing location, he was coming from the east direction.

- The captain checked the position of the passengers to be consistent with landing procedures; he was standing at the centre of the basket.
- The captain dropped the “drop line rope” for ground crew after crossing the water canal, because the air direction was towards the sugar cane fields, and he wanted to help the ground crew to pull him far from the sugar cane fields.
- The captain moved toward the leader of the ground crew requesting him to push him far from the sugar cane. The captain was injured by fire while he was turning left to look forward.
- The captain attempted to bend to pick the fire extinguishing bottle that was on his left side, but he was not able to reach it because of the fire intensity.
- The fire was coming from the forward burners; the captain can not identify exactly the burner that was developing the fire.
- At the beginning of the landing, the fuel quantity for both the aft cylinders showed $\frac{1}{4}$ the capacity, whilst the forward burners were not used except for the “pilot light”. After about 35 minute, the captain used the two forward cylinders.
- The captain can not determine which part of the hose that was the source of the fire, and he can not determine its volume, but it was from the left side.
- The fire was in one direction and fixed, of yellow color. The fire sound was similar to the spraying sound coming out of an “insect repellent pressurized cans” when it picks an ignition source.
- The captain does not remember what was the last burner that was under control by the burner handle.
- Injury was at his left side (hand, arm, left side of his face)
- As a rule, any hose showing defect or cracks at the external rubber or abnormal bending at the hose connection to the cylinder TEMA is replaced.

- The location of the “drop line rope” is far from the hoses, it can not be scrambled around them.
- The captain did not experience previously any leak in the hoses except at the TEMA O” seal, the O” seal is replaced in the condition
- When performing the procedures for PDC (pre departure check), he checks the serviceability of the hose through smelling or hearing, and observing the white soapy powder on the TEMA if there is a case of leak.
- The captain stated that PDC inspection procedures apply to parachutes, the karabiners, the wires and part of the hose that is close to its connection with the cylinder TEMA. The part that is connected to the burner is not inspected during the PDC as it is higher than normal vision scope level, and not listed in the check. The hose is not disconnected from the burner when transferring or storing the balloon, it is disconnected only from the cylinder when reaching the storage location.
- The captain confirmed that he is responsible about “hot inflation” and he was assisted by the ground crew.
- The captain could not close the cylinder because of the fire.
- The captain mentioned that he bent on his right side, and then he fell down from the basket.
- The captain mentioned that his injury percent is 70%
- The area was suitable for landing. It contained some remains of the sugar cane but this had no adverse effect on landing. The weather was convenient.
- Normally, notification about defects (snags) is made verbally to the maintenance engineer. In case he is not available, the ground crew leader is notified. There were no snags before the event flight being recorded
- The captain used the vent system rope to modify the direction of the balloon and not to decrease its height.
- The maximum height for using the FDS (Fast Deflection System)

is 30 ft. It is used to deflate the air from the envelop in case of severe wind or at the end of the flight on ground after turning off the burners. It is in the right forward side.

- The captain started using the forward burners after about 35 minutes from the beginning of the flight and 5 minutes before landing.
- The balloon took off from the balloons take off side to the south western direction, passing by the two statues of “Memnon”, then “Naga Al Acaltah”. “Susan Mubarak” city was to the right side of him. He was tending to move to the desert for landing there, however, after crossing the “Rayyania water canal” and descending to lower height, the air carried him in the west direction.
- The captain confirmed performing the PDC (pre departure check) by himself and that he signed it. The captain was asked about the dissimilarity between his PDC signature and his previous signatures. The captain stated that he uses several signatures in order not to be imitated.

1.5.2 Engineer/ [REDACTED], maintenance manager at “Egyptian Airship and Balloon” Company:

A. Relevant information:

- Age: 28 years
- Gender: Male
- Holding B Sc. Engineering degree Communication and electronic department year 2005.
- Holding a Balloon Maintenance Engineer certificate (Certificate No. 2485/2007) issued from the Aircrafts Airworthiness Central Directorate”, Egyptian Civil aviation Authority on 23 September, 2007, valid up to 22 march, 2009
- Holding a temporary approval same number issued on 23 March, 2009 from the same department and valid up to 31 March 2012.
- Holding a temporary approval same number issued on 23 March, 2009 from the same department and valid up to 30 June 2012.

- Holding a temporary approval same number issued on 10 July, 2012 from the same department and valid up to 31 December, 2012.
- A letter was issued by the chairman of the Aircrafts Airworthiness Central Directorate on 17 December 2012, to grant him a Maintenance Engineer certificate balloon, under the number 3872, starting on date 10 December, 2012 and valid for one year.
- On 3 November, 2008, a letter was issued for him by the chairman of the Egyptian Civil aviation Authority approving him as a maintenance manager for Horus Company for balloon. He worked for 4 years at this company.
- On 17 July, 2012, a letter was issued by the chairman of the Egyptian Civil aviation Authority approving him as a maintenance manager for “Egyptian Airship and balloon”.
- He attended a Human Factor Course at Express Company for balloon on 30 October, 2010
- Attended a ‘Balloon maintenance course” at Cameron Balloons on 24 February, 2009

B. Maintenance manager Statement:

- He was on vacation from the company that started on 16 February 2013 up till the accident date, he was outside the country. He was informed about the accident by captain/ [REDACTED] Company Operation Manager.
- He performs annual inspection on the balloon, and the 100 hrs inspection, rectifying balloon snags as applicable whether they were recorded by the balloon captain or by himself
- Since he joined the company, he carried out the following maintenance works on the said balloon:

| Serial | Procedure | Date |
|--------|-----------------------------|-------------------|
| 1 | Annual Inspection | 5 October, 2012 |
| 2 | Cleaning the Pilot Light | 19 December, 2012 |
| 3 | Cleaning of Pilot Regulator | 8 January, 2013 |
| 4 | Basket Varnished Cleaning | 8 February, 2013 |

- He also replaced the parts listed in the following table

| Date | Parts | Serial |
|----------------------------|--------------------|--------|
| 10 June, 2012 ² | TEMA O Seal | 1 |
| 27 June, 2012 | Panel | 2 |
| 12 July, 2012 | Burner hose No 192 | 3 |
| 30 July, 2012 | Vent Rope | 4 |
| 13 August, 2012 | Panel | 5 |
| 25 August, 2012 | Velcro | 6 |
| 2 September, 2012 | TEMA O Seal | 7 |

- He explained some of the maintenance procedures for the balloon, including the following:
 - Visual inspection of the cylinder including checking the smell of the cylinder. Inspecting the main valve, pressure bleed valve, relief valve and the gauge
 - Inspecting the cylinder, and hose to ensure that there is no leak (within the PDC procedure)
 - The cylinder is pressurized by nitrogen to 12 bars at the company store.
 - In case there is a defect in TEMA (e.g. leak), it is replaced. Installation is made by hand, by pressing on the TEMA on the facing part of the cylinder and closing the lock then the parts are tested to ensure no leak condition.
 - In case a defect is being detected (leak or cut in one of the hoses), the part is replaced. Detection is being made through smelling, or water and soap.
 - Gas leak might occur at the connection between the hose and

² The maintenance engineer joined the company starting from June 2012 as a maintenance engineer. Then he was approved as a maintenance manager on 17 July 2012

the TEMA, or at the location of the connection between the hose with the burner, in addition to the connection between the TEMA and the cylinder.

- When replacing the hose, the hose is connected to the burner through hand tightening, then using conventional wrench. A leak test is performed after installation by the maintenance engineer,
- Contamination has been observed in the propellant cylinder resulting in blockage of the Pilot Light several times
- There is no specific location for positioning the Drop Line
- The manufacturer did not issue any Service bulletins throughout its service in the company

1.5.3 Captain/ Hany Selah Eldin Zaky, Company Operation Manager

A. Relevant information

- Age: 45 year
- Gender: Male
- Holding Commercial pilot license balloon number (4), approved as a maintenance engineer on the flying balloon
- A letter was directed on 28 December, 2010 under the number 1413, allowing revalidation of the final approval granted to him to work as the Operation Manager for “Egyptian Airship and balloon” company.

B. Operation Manager Statement:

- He was not there at the time of the accident, but he moved to Luxor immediately after the accident.
- Based on the approved “Company Operation Manual” (Approved by Egyptian Civil Aviation Authority) and as an Operation Manager, He is responsible for the following:
 1. Regulating Flights scheduling and the flying hours for the pilots.
 2. Keeping company records, manuals.

3. Recording relevant information in the ‘Technical Log Book’ and the ‘Log Book’
 4. Ensuring validity of the company certificates and documents
 5. Observing (follow up) of the Technical log book, and watching the flights at the look log
 6. Recording the pilot licenses, reviewing and checking medical examinations and their validity dates
 7. Continuous communication with the maintenance manager to follow up balloon serviceability.
 8. Supervising ground crew qualifications and training
- Responsibility of the ground crew includes:
- Inspecting the balloon,
 - Bringing the balloon from its storage location (garage)
 - Pressuring the cylinders with nitrogen
 - Getting the balloon from the car (first the envelop and then the basket)
 - Preparing the balloon by performing cold inflation

(There is no defined regulation for the suitable number of personnel for each type; however the operator uses a minimum number of ten persons)

- The Company Exposition Manual includes information about ground crew training, the company implements this training
- The operation officer submits the technical log book (flight page), PDC form to the pilot. The pilot performs the weight calculations; inspection works and then signs it. It remains with the pilot in a bag throughout the whole flight. After the landing, the pilot submits it to the officer. The officer brings it to the operation office. At the operation department, they complete the remaining information related to hours. The yellow copy remains in the office. The red copy is kept at maintenance department to respond

for any snag,

- Regarding the accident flight, the pilot/ [REDACTED] was the one that should have done the PDC. He is approved by the Civil Aviation Authority to perform this check. The operation manager stated that he is not able to verify if the signature on the form is for captain / [REDACTED] or not. He advised to ask the captain.
- It is not compulsory that the maintenance engineer and the operation manager to be there for the balloon flights
- The existing fire fighting tool is a powder fire extinguisher cylinder, 5 kg capacity, with valid serviceability. The ground crew brings it with the balloon on the truck. It is under the requirement conditions of the Airport Company. A person is allocated for the use of the cylinder as needed throughout the preparation time. In addition there is another fire extinguisher cylinder inside the balloon (one kg or ½ kg weight)
- The passengers do not sign any form that shows the risks that the passengers might be subjected to during the flight.
- The cylinders life time is 10 years, the cylinder is then subjected to hydrostatic test, the life time might be extended for another 5 years
- He stated that he did not replace the coil throughout his maintenance career. Serial number existing on the burners side should be similar to the number on the burner lower area (the burner should carry only one serial number). Regarding the balloon registered as SU-252, upon inspection, it has been noticed that the serial number at the burner lower surface and the log book, are not identical to that on the coil. According to his statement, the manufacturer should be asked about that.
- The Drop Line rope is fastened to the balloon before take off. It is suspended by karabiner on the burner frame. It is behind the pilot either on his left side or right side, depending on the manufacturer.
- The cylinders are filled with Butane gas at “Al Tode” factory.
- The company received 12 hoses through the time of his service in

it.

1.5.4 Mr./ [REDACTED], chief of the ground crew, the day of the accident.

A. Relevant information

- Age: 49 year
- Gender: Male
- Working in the balloon field since August/ 1992
- Mr./ [REDACTED] statement was as follows:
 - He works as an assistant to the chief of ground crew. He started to take the balloon out of the company garage (store) to the take off site, and then he became engaged in the follow up for the balloon movement through radio communication to receive the balloon and make the necessary procedures to land the balloon, and to deplane the passengers.
 - At almost 05:10 am, local time, he got the said balloon from the store with the assistance of his crew, and they moved to the take off site. The balloon was prepared for the departure. After boarding the passengers and the balloon captain, the balloon started take off at 6.15 local time after acquiring the take off clearance from the delegate of the Egyptian Company for airports.
 - The balloon was followed up through radio communication. After about 35 minutes from take off, the balloon captain [REDACTED] informed him that the balloon will land west of the water canal
 - After reaching the area mutually agreed upon west of the canal and crossing the electric cables and the water canal, where he and his crew were waiting the balloon, he asked the balloon captain to drop the Drop Line rope, this was done in front of the sugar cane field at the open area land. He started drawing (pulling) the Drop Line rope with his colleagues (8 colleagues).

- While pulling the rope from the ground aft of the balloon, the captain asked them to pull the rope aft; he was watching them while they were pulling. The basket height was about 2-3 meters from the sugar cane plants, about 5-6 meters from the ground surface.
- Suddenly, they have seen a fire flame originating from the forward section of the balloon, hitting the back of the balloon captain. The captain turned towards the flame, he was hit by the flame on his face.
- One of the passengers jumped from the basket on the sugar cane. The captain jumped after him, he was screaming for help.
- He was much impressed following the balloon. He did not follow the status of the balloon captain or the passenger.
- The ground crew left the pulling rope, the flame continued growing, and the balloon continued climbing also. The passengers continued jumping from the balloon while it was climbing (about 7-8 passengers). The foreigner passenger was the first person to jump, followed by the balloon captain, then a lady, and then five persons. The balloon continued climbing until it exploded. The balloon fell at the wreckage site.
- It is normal that all the balloons for different companies land at this location
- The number of the ground crew persons serving the balloon is normally 8-10 persons. For big balloons, accommodating 32 people (reduced to 28), the number of ground crew persons is 13-15 people.
- The Karabiner is normally attached to the other fixed one at the frame ceiling beside the burner.
- No evidence of abnormality was observed with the balloon. No one has seen any wrapping of the rope around the burner hose.
- The flame started behind the balloon captain upward from only one side at a height of about one and half meter from the

cylinder. The fire continued, the flame became denser as the balloon was climbing. An explosion took place after that, the balloon fell down on the ground.

- He was the one who did perform the heating and the inflation of the balloon envelope using another external cylinder in order not to consume the balloon cylinder. When the balloon was erected, he presented the balloon to the balloon captain (captain [REDACTED]) and then he moved out of the balloon.

1.5.5 Summary of the ground crew statement (9 persons)

- The whole team declared that during the time they were pulling down the balloon after dropping the Drop line rope, they have seen the fire origination, however they did not agree about the place of fire origination. Some of them believe that the fire started aft of the balloon captain, some other persons believed that it started forward of the captain. The remaining crew believed it started from the side section.
- They all agreed that one of the passengers jumped first followed by the balloon captain.
- They all agreed that the balloon was flying at a low height near the sugar cane areas.
- Some of them believe that a sound of explosion took place after the impact of the balloon with the ground.
- They all agreed that the ground crew included 10 persons plus the supervisor.
- They disagree about the Drop Line fixation location. Some of them stated that it was left side of the balloon captain; some others stated that it was right of the balloon captain.

1.5.6 Statement of Mr./ [REDACTED], operation supervisor, Airports company, operation supervisor for balloons take off site:

- Age: 28 year
- Gender: Male

– Mr./ [REDACTED] statement was as follows:

Working procedures for the balloons take off sites are as follows:

- The lists of balloon companies operation are received by fax at Luxor airport one day before the flights including details of the flights, types, pilot names and the number of passengers
- A form is completed by a delegate from each company at the take off site including the actual information related to the types, number of passengers and names of pilots.
- Daily statistics for the operation of the balloon flights are made
- Contacting Luxor airport to inform him about the operation list and take off clearances requests
- Requesting the meteorology report for 6:00 am local time, including temperature, level of horizontal visibility, wind direction and wind value, dew point, barometric pressure. These information are recorded in special form designed for this purpose and is circulated to the companies. A delegate from each company signs upon receipt of the form.
- The group of personnel (staff) is distributed among the different companies. They perform inspection of the balloons including:
 - ✓ Number of passengers and its conformity with the number of passengers for the balloon type.
 - ✓ Inspecting the fire extinguishers on board of the balloons and external ones used in the preparation phase
 - ✓ Checking balloon captain license and the validity of balloon license.
- After the first flight, they ask the tower about the location for the first landings for each balloon company, to allow for following take off and so on.
- He did not obtain the training for “balloon sites management”, He got his experience in this field through working with another colleagues that have previously

attended this type of training.

- Because of different locations, the meteorological report received from the airport might differ from the actual meteorological report at the balloon take off site.
- They do not receive any copy of the PDC document. This is not a document that is normally received by them.

1.5.7 Statement of Mr./ [REDACTED], security specialist, Luxor airport.

- Age: 35 year
- Gender: Male
- He was in charge of inspecting the event balloon.
- Mr./ [REDACTED] statement was as follows:
 - He was assigned to inspect the balloons for Sky Cruise Company and Dream Company the day of the accident.
 - He submitted the meteorological report to Sky Cruise company delegate, and he made sure that the fire extinguisher cylinder was on ground during the preparation of the balloon. He checked the number of passengers against the allowed number. He made sure that the first aid kit was there.
 - He does not receive any copy of the PDC document.
 - He did not observe any abnormality on the balloon.

1.5.8 Statement of the English passenger.

- The English passenger did not forward any information to the investigation team.

1.6 Balloon Information.

- The balloon is registered as SU-283, type “Ultramagic N425”, manufactured by Ultramagic Balloon S.A. company, Spanish, serial number 425/12.
- The balloon holds registration certificate in the Egyptian Records under the number 1263, dated 10 November, 2008.
- The balloon holds a valid airworthiness certificate number 1112, valid for the period between 13 October, 2012 to 12 October, 2013. It is issued by the Civil Aviation Authority.

- The balloon holds a valid Flight Permission number 741/2012, valid for the period between 1st January 2013 to 25 March 2013, It is issued by the Civil Aviation Authority.
- The balloon holds VHF radio equipment license (ICOM IC-A4), serial number 17349, 1/4/3146 to operate a radio station on board of the balloon, issued from the National Telecommunication Regulatory Authority (NTRA) dated 26 November 2012, valid for the period between 1st January 2013 to 31 December, 2013.
- Last balloon flight before the accident flight was on 24 February, 2013.
- Number of balloon flying hours just before the accident flight was 659 hours, 40 minutes. This does not include the flying hours before de-registration
- Maximum total weight for the balloon is 3712 kg.
- The empty weight for the balloon is 917 kg.
- Information about the Envelope
 - Envelope Type : Ultramagic N-425
 - Envelope Serial No : 425/12
 - Envelope Volume: 12000 Cubic Meters.
 - Envelope Weight 348kg.
- Information about the Basket
 - Basket Type Ultramagic C-12170x450 Double T.
 - Basket Serial No. C12/02.
 - Basket Weight 360 Kg.



- Information about the Burner
 - Burner Type Mk-21 Quadruple.

- Burner Weight 43 Kg.
- Burner Serial Number 190/191/192/193.

1.6.1 Gas Cylinders installed on the balloon:

- The Investigation team compared the cylinders available in Egyptian Airship and balloon company (type M-30) with the company cylinder list (inventory) to determine the numbers of the cylinders that were onboard of the event balloon, taking into considerations that all the numbers of the four cylinders that were onboard of the event balloon were completely damaged by the fire.
- The output of the study regarding the cylinders existing in the company store (Exhibit #1), indicated that the missing cylinders are as shown in the following tables:

| S/NO | Validity | Test | Due at |
|-------------|----------|--|-----------------------------|
| UM-0035 | 10 Years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 30/6/2015 |
| UM-0036 | 10 Years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 30/6/2015 |
| UM-0037 | 10 Years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 30/6/2015 |
| UM-20030087 | 10 Years | Hydraulic proof test must be carried out first after 10 years then every 5 years | FROM 26/6/2003 TO 26/6/2013 |
| UM-20030088 | 10 Years | Hydraulic proof test must be carried out first after 10 years then every 5 years | FROM 26/6/2003 TO 26/6/2013 |

- It can be concluded that four cylinders out of the five listed

cylinders were installed on the event balloon.

1.6.2 History of the event balloon since the start of operation in the company and its entry to the United Arab Republic of Egypt:

- Egyptian Airship Balloon (Sky Cruise) company bought a balloon on 22 April, 2005 type Ultramagic N-425, approved by Egyptian Civil Aviation Authority, serial number 425/03, from Brima Sverige AB (Sweden). It was registered in Sweden as SE-ZLI. Its total flying hours at this time was 58 hrs.

(The manufacturer sold the balloon to an operator in Sweden in May 2004)

- The balloon specifications are as follows:
 - Envelope N-425
 - Basket C-12 Fully Padded
 - Quad Burner Mk-21
 - 5x80 Liter Stainless Steel Tanks with Jackets.
 - 2x13 Hp Fans Yellow Spare Nomex & Ultralast Fabric
- On 5 May, 2005, the Egyptian civil Aviation Authority allocated the registration letters SU-257 to the balloon, based on request submitted to ECAA from Egyptian Airship and balloon company dated 19 April, 2005
- An airworthiness certificate was issued to the balloon under the number 1176, dated 31 May, 2005. A flying permission was issued for the balloon under the number 220 on year 2005, valid for the period from 20 August, 2005 to 25 March, 2006.
- The Egyptian Airship and Balloon Company addressed the ECAA on 18 July, 2005, requesting an airworthiness certificate to the balloon as they were not able to obtain Export C of A certificate.
- The balloon continued operating until a de-registration certificate was issued to it on 13 August, 2008 from the ECAA.
- The balloon envelope was replaced solely for that balloon (SU-257). Other parts, including the basket, burners, etc. were not

replaced. The balloon was registered under the letters SU-283. Operation started on 13 October, 2008 after performing a flight test to it on 25 September, 2008.

1.6.3 Technical Log information regarding the accident (exhibit #2):

The following has been recorded in the Technical log for the accident flight:

- The names of the passengers and their weights.
- Calculations for the permitted lift, it was as follows:
 - Datum Temp 20° C
 - Press Alt 1500 ft
 - Max lift / 1000 cu/ft 7.2 kg

- Total Permitted Lift:

| | |
|-----------------------------------|----------|
| Total Permitted Lift for climbing | 3060 kgs |
| Total Lift Requested | 2393 kgs |
| Spare Lift | 667 kgs |

- Total balloon flying hours:
 - Hours To Check (BF) 32:15
 - Hours This Page 00:45
 - Hours To Check 31:30
 - Total Balloon Hours 660:25

Including 45 minutes assumed by the operator for the event flight

- In addition to the above records, the technical log included the captain name, his signature and the date of the flight;

1.6.4 Technical Record for the balloon snags:

- Review of the “Technical Log. Sector Record Page Load sheet and Passenger Manifest” for the event flight the time between January 1st, 2013 to 24 February, 2013 did not show any malfunction.

1.6.5 Checks carried out on the balloon:

- Review of the balloon record, showed that the following maintenance works have been carried out on the balloon

| Maintenance work carried out on the balloon | Date |
|---|------------|
| Servicing for the regulator of the aft left coil | 12/1/2009 |
| Basket varnishing | 19/1/2009 |
| Burner servicing & cleaning | 26/1/2009 |
| Hoses check for leak& found ok | 3/2/2009 |
| Error in the fixation of the parachute and has been corrected during the preflight check | 4/3/2009 |
| Two pressure valves are replaced in according to Maintenance manual (the two back pressure valves) | 30/12/2009 |
| Parachute retaining line are replaced no.(11) in according to Maintenance manual part no:2.10.1 &2.10.2 | 10/3/2010 |
| TEMA male nipple part no. CY 5121 are replaced in according to Maintenance manual part no:4.2.11 | 20/3/2010 |
| 1 panel is replaced in according to Maintenance manual | 21/3/2010 |

| | |
|--|------------|
| part no:2.6 the panel position Gore panel (1) | |
| Temperature flag is replaced in according to Maintenance manual part no: 2.11.1 & the Temperature tag checked and its max Temperature reached 83°. That means the envelope ok, no over heat happen. | 17/5/2010 |
| Full 8mm poly /Kevlar Red / White line (parachute) are replaced in according to Maintenance manual part no:2.10.4 | 5/8/2010 |
| Front left main valve is serviced in according to Maintenance manual part no.4.3.7.6 and the following parts are replaced 1) 2 thick nitril "O" seal , 2) 1 main valve spring | 19/9/2010 |
| 5 Panels are replaced as following : 1- Panel 3 Gore 8 2- Panel 3 Gore 8.5 3- Panel 3 Gore 9 4- Panel 4 Gore 8 5- Panel 4 Gore 8.5 all arrange hyper M.M PART (2.6) test And the following lines to : Right & left full rotation vent Black & Blue 45m&45m Parachute retaining line Gove (7) 17m past M.M (2.10.1)&(2.10.2) | 20/10/2010 |
| Change basket type C/12, (SN:02 with 04) for balloon Reg. no. SU 283 due to accident in balloon according to fm.4.5.4 and replacement 1 panel – flight test, flight test carried out and balloon is ok & satisfactory and ready to fly . | 18/11/2011 |
| Tema “O” seal outer of bu:190&191&192&193 has Been replaced acc to M.M | 15/6/2012 |
| Panel between load tape 2&3 replaced over B NOMEX HAS BEEN REPLACED acc to M.M | 27/6/2012 |
| Hose of bu:192 replaced acc to M.M | 12/7/2012 |
| Turning vent "black " Rope has been replaced acc to M.M | 30/7/2012 |
| Panel between load tape 5&6 over nomex has been replaced acc to M.M | 13/8/2012 |
| Velcro male has been replaced acc to M.M | 25/8/2012 |
| Tema “O” seal outer of bu:190&191 has been replaced acc to M.M | 2/9/2012 |
| Pilot light has been Cleaning of acc to M.M ref. page 4.31 | 19/12/2012 |
| Cleaning of pilot Regulators Valves has been according to M.M ref. page 4.27 | 8/1/2013 |
| Basket has been varnished according to M.M ref. page 3.1 | 8/2/2013 |

- These checks were carried out in addition to the 100 hours checks and the Grab tests. Its last test was carried out on 5 October, 2012. This test was followed by a Flight Test same date at number of hours of 591 hours: 55 minutes

1.6.6 Information from the Maintenance Manual:

Point 6.3 in the Maintenance Manual, under the annual/100-hour inspection section (page 6.2 of the Manual) and related the logbook checks it is established that all repairs and modifications should be recorded and the S/N of the equipment should agree with items submitted for inspection.

Point 4.3.11.4 Removal of fuel hoses establishes how to replace fuel hoses safely.

Point 4.3.10 Preventive maintenance, point 6. Fuel hoses to check the condition on the fuel hoses.

1.7 Meteorological Information

Based on the report received from the “General Organization for Aviation Meteorology” the time between 05:00 up to 08:00 local time at Luxor city, meteorological condition was as follows:

| Time hr:min | Surface Winds direction degree | Surface Winds speed kts | Horizontal visibility meters | Aviation evidences | Suction (draft) | Atmospheri c press. Hecto Pascal | Dry Air Temp Celsius | Dew point temp Celsius |
|----------------|---|----------------------------------|------------------------------------|-----------------------|--------------------|---|----------------------------|---------------------------------|
| 5:00 | 80 | 1 | > 10 km | Nothing | ----- | 1014 | 18 | 6 |
| 6:00 | still | still | > 10 km | Nothing | ----- | 1015 | 16 | 5 |
| 7:00 | still | still | > 10 km | Nothing | ----- | 1015 | 15 | 4 |
| 8:00 | 310 | 2 | > 10 km | Nothing | ----- | 1015 | 18 | 7 |

- The following table shows the upper wind direction and the upper wind speed at Luxor city for the same time duration (5 to 8 am local time):

| Ser. | Altitude ft | Wind Direction Degrees | Wind speed kts |
|------|-------------|------------------------|----------------|
| 1 | 100 | 60 | 5 |
| 2 | 200 | 60 | 5 |
| 3 | 300 | 60 | 5 |
| 4 | 400 | 50 | 5 |
| 5 | 500 | 40 | 5 |
| 6 | 600 | 40 | 10 |
| 7 | 700 | 30 | 10 |
| 8 | 800 | 30 | 10 |

- Surface wind speed was ranging between 5-15 kts with a direction from 50 to 360 degree
- Surface visibility: ranging between 6- 10 km
- Weather condition: Fair
- Freezing level: 4500 meter
- Turbulences: NIL
- Icing: NIL
- The report showed that there were no atmospheric conditions that can adversely affect the low flight at higher atmospheric layers, consequently there were no warning or atmospheric alerts
- The actual meteorological report that was sent to Luxor airport and consequently the balloon companies was as follows:
- At 06:00 local time the temp. was 16 degree Celsius, dew point was 5 degree, atmospheric press QNH was 1015, relative humidity was 47 %, atmospheric condition CAVOK.
- At 07:00 local time the temp. was 15 degree Celsius, dew point

was 4 degree, atmospheric press QNH was 1015, relative humidity was 47 %, atmospheric condition CAVOK.

1.8 Aids to Navigation

- Not relevant.

1.9 Communication:

1.9.1. Communication between Luxor airport Air Traffic Control Tower and the ground dispatcher:

- At 04:05 UTC on 26 February 2013, communication was established between the ground dispatcher and Luxor airport Air Traffic Control tower controller on duty, and he was informed that he as a permission to perform seven flights for seven companies as a first round as follows:

| Ser | Balloon registration | Balloon Captain | Number of Passengers |
|-----|----------------------|-----------------|----------------------|
| 1 | SU-301 | | 24 Passenger |
| 2 | SU-284 | | 20 Passenger |
| 3 | SU-309 | | 24 Passenger |
| 4 | SU-283 | | 20 Passenger |
| 5 | SU-291 | | 20 Passenger |
| 6 | SU-271 | | 20 Passenger |
| 7 | SU-281 | | 13 Passenger |

- At the same time, the 2nd round was notified as follows:

| Ser | Balloon registration | Balloon Captain | Number of Passengers |
|-----|----------------------|-----------------|----------------------|
| 1 | SU-260 | | 20 Passenger |
| 2 | SU-287 | | 12 Passenger |
| 3 | SU-300 | | 7 Passenger |
| 4 | SU-289 | | 16 Passenger |

- At the same time, the 3rd round was notified as follows:
Balloon SU-285 with cap/ [REDACTED] as balloon captain,
with 14 passengers on board

1.9.2. Communication between Luxor airport Air Traffic Control Tower and the balloon captains:

- At 04:10 UTC, communication was established between the Air Traffic Controller and the captain of the balloon registered as SU-284 belonging to “Hod Hod Soliman” company. The ATC was informed about the balloon captain name and the number of passengers.
- At the same time, communication was established between the Air Traffic Controller and the captain of the balloon registered as SU-301 belonging to “Sindbad” company. The ATC was informed about the balloon captain name and the number of passengers.
- At the same time, communication was established between the Air Traffic Controller and the captain of the balloon registered as SU-291 belonging to “Viking for balloon” company. The ATC was informed about the balloon captain name and the number of

passengers.

- At the same time, communication was established between the Air Traffic Controller and the captain of the balloon registered as SU-309 belonging to “Dream for balloons” company. The ATC was informed about the balloon captain name and the number of passengers.
- At time 04:26 UTC, communication was made between the Air Traffic Controller and the captain of the balloon registered as SU-284. The ATC was informed that the landing will be in the western side land.
- At time 04:27 UTC, communication was made between the Air Traffic Controller and the captain of the balloon registered as SU-260. The ATC was informed that the balloon has made a complete landing.
- At time 04:30 UTC, communication was made between the Air Traffic Controller and the captain of the balloon registered as SU-287 belonging to “Hodhod Soliman” company. The ATC was informed about his name, number of passengers, and that the balloon started its take off.
- At time 04:35 UTC, communication was made between the Air Traffic Controller and the captain of the balloon registered as SU-289 (Captain ██████████) belonging to “Sky Cruise” company. The ATC was informed that the balloon has started its take off, and was informed also about the number of passengers. The ATC asked the captain if the first balloon has landed or not. The balloon captain ██████████ asked the ATC whether the balloon-289 captain has notified landing or not. The ATC answered “no captain”. The balloon SU-289 captain acknowledged that he will make a contact to check this matter.
- At time 04:47 UTC, the captain of the balloon registered as SU-260 acknowledged Final Landing of the balloon SU-285 under the commandship of captain/██████████ with 15 passengers on board. (We have SU-285 captain ██████████ Final Landing)

- At the same time, the captain of the balloon registered as SU-309 belonging to “Dream for Balloon” company, informed the ATC that a complete landing on the ground has been made.
- At the same time, the captain of the balloon registered as SU-300 belonging to “Dream for Balloon” company requested clearance for take off.
- At time 05:07 UTC, the captain of the balloon registered as SU-285 informed the ATC that a complete landing has been made.
- At time 05:08 UTC, the captain of the balloon registered as SU-271 informed the ATC that a complete landing has been made. The ATC asked the captain if he has previously informed him about the balloon take off. The captain answered “yes”. The ATC acknowledged that for sure the captain did not inform him; otherwise he would have recorded that. The ATC asked the captain about the approximate time of the balloon take off. The captain mentioned that the take off time was six thirty.
- At time 05:09 UTC, the captain of the balloon registered as SU-281 belonging to “Magic Horizon” company, informed the ATC that a complete landing has been made. The ATC asked the captain if he has made the take off with Alaska the same time, the captain mentioned that he called him on the same frequency without any reply. (I called you on the same radio frequency, no one replied)

1.9.3. Communication between Luxor airport operation and the Air Traffic Control Tower:

- At 05:50 UTC, communication was established between Mr. [REDACTED] from “Luxor airport operation” and the Air Traffic Controller on duty, asking the ATC controller on duty if he was informed about an accident. The ATC asked about the time of the accident. He answered “now”

- The ATC controller on duty asked Luxor airport operation responsible to give him the available information. He asked him if he has a captain under the name [REDACTED] in his operation, he answered “yes” and he mentioned that he is on the balloon SU-283 belonging to “Sky Cruise” company.
- Luxor airport operation in charge told him that the balloon has exploded in the air, 19 persons were killed.

1.9.4. Daily log book for Luxor airport Air Traffic Control Tower on 26 February 2013:

- At 05:50 UTC the following was recorded:
 - Mr. Mohamed Ali from “Central Control Operation CCO” mentioned that the balloon SU-283 belonging to “Sky Cruise” company has exploded in the air, 18 passenger out of 20 passengers were killed in addition to the captain “██████████”, knowing that this event balloon did not notify about take off or landing on the radio frequency telephone.
- At 05:54 UTC the following was recorded:
 - Contact was made with safety assurance several times without any reply, contact has been made with Area Control Center ACC to inform them (Safety assurance) to communicate with them, in addition to informing the operation and navigation managers.
- At 06:15 UTC the following was recorded:
 - Mr. ██████████ from safety insurance informed about the same event.

1.9.5. Form showing the information about the balloon flights made on 26 March, 2013, issued by Luxor international airport:

| Ser no | Balloon company name | weather status | Registration letter | Time of take off clearance UTC | Time of actual departure signature | Flying altitude ft | number of passengers on board | balloon captain name | Time of actual landing signature | Remarks, violations |
|--------|----------------------|----------------|---------------------|--------------------------------|------------------------------------|--------------------|-------------------------------|----------------------|----------------------------------|---------------------|
| 1 | Sindbad | | SU-301 | | 4:16 | | 24 | | 4:28 | |
| 2 | Hod Hod Soliman | | SU-284 | | 4:16 | | 20 | | 4:27 | |
| 3 | Dream | | SU-309 | | 4:24 | | 24 | | 4:53 | |
| 4 | Sky Cruise | | SU-283 | | | | 20 | | | |
| 5 | Viking | | SU-291 | | 4:20 | | 20 | | 5:08 | |
| 6 | Alaska | | SU-271 | | 4:30 | | 20 | | 5:08 | |
| 7 | Magic Horizon | | SU-281 | | 4:30 | | 28 | | 5:09 | |
| 8 | Sindbad | | SU-260 | | 4:29 | | 20 | | 4:47 | |
| 9 | Hod Hod Soliman | | SU-287 | | 4:31 | | 12 | | Did not inform landing | |
| 10 | Dream | | SU-300 | | 4:57 | | 7 | | Did not inform landing | |
| 11 | Sky Cruise | | SU-289 | | 4:35 | | 16 | | | |

1.10 Aerodrome Information (Information about the balloons take off Area):

- The balloons take off area lies at Karana region at “Houd El Sabeel”, on the west side land, Luxor city
- This area lies in the desert mountainous area, north of the “valley of the Kings”. It is defined by the:

Longitudes

- E 32°36’58”
- E 32°37’12”

Latitudes

- N 25°43’43”
- N 25°43’56”

- It is surrounded from the western side by “new Karana Street” followed by Karana Mountain. It is surrounded from the eastern side by “agricultural lands”,. On the northern side, there is an office belonging to the Egyptian company for airports (for the supervision of the site). It is surrounded from the southern side by “agricultural lands)

1.11 Flight Recorders

Not applicable. No flight recorders on board.

1.12 Wreckage and impact information

1.12.1. First (preliminary) technical examination:

- The Investigation team examined the accident site immediately after the accident. Examination revealed the following:

1. The falling wreckage site:

- The balloon fell down on an agriculture land in the side of “Hager El Dabeyyah”. This land was cultivated with wheat. The wheat height was almost 60 cm. The coordinates of the area center is almost N 25°40’55”, E 32°33’50”



- The balloon falling down site is surrounded from the South Western side with low tension cables.
- The site is surrounded from the Northern Western side, with an unpaved road and then a canal with a width of almost 8 meter.



- The site is surrounded from the North eastern side with some palm trees, and an irrigation canal (Merwa) with the width of ½ meter, then an unpaved road of a width of three meters, followed by a small canal of a width of another three meters, followed by palm trees with a house of four stories behind the trees.
- It is surrounded from the West side agriculture lands
- The impact of the balloon resulted in a rectangular pit of almost 2.2 meter length, 1.8 meter width and about ½ meter depth.



2. Wreckage Status:

2.1 Burners Status

- The four burners were fixed through fastening screws to the balloon metallic frame
- The frame connected to the burners was affected by the rescue procedure. Some cuts in the frame were made to facilitate rescue procedures



- The four burners showed traces of fire; in addition of traces from the falling site muddy soil.
- Three fuel hoses were attached to the burners, whilst one of the burners was missing all the hoses. One burner hose connection was attached to it.
- The size of the attached burner hose connection (missing the hose), was different than the other three connecting nuts
- The Cow Valve Handle that belongs to the burner with the missing hose was completely melted.

**Burner
Cow
valve
Handle**



2.2 Basket:



- The basket was completely burned except the metallic frame, the base and one of its sides.
- The basket was moved slightly beside the pit that was caused as a result of the final fall down (crash) of the balloon. The basket frame beams showed some cuts as a result of fire extinguishing and human remains recovery.

2.3 Envelop:

- The envelop was located on the unpaved road adjacent to the wreckage site. The rescue personnel positioned this envelop far from the wreckage to facilitate moving the dead bodies.
- The features of the balloon yellow and green clothes (tissues) were definite. They did not burn totally, except at some parts which allowed deflation of the hot air until the complete fall down of the balloon in a free fall
- The cables attaching the envelop to the basket were scrambled as a result of the fall in addition of the operations of lifting and turning the basket.



2.4 Hoses:



- Three hoses were found connected to the burners and were scrambled with the wreckage. The fourth hose was not connected to its burner. It could not be found in the wreckage fall site.
- The outer rubber of the hoses was burned except for some few parts. The inner metallic wire of the hoses was the only remaining parts.
- The hose union nut was found connected to the burner. The hose was separated from the hose swaged on sleeve. The sleeve was found loose about the axial axis. It was apparent that the fastening nut thickness was different than the other three nuts.
- The TEMA attachment quick connections were not found with the fuel cylinders for any of the three hoses at the wreckage site.

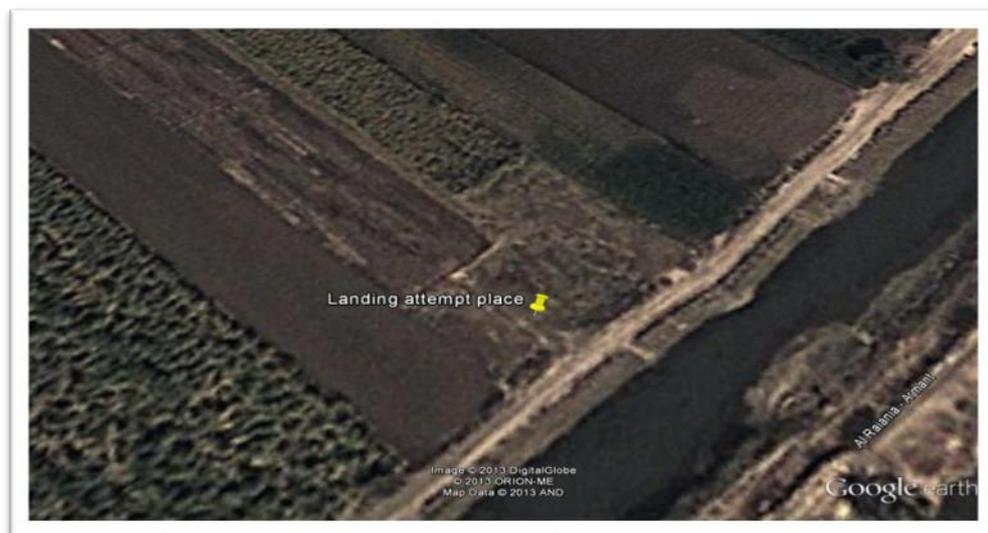
2.5 Fuel Cylinders:

- The four cylinders were transferred to Luxor “Criminal Evidences” department under the custody of the D.A (District Attorney) considering the risk of leaving them in the wreckage side.
- The cylinders were technically examined by the investigation team at Luxor “Criminal Evidences” department

3. Examining the balloon landing trial site made by the balloon captain:



- The balloon captain selected a clear land of 15.3 meter by 30 meter dimension near the sugar cane fields at the side of “Hager El Dabeyyah” for landing. The coordinates of this area center are N 25°41’00” , E 32°33’56”



The area was surrounded from the North and North eastern sides by sugar cane fields of about three meters height.

- The area was surrounded from the south western side by unpaved road of three meters width, then a water canal of eight meters width, with railway tracks for the trains transporting the sugar cane behind it with electrical cable above them of about four meters height.
- The area was surrounded from the North eastern side by agricultural land cultivated with barely with about 60 cm height. There are high tension electrical towers same direction and about 70 meter distance with about 60 cm height. At a distance of almost 40 meters same direction, there is a tree of about five meters height.
- The area was surrounded from the western side by sugar cane fields and a house of four stories, then the site for the fallen wreckage.
- Some traces of fire were observed in the sugar cane fields as a result of the victim falling inside them
- Some traces of bloods were also observed at the locations of victims falling.



4. Examining the area for balloon take off:

The area for balloons take off was examined by the investigation team at “Elkarana” area, “Houd El Sabeel” at the west side land, Luxor city on 27 February, 2013. The examination revealed the following:



- The site is in a clear area existing in the desert mountainous area north of “Valley of the Kings”.
- The site is surrounded from the western side with the “new Karana” road, followed by Karana Mountain.
- The site is surrounded from the eastern side with cultivated lands by the extension of the western side land until reaching the river Nile.
- On the northern direction, there is an office belonging to the Egyptian company for airports (to supervise the site).
- The site is surrounded from the southern side with agricultural lands.



5. Examining the cylinders that under the custody of Luxor D.A. (District Attorney) inside the ‘criminal evidences’ department at Luxor.

The investigation team moved to the D.A (District Attorney) and was allowed to examine and transfer the event balloon fuel cylinders after ensuring that it is safe to do that. The investigation team examined the cylinders. The examination revealed the following:

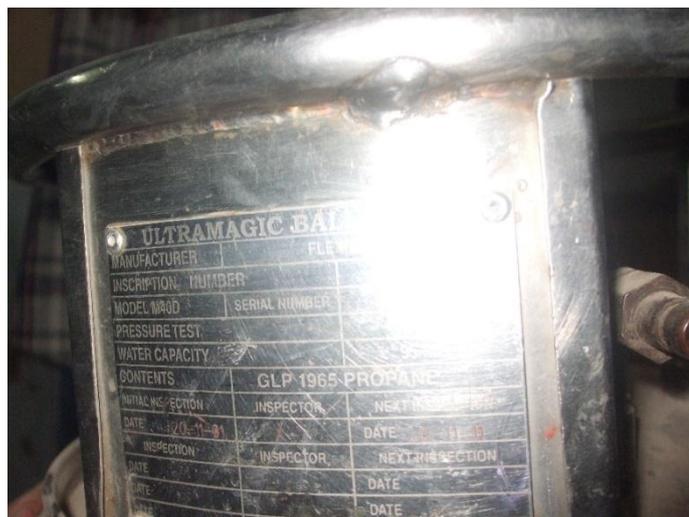
- One of the cylinders was splitted (divided) into two parts. The upper part and the remainder part. Visual examination indicates a condition of explosion.
- Three cylinders were found in a complete figure (shape). There were apparently affected by the fire. The cylinders did not contain any Butane gas inside.
- One cylinder of the three cylinders was found connected with its hose that connects it to the burner. Evidence of fire traces were observed. Almost complete burning was observed also in the outer rubber area except for some few areas.
- All the cylinders pressure gages were damaged and adversely affected by the fire and impact.
- It was not possible to identify the numbers of the cylinders because their bad conditions. The information tags that are

supposed to be fixed to the cylinder upper portion were missing.

.6. Listing of the cylinders that were there in the “Egyptian Airship and Balloon” company store (accident event)

The investigation team moved to the “Egyptian Airship and Balloon” company store (accident event) for investigation. The examination of the cylinders revealed the following:

- The name of the company “Ultramagic” is sculptured on the cylinders on a rubber frame.
- The cylinders were listed based on information included on the metallic label (placard) fastened with aluminum screws to the upper part of the cylinder. These tags include the following information:
 - Manufacturer.
 - Model.
 - Serial Number.
 - Pressure Test.
 - Capacity.
 - Contents.
 - Manufacturer Date.
 - Inspection Date.
- The cylinders in the store were listed and compared to the cylinder list for the cylinders existing in the company.
- The study showed that five cylinders were missing. Four of them were installed on the event balloon as indicated in item 1.6.1 of this report



7. Transferring of the wreckage:

- The wreckage was transferred under the supervision of the investigation team to a safe and secured location within one of the stores at the custom area of Luxor.
- The investigation team (committee) transferred the cylinders from the “criminal investigation” department in Luxor to the store assigned to keep the wreckage in Luxor airport.



1.12.2 Second technical examination

- On 11/3,12/3/2013, the second examination of the event balloon wreckage was made at Luxor airport by the investigation team, in addition to:-
 - Mr./ [REDACTED] - Aircraft accident investigation accredited representative, state of Spain
 - Mr./ [REDACTED] - representative from 'Ultramagic' company, balloon manufacturer
- Examination of the balloon wreckage and reassembly of its available parts (cylinders, hoses, burners) were made by the participants. Following has been observed:
 1. All the wreckage parts seemed to be manufactured by Ultramagic' company, the balloon manufacturer (according to the information received by the manufacturer representative).
 2. All fire traces on the burner have been cleaned; the serial number of the burners appeared and showed the numbers 191 and 193. The serial numbers on the other burners were lost
 3. The hose connector to the burner 193 differs in its shape compared to the three hoses connected to the other burner
 4. The external dimensions for the connectors head connected to the burners were measured. Dimensions were found to be 19.4 mm, 22.3 mm, 22.0 mm and 22.5 mm (19.4 mm for the burners number 193)
 5. The hose of the burners number 193 was separated from the burners side, whilst the other hoses were separated from the cylinder
 6. The real length of the hoses have been measured after the complete straightening of the hoses, and after getting rid of the several bents (resulted from being scrambled with the wreckage). There were found as follows (including the connections)
 - the hose connected to the burners number 193 was 329cm long
 - the hose connected to the burner number 191 was 289 cm long
 - the other hose was 309 long
 - the other hose was 336 long
 7. The cow burners handle, attached to the burner number 193, was found in a melting condition.

8. One of the cylinders was found destroyed. It has been noticed that the parts for of the cylinder welded parts and the position for the arm of the main valve showed some lose movement towards the closing position direction
 9. All cylinders identification plates were lost leaving marks of 6 holes at the top protection crown for the cylinder
 10. The part no. for the hose related to the burner number 193 was found to be PV0500178/1 , this is consistent with Binsa (hose manufacturer) for the year 2005 (according to the information received from the manufacturer)
 11. The part no. for the hose related to the burner number 191 was found to be “PV8015730/01”, this is consistent with Binsa, for year 2008 (according to the information received by the manufacturer)
 12. The TEMA connected to the cylinder of the burner number 193 carried the part number TEMA 3810 and is made in Sweden
 13. The three other quick connections (TEMA) were not connected to the cylinder
 14. Visual inspection on the hoses revealed that there were no cracks in any of the metal nuts; however the external rubber was not there, except for some small parts.
- The committee has made a visit to the premises of the balloon owner and investor company to obtain some information. It was observed that there were 7 new hoses imported from "Ultramagic" company on February 2012
 - The investigation committee has made another visit to the company store and performed a simulation for the cylinders nitrogen pressurization. It has been observed that the cylinders seem to be normal. Also it was been observed that about 10 cylinders owned by Ultramagic company, had the identification plates fixed to them with aluminum rivets to the cylinder crown, few of them were welded to the cylinder . (Exhibit #3)
 - The operation manager noticed that there are four burners of the same type that do not include any number on it (neither on the lower area nor in the side area).
 - The manufacturer has confirmed in his later comments that the burners have always been marked with a unique S/N on one of the three side brackets of

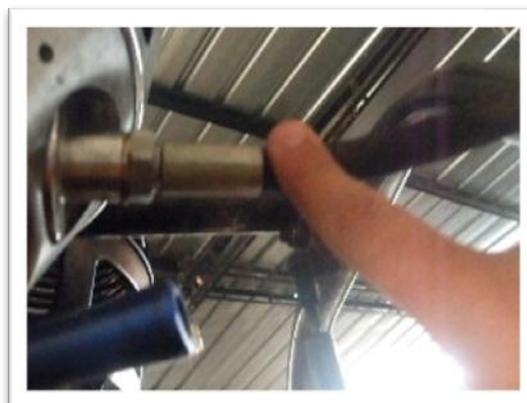
the vapourization coil (up to approximately S/N 200) and on the lower part of the burner for higher S/N's.

1.12.2.1 Reassembly of the wreckage parts:

- The committee made an attempt to re-assemble the parts together again to check the arrangement of the balloon and their positions
- The balloon frame with the attached burners was assembled
- One of the side that carried 3 Karabiners was still there, indicating that this side was the side where the pulling rope was fixed with the car
- By assembling the burner parts, it was shown that the burner sequence in the balloon was as follows
 - Forward right burner is the burner number 193
 - Aft left burner is the burner number 191

1.12.3 Examination of a balloon of a similar type as the event balloon:

- The investigation Committee has examined a balloon of a similar type as the event balloon (Ultramagic- N425) in the store of one of the balloon company, the following was observed:
 - The fuel hoses were fixed on four beams on the balloon metal frame and covered with a jacket of the rubber cloth.



- Bents were visible in the hoses, in the upper part before connecting the hoses with the burners



- The cow handles were below the location of the connection the fuel hoses with the burners immediately.
- The Serial Number S/N for every burner fixed on a metallic plate on the lower side of the burners by riveting using Aluminum fasteners.



- The Drop Line hose suspended inside a bag in the center part of the basket on the right side of the balloon captain, far from the hoses.
- The fire extinguisher is fixed to the center part of the basket inside the place where the balloon captain was standing and on his left side.



1.12.4 An experiment to simulate the gas exiting from the cylinder through the hose:

An experiment was made including opening the fuel outlet valve from cylinder having an internal pressure of 12 bars, and observing the hose movement the time the gas goes out, the following has been observed:

- The hose moved strongly to the right and left of the position where the one performing the experiment was holding the hose.
- The gas was going out as a white liquid spray.
- A loud noise was heard when the gas was going out the hose.



1.12.5 Comparison between hoses that were unserviceable and consequently been discarded belonging to the balloon operator, with new delivered hoses to the company:

1.12.5.1 Examination of one of the used hoses, with a comparison between its two ends (the end connected to the burner and the end connected to the cylinder)

A thorough examination for one of the hoses that was used and then became unserviceable and consequently been discarded, was made by the investigation committee (Part number PV8015730/01, produced by BINSÁ company on year 2008, similar to the hose that was connected to burner 191 on the event balloon). The following was observed:



- The start of the influence of the heat and the environmental conditions at the adjacent part of the igniters at the part near to the quick connection connectors (TEMA) were easily observed, this can be identified through the dissimilar colors.
- Cracks were visible at the part adjacent to the burners, its intensity increasing as it becomes more near to the igniter, it decreases as it becomes more far from it, until it almost disappears



1.12.5.2 Examination of one of the unserviceable hoses that has been discarded, taken from service

A thorough examination for one of the hoses having the same part number (PV8015730/01, manufactured by BINS A Company) by the investigation committee, torn parts of the rubber were observed at the part adjacent to the connection of the hose to the burner, showing the parts of the hose reinforcing metallic wire as shown in the adjacent photo.



1.13 Medical and Pathological Information

1.13.1 Injuries of the balloon captain

Just after the accident, the balloon captain was transferred to Luxor hospital. Medical examination was carried out on him, the following report was issued:

- The examination revealed that the captain was suffering from fire burns of 70 % degree (from the three degrees) at different parts of his body, plus fire burns in the respiratory system, he was transferred to Al Helmhah military hospital.
- On 24 April, 2013, the medical check on the balloon captain was signed by the delegated forensic doctor, the report included the following:
 - The medical forensic examination, and the examination of the medical documents attached, revealed that the balloon captain was suffering from fire burns spread into the head, the face, the back, the left upper side, the right upper arm, chest front, abdomen area, and lower legs. Some of these areas showed inflammation, with some pus especially in the left shoulder, left upper arm, left arm and left of the head.

1.13.2 Mr. [REDACTED] the only survivor among the passengers (British nationality)

Medical examination was made on Mr. [REDACTED] immediately after the accident. The examination showed that the jump from the balloon caused a slight loss of conscious. There were no external injuries in the head, no internal bleeding into the brain, no fracture in the skull bones. The patient was kept for a while under observation and then he left the hospital

1.13.3 Anatomy status for the balloon dead bodies

The dead bodies (19 bodies) were medically examined by the doctors of the Forensic medicine department to reach the cause of the death. Necessary specimens were taken from them to check for the DNA. The reports concluded the following:

- 5 bodies were free of fire. Death was related to the fall from the balloon

- 14 bodies died because of fire and fall from the balloon

1.14 Fire

- Fire started in the balloon with the existence of the gas compressed in the cylinder, and source of ignition
- It was not known if the fire extinguisher bottle was used before the balloon crash or not
- The fire vehicles (brigade) moved immediately to the accident site just after receiving the notification.
- The fire within the balloon wreckage was extinguished by water agent

1.15 Survival aspects:

- Just after the accident, the “Civil Defense” personnel moved directly to the accident site with fire vehicle and ambulance. There were no survivors among the balloon passengers
- All dead bodies were moved from the fall locations to the hospitals in Luxor
- The captain was carried by some of the citizens to the hospital

1.16 Test and Researches

1.16.1 Central Metallurgical R& D Institute (CMRDI) report (Exhibit #4):

The committee sent some parts from the balloon wreckage to be analyzed at the lab of metallurgical researches and development center belonging to the ministry of scientific researches. The parts that were analyzed are shown in the following comprehensive report

CMRDI Report:

| Item | # |
|--|----|
| Hose attached to burner (193) with its TEMA connector (fast link with cylinder) | 1 |
| Connector to burner (193) "connecting hose to burner 193" | 2 |
| Cow burner valve. attached to burner (193) | 3 |
| Hose attached to burner (191) | 4 |
| Cow valve. attached to burner (191) | 5 |
| Hose of one of the two unidentified burner serial number (left front side) | 6 |
| Cow valve. of one of the two unidentified burner serial number (left front side) | 7 |
| Hose of one of the two unidentified burner serial number (right rear side) | 8 |
| Cow valve. of one of the two unidentified burner serial number (right rear side) | 9 |
| Wreckage of one of the cylinders | 10 |

Investigation on different items

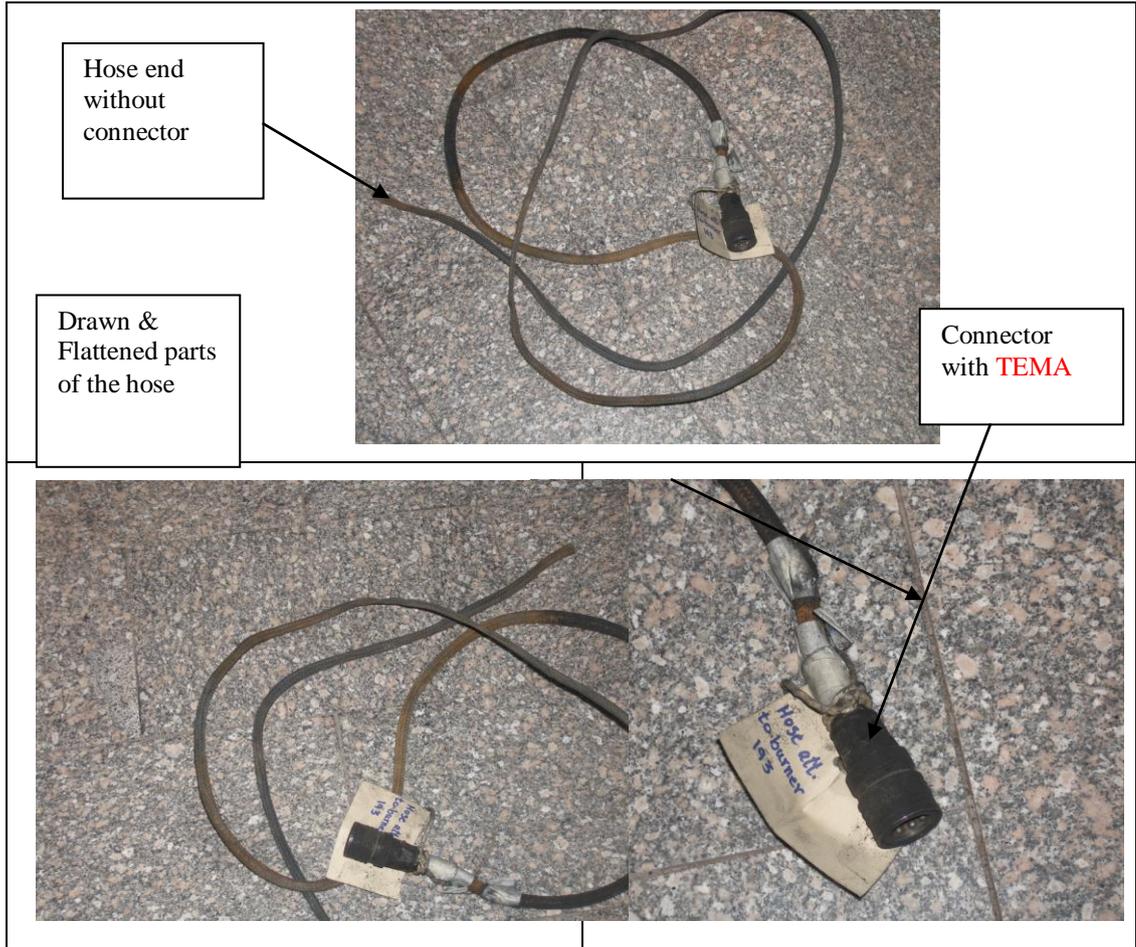
Item #1: Hose attached to burner (193) with its TEMA connector (fast link with cylinder)

The following photos shows the situation of item #1

By visual inspection to the hose which was connected to burner 193, the TEMA was found connected to the hose.

The connector to the burner wasn't connected to the hose.

- It was found that the hose lost totally the outer rubber layer as a result of a fire exposure.
- The hose contains different diameter areas as a result of a puling force of fragments. The hose diameter was found deformed and varies between 13 mm to 6.8 mm.
- The hose was expanded due to puling with its length measuring 323cm.



Item #2: Connector to burner (193)

Connector to burner 193 was found unconnected to its hose.

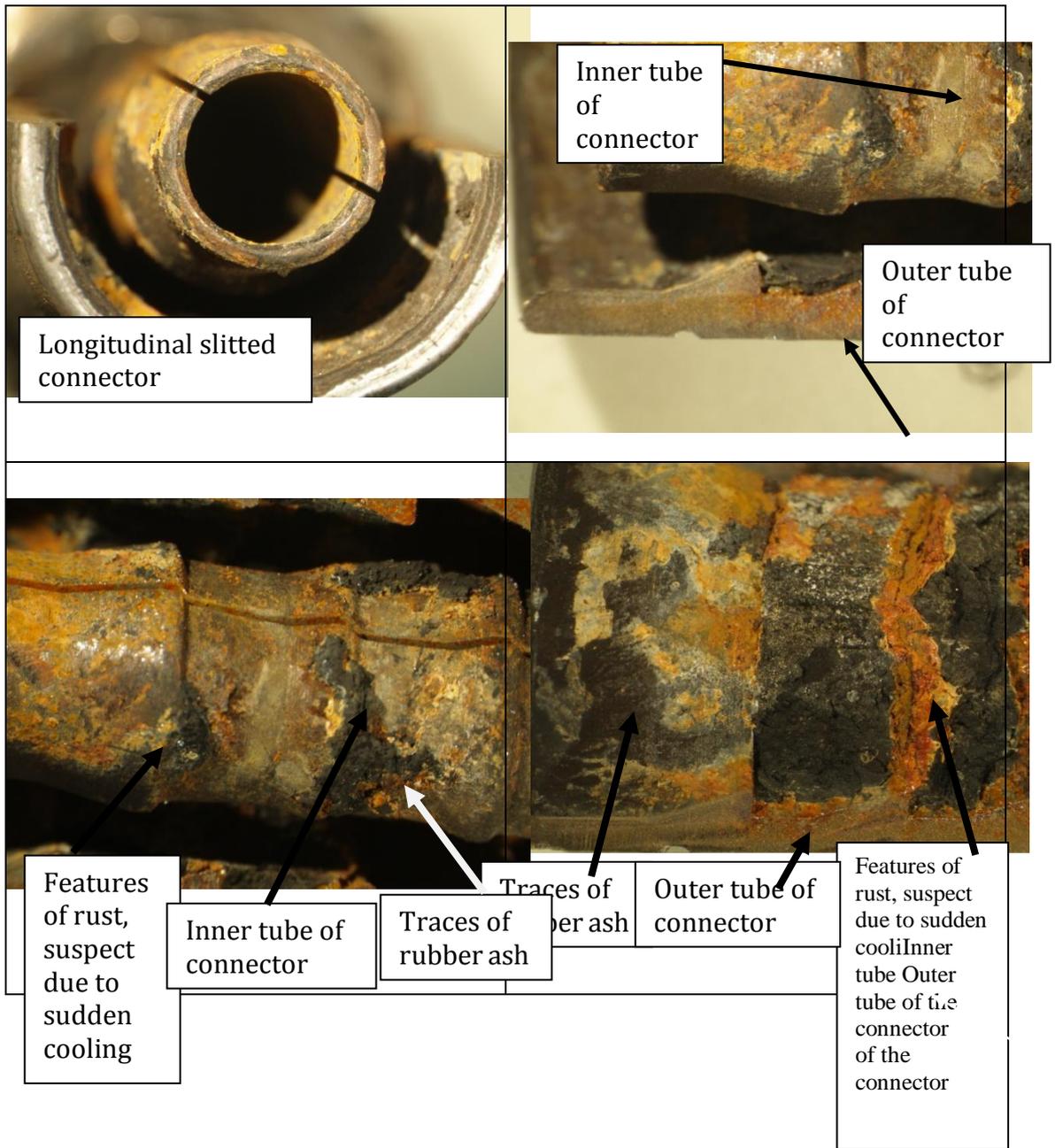
The connector is extensively investigated by slitting into longitudinal cross section by wire cutting to avoid contamination of the inner contents.

The following photos shows the details of the connector to burner 193 (item #2)

- The inner as well as the outer tube of the connector were found containing traces of rubber ash.
- The surfaces of the inner as well as the outer tube of connector were covered with rust, suspect as a result of sudden cooling with water.
- The traces of rubber ashes suggest that connector was subjected to extensive fire that burned rubber inside connector.
- It was observed that longitudinal cross section indicates teeth that is supposed to bite the hose preventing it from separation under normal circumstances.
- A chemical analysis has been carried on the connector alloy. The chemical composition is stated in the following table:

| Element | C | SI | M n | P | S | Pb | Fe |
|---------|-------|-------|------|-------|---|------|-------|
| Wt % 0 | 0.084 | 0.001 | 1.18 | 0.064 | 0 | 0.45 | 97.88 |

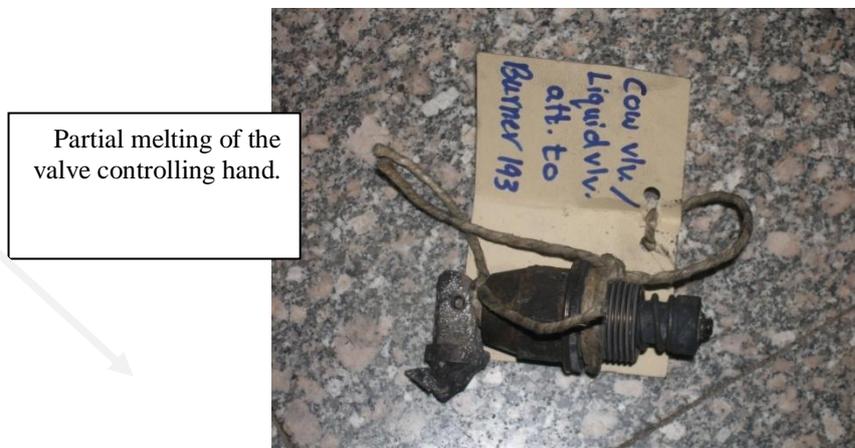
Consequently, the connector material is a free cutting steel alloy, with material No.1.0718 & grade A9G-RV.



Item #3: Cow burner vlv. attached to burner (193)

The following photo shows the situation of item #3

- The cow valve connected to burner 193 was found with partial melting of the valve controlling handle.
- The cow valve was subjected to a direct fire, which caused partial melting of the valve controlling handle manufactured of Aluminum alloy - 6000 series (Magnesium Mg and Silicon Si are major alloying elements) AlSi1Mg0.5Mn with UNS. No. (A96351) alloy with an approximate 650 °C melting temperature.



The following table represents the chemical composition for partial melted handle of controlling valve attached to burner 193 (item#3).

| Element | Si | Fe | Cu | Mn | Mg | Al |
|---------|-------|-------|-------|-------|-------|-------|
| Wt., % | 0.985 | 0.433 | 0.033 | 0.781 | 0.726 | 96.95 |

The mechanical properties of AlSi1Mg0.5Mn alloy on the annealed state are stated below:

| | |
|---------------------------------|-----|
| Tensile strength (MPa) | 160 |
| Yield strength (MPa) | 110 |
| Min. elongation at fracture (%) | 14 |
| Brinell hardness (HB) | 35 |

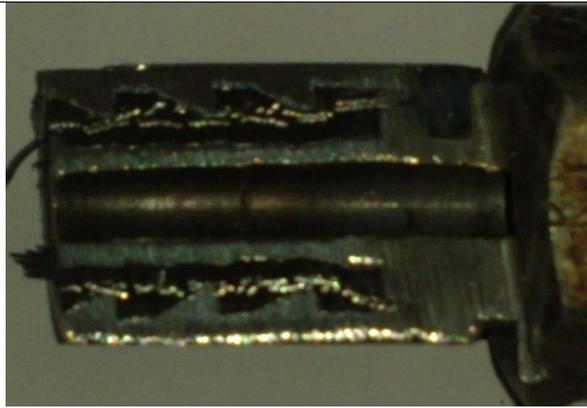
Item #4: Hose attached to burner (191) with its connector to the burner

It was noticed that one its end was attached to the burner, while the other side was connected to TEMA, it was affected by the shear force resulting in its fracture (as shown in the following photos)

| | | |
|--|---|--|
| <p>Part of outer rubber layer</p>  |  |  |
| <p>Hose attached to burner 191</p> | <p>A part of the connector was separated and connected to the TEMA</p> | <p>Features of a part of the connector which was separated and connected to the TEMA</p> |

It was noticed that the hose contains two areas still covered with rubber. The rest of the hose was burned showing the internal fiber steel reinforcement with an average diameter 12 mm.

The approximate length of the hose is 275 cm.



Longitudinal cross section of connector 191



Diameter sector cross section of connector 191

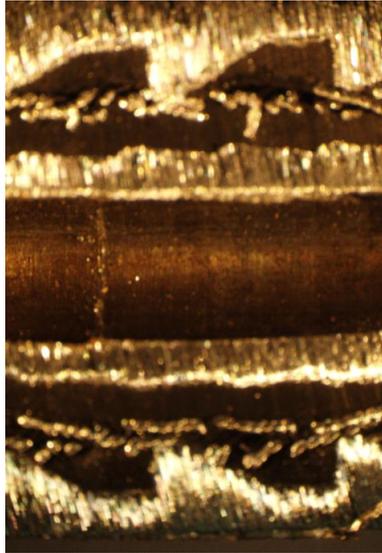
After longitudinal cutting of connector to burner 191, it was noticed that the inner as well as the outer tubes contains teeth that bite the rubber layer of the hose. Biting continues to the fiber steel reinforcement.

The biting mechanism clearly shown in the following photos suggest it is a remote possibility that the hose could release from its connector under normal circumstances unless it is subjected to an external pulling force.

Inner tube teeth



Outer tube teeth



Outer tube teeth

Rubber

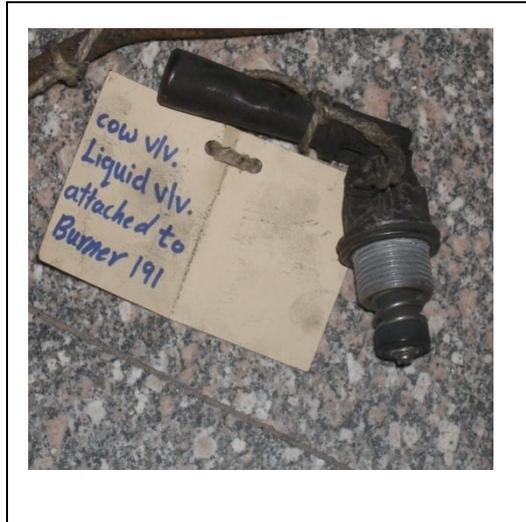
Fiber steel reinforcement



Longitudinal cross section of connector to burner 191

Item #5: Cow vlv. attached to burner (191)

The following photo shows the situation of item #5



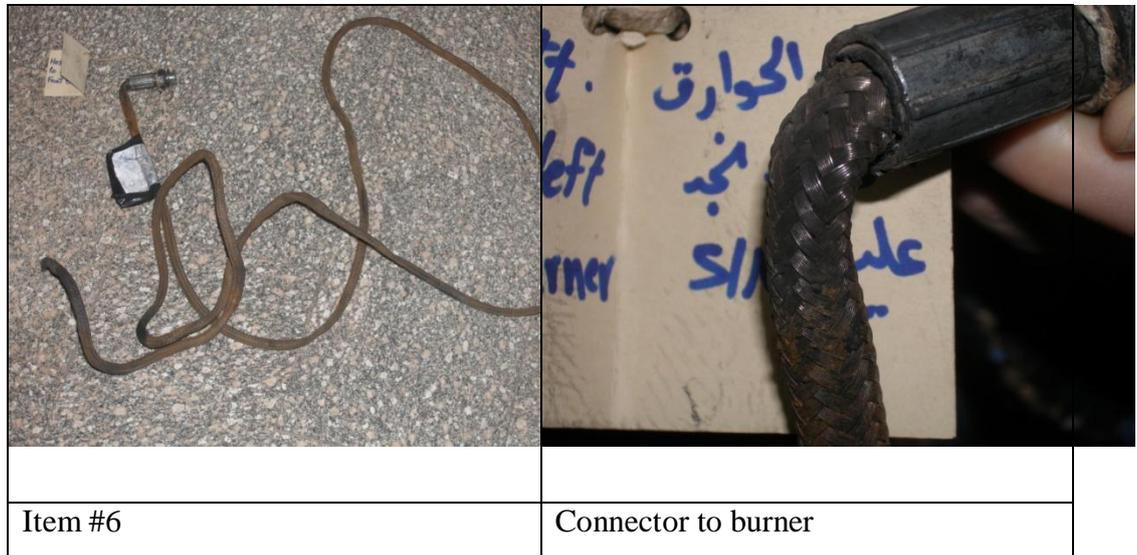
The cow valve attached to burner 191 was found in a right situation (undamaged) .

Item #6: Hose of one of the two unidentified burner serial no. (left front side)

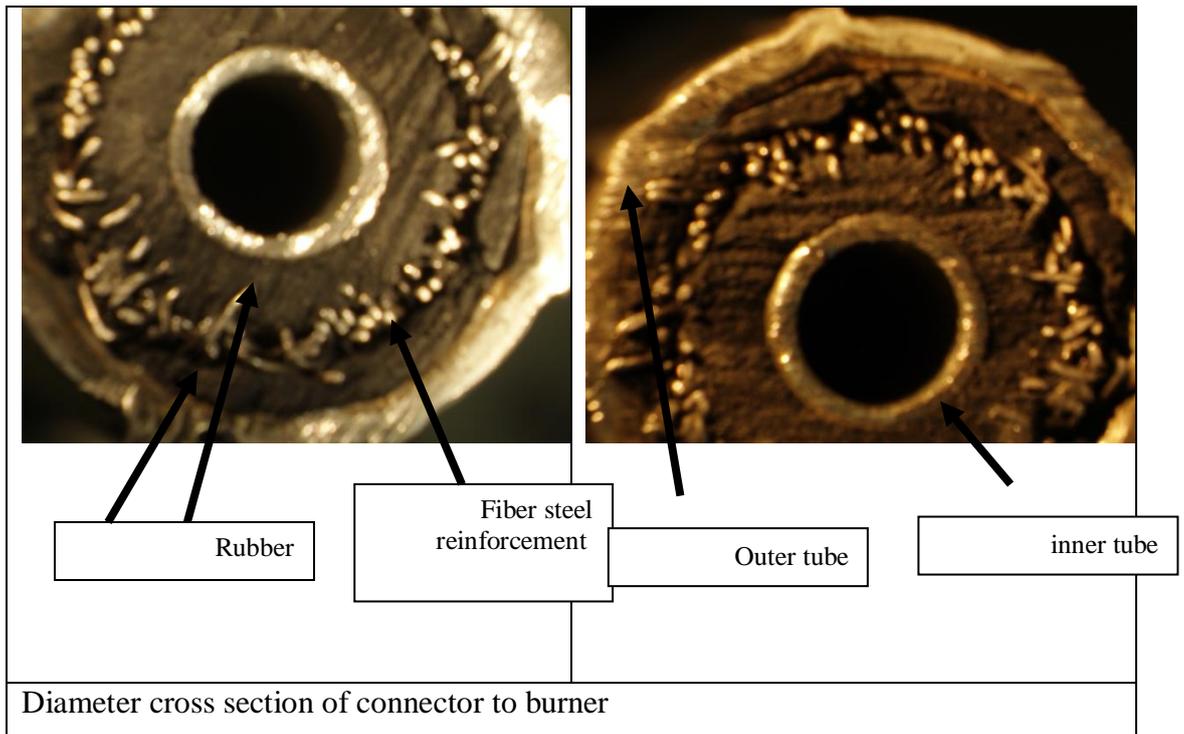
It was noticed the rubber between the outer and inner tubes for the hose connection

The end of the hose was released from the connector to the TEMA It is clear that hose was subjected to extensive fire where its approximate length 320 cm.

It is also noticed that there is great variety between the hose diameter (8.9 -12.7 mm) as a result of a pulling force.



The following photos show that the connector to burner contains rubber hose between the inner and outer tubes. The fiber steel reinforcement is clearly impeded in the rubber layer.



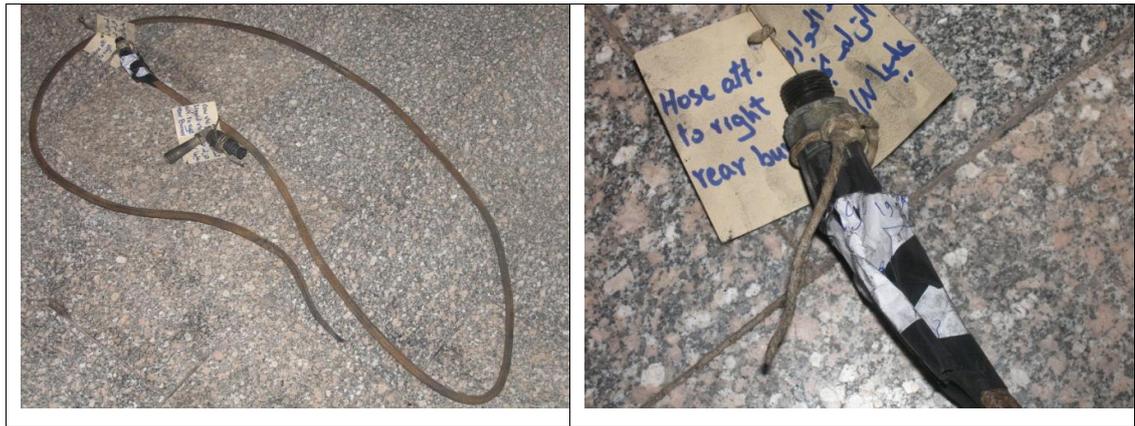
Item #7: Cow vlv. of one of the two unidentified burner serial No. (left front side)



By visual inspection, it contains no damage at any part of the valve.

Item #8: Hose of one of the two unidentified burner serial No. (right rear side)

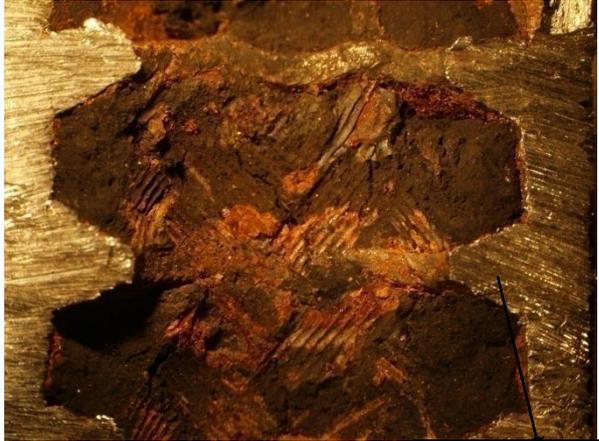
The hose contains one of the connectors, while the other end was found free (released from connector). The hose is highly damaged by a fire, where its length 293 cm. It is also noticed that there is great variety between the hose diameter (8.4-12.9 mm).



The connector was mechanically cut to longitudinal section to look at investigate the effect of fire. After longitudinal sectioning, it was found that rubber of the hose was totally fired and traces of rubber aches was noticed at a different areas between the inner and outer tubes of the connector.



Longitudinal cross section of connector connected to hose item#8



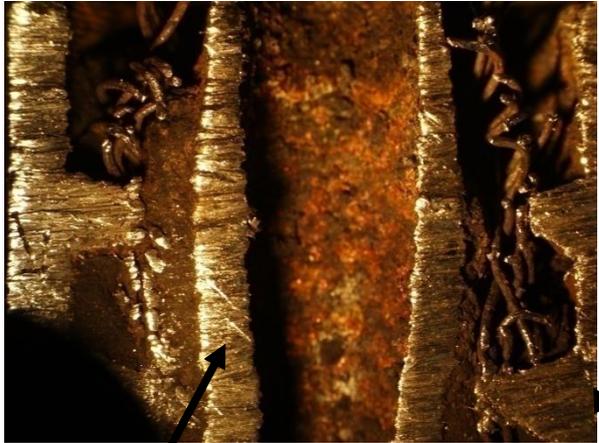
Rubber ash traces

Outer tube of the connector



Rubber ash traces

Fiber steel reinforcement



Inner tube of the connector

Outer tube of the connector

Item #9: Cow vlv. of one of the two unidentified burner serial No. (right rear side)



The cow valve item #9 of one of the two unidentified burner (right rear side) is undamaged.

Item #10: Wreckage of one of the cylinders

Item # 10 has been received as wreckage of one of the cylinders that provide the balloon with the fuel gas. It is assumed that gas was reserved as liquid under high pressure in the cylinder.

The Wreckage of the cylinder clearly shows that:

- An out burst happened from inner to outer of the cylinder, where the edges of the failed wall of the cylinder move outward.
- According to the general law of gases, increase of gas temperature is leading to increase of volume and consequently gas pressure. It is supposed that the gas cylinder was subjected to fire as its clear on the upper part of the wreckage of the cylinder surface. It was found that the opposite side of the failed edges lost the feature of the surface coat painting.
- Lower, upper and longitudinal seam welding lines still in a right way situation and were not subjected to any failure.

The following photos show different positions of the gas cylinder (item #10)

Longitudinal seam welding lines



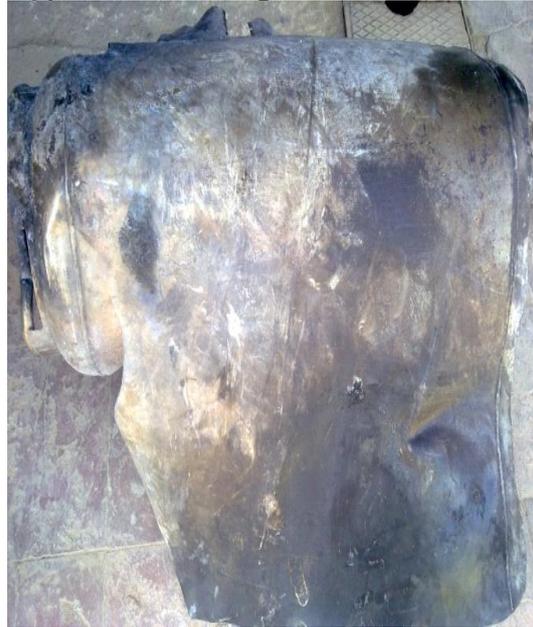
Edges of the failed wall of the cylinder move Outward



Lower seam welding lines
Edges of the failed wall of the cylinder move outward



Loss of surface coat painting
Upper seam welding lines



A sample has been cut from the wreckage of the cylinder Item #10 for thickness measurements as well as for chemical analysis.

- The average thickness of the gas cylinder wall was 1.98 mm.

- The following table represents the average chemical composition of the sample taken from the wreckage of the gas cylinder;

| Element | C | Si | Mn | P | S | Cr | Mo | Ni | Al | Co | Cu |
|---------|-------|-------|------|-------|-------|------|------|------|-------|-------|-------|
| Wt., % | 0.022 | 0.364 | 1.45 | 0.024 | 0.002 | 21.5 | 3.18 | 6.04 | 0.025 | 0.124 | 0.256 |

- The chemical composition emphasizes that the material of the sample is austenitic-ferritic stainless steel alloy material No.1.4462 grade X2CrNiMoN22-5-3
- The expected (standard) mechanical properties of the alloy are listed in the following table:

| grade # | Yield Stress, MPa | Ultimate Strength, MPa | Elongation, % | Impact value, J |
|------------------------|-------------------|------------------------|---------------|-----------------|
| | ≥ | | ≥ | ≥ |
| <u>X2CrNiMoN22-5-3</u> | 450 | 600-900 | 30 | 120 |

Conclusions based on material investigation :

1. The hose attached to burner 193 was found without the outer rubber layer and containing different diameters. The hose was expanded due to a pulling force.
2. The inner as well as the outer tube of the connector to burner 193 were found containing traces of rubber ash and covered with rust which is evidence that connector was subjected to extensive fire. The connector material is a free cutting steel alloy, with material No.1.0718 & grade A9G-RV.
3. The cow valve connected to burner 193 was found with partial melting of the valve controlling handle. The valve controlling handle is AlSi1Mg 0.5Mn alloy.
4. The connector to the TEMA (hose attached to burner 191) was found failed by a shear force. The teeth of inner as well as the outer connector tubes bite the rubber layer of the hose, where biting continues to the fiber steel reinforcement preventing release of the rubber hose from the connector.
5. The cow valves attached to burner 191, and other cow valve connected to one of the two unidentified burners serial No were found in a right situation (undamaged) .
6. the connector to hose of the unidentified burner (item #6) contains the rubber hose between the inner and outer tubes. The fiber steel reinforcement is clearly impeded in the rubber layer.
7. Hose of the unidentified burner serial no. (Item #8) was highly damaged by fire. It is found that rubber between the inner and outer tubes of the connector was totally fired and traces of rubber ashes were noticed at different areas.
8. An explosion happened from inner to outer of the cylinder, where the cylinder was subjected to fire on the upper part. the material of the cylinder is austenitic-ferritic stainless steel alloy with 1.98 mm thickness

Research team from CMRDI

Professor XXXXXXXXXX

1.17 Organizational and Management

1.17.1 Information about the “Egyptian Airship and Balloon (Sky Cruise) company”, the owner and investor of the event balloon:

- Company name: Egyptian airship and balloon (Sky Cruise)
- Holding an Air Operation Certificate (AOC), issued from the Egyptian Civil Aviation Authority ECAR” dated 26 March 2003. The AOC is renewed and valid for the time from 15 March, 2012 to 25 March, 2013
- The company holds a letter of military approval semi annual, to practice the balloon activity valid for the time between 1st July, 2012 to 31 December, 2012 based on the approval letter c/5894 issued on 9 July, 2012
- The company made coordination with the control tower at Luxor airport concerning performing balloon flight (letter issued on 5 may, 2009)
- The company has a contract with Bavaria Misr company for maintaining the fire extinguisher unit) carried on board of the company balloons (12 extinguisher units) issued on 5 January, 2013

1.17.2 Information about the Egyptian Airports Company:

- On 2nd December, 2009 , the Egyptian company for airports, based on the letter issued from the ECAA chairman number 9684 dated 25 October, 2009, established the organization structure for the Balloon Take Off area management at Luxor, in addition to duties, jobs description for the employees of the Balloon Take Off area management
- The balloon department at Luxor airport assumes supervision on the take off areas according to Egyptian civil aviation authority ECAA instructions number and included in his letter number 3863, dated 11 August, 2011 (exhibit #5)
- On December 2, 2009, based on the letter issued by ECAA number 9648, dated October 22, 2009, the Egyptian company for Airports established organization structure for the take off site at Luxor,

including duties and job description for the balloon take off site
department employees. (Exhibit #6a, #6b)

1.17.3 Information about the central metallurgical research and development institute (CMRDI)

- The CMRDI is a research center belonging to ministry of scientific researches, Arab Republic of Egypt. The center provides technical assistance for the industry, research products, consultations, technical services, training, tests, and approvals. The center coordinates locally and internationally for researches and development
- The center performed several tests on parts of the aircraft wreckage in the accidents and incidents that were investigated by the Egyptian directorate of accidents and incidents investigation, in addition to directorate of accidents/ incidents investigation for adjacent states

1.18 ADDITIONAL INFORMATION

1.18.1 Inspection actions performed on “Egyptian Airship and Balloon” company by Egyptian Civil Aviation Authority:

Last inspection has been performed on “Egyptian Airship and Balloon” company by ECAA on 14-16 February, 2013 for the purpose of renewal of the company Air Operator Certificate (AOC).

1.18.2 Inspections actions made by the Egyptian Civil Aviation Authority on event Balloon:

a. The last check carried out on the balloon:

The last check carried out on the balloon was 100 hrs check (Annual), made by the company maintenance manager under the supervision of the Egyptian Civil Aviation Authority on 5 October, 2012

- The following includes the observations made by ECAA inspectors, in addition to the chief inspector reply:

| Ref. No. | CAT | PEMARKS | CORRECTIVE ACTIONS |
|----------|-----|---|---|
| A01 (7) | 2 | GMM is not Updated till now | 1 The update has been sent for approval on 24 July, 2012. It has not been approved yet. |
| A01 (10) | 2 | Flight manual is updated but is not approved till now. last rev 18 dated 20/1/2012 and the approval rev.16 dated 8/9/2009 | 2 The flight guide update has been sent for approval on 24 July, 2012. It has not been approved yet. (The receipt indicating that the update document is received by the customer service was attached) |
| A03(4) | 2 | There are some of cutting area at the over scope of the envelope in different places (small are | The small holes within limits and has been repaired |
| A04(4) | 2 | The leather area (row hide) at the bottom of basket need to fix it (i.e. Loose) | The cutting area has been re fixed |
| A07(2) | 2 | Fire bottle at flight area serviceable pressure gauge but has inspection new date (no next due date(| New ticket has been positioning with the inspection date |

- Flight Test:

A flight test was carried out on 6 October, 2012 at a number of flying hours of 591 hrs, 55 minutes, consequently the Airworthiness certificate No 1112 was renewed on 5 October 2012 with the validity from 13 October, 2012 to 12 October, 2013

B. Egyptian Civil Aviation Regulations regarding the flying balloons activity:

- The Egyptian Civil Aviation Authority issued its regulations regarding the balloon on 1996, including:
 - ECAR 101 "Manned Passenger Carrying Balloon"
 - ECAR 61 "Licensing: Pilots, Flight Instructors and Ground Instructors", including what is related to Private Balloon.
- On 2004, the ECAA issued the regulations related to the operation of the Commercial Balloon (ECAR 61, ECAR 101
- Regulations updates were made by ECAA up to year 2009
- On year 2010, the ECAA issued its regulation ECAR 62 to transfer what is included in ECAR 61 regarding the balloon in it, in addition to issuing ECAR 101 under the title "Balloon, Glider& Motor Glider Pilots Licenses& Flight Instructors Rating"

1.18.3 ECAA instructions regarding charging of the gas cylinders (Exhibit #7):

On 29 July, 2008 a letter was issued by the chairman of the ECAA and was circulated to the chairmen of the balloon companies regarding the procedures for charging the flying balloons cylinders with gas. (Refer to Exhibit # 7). The letter included instructions for all balloon companies to charge gas cylinders only at the ECAA approved organizations

1.18.4 The hydrostatic tests done on the gas cylinders at the organizations approved by ECAA

- Ultramagic company establishes performing hydrostatic test on all gas cylinders when they reach 10 years life time from the of manufacture date, then every 5 years (according to the maintenance manual, item 6.5 under the title special inspection of cylinders and fuel hoses after 10 years ('d' type) related to balloon to renew the cylinder working serviceability).

6.5 Special Inspection of Cylinders and Fuel Hoses After the 10 Years ('D' type)

This Inspection should be carried out 10 Years after the original supply of the Cylinders and/or the liquid fuel

After the "D" type Inspection has been carried out, subsequent Inspections should take place thereafter 10 Years unless a shorter period has been determined in a previous Inspection.

Fuel Cylinders

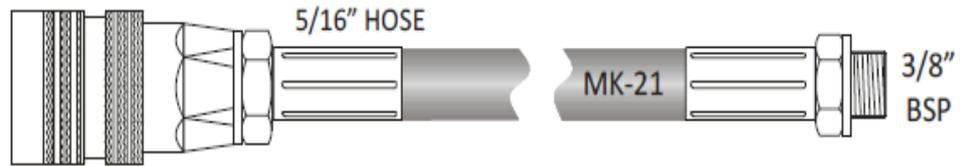
- 1. Check the date of construction and check that the latest test is valid*
- 2. Visually inspect the exterior of the Cylinders for dents or damage, especially in the lower part.*
- 3. Remove the dust cover of the pressure relief valve and inspect for contamination or corrosion. Check the date of the valve.*
- 4. Check that the valves for signs of damage or corrosion and that they function correctly paying particular attention to the function of the "O" rings and flat faced seal on the Rego type male tank connection.*
- 5. Inspect all boss fittings and valve attachment points for damage or misuse.*
- 6. Check the freedom of movement of the contents gauges.*
- 7. Check all pressure holding joints with leak detector.*
- 8. Carry out a hydraulic test of the system to a pressure of 30kg/cm².*
- 9. Check the thickness of the walls of cylinders where excessive abrasion has occurred or damage exceeds that allowed in section*

*6.5.5 of the MM. Original nominal minimum wall thickness is 2.0
0.2 mm. when it is necessary to measure wall thickness please
consult Ultra magic S.A.*

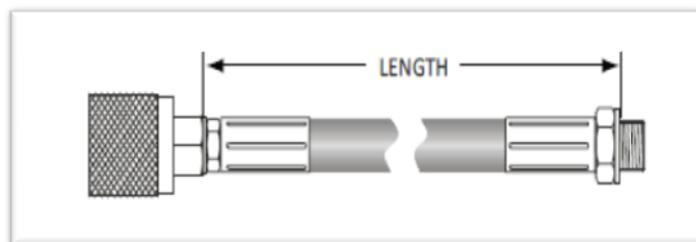
- The mentioned test was implemented on the cylinders belonging to 'Egyptian Airship & Balloon' numbers 33306898, 20010206, 33306896, 557, and 558 at engines factory.

1.18.5 Information about the hoses:

1 Hoses Specifications (reference manufacturer document)



- The hoses are the connecting link between the burner and the fuel cylinder, they are fixed to cylinder by one of two means, REGO or TEMA. For the event balloon type Ultramagic N425, all the hoses were fixed to the gas cylinders by TEMA connection (5/16" at the side of the burner, 3/8"
- The burners installed on the balloon were of the type MK21, they are suitable for the hoses of a thread of 3/8" (burner side), 5/16" (TEMA side) as shown in the spare part manual issued by the manufacturer, the 4th part.
- Based on the spare part guide issued by balloon manufacturer, the hoses lengths as shown in the 4th part of the guide are 2.5 meters for the Standard Length, 3 meters for long hoses.



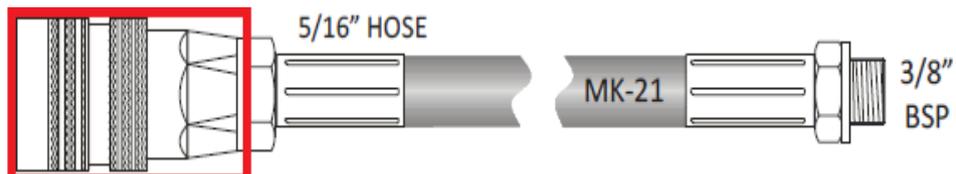
- Based on the maintenance guide issued by the manufacturer Ultramagic in item 4.3.7.4, **the hoses are specially selected to withstand the**

operational fuel pressures and the wear and tear associated with use and handling.

- Ultramagic company warned all the companies using the balloon against using any other hoses that are not produced by it (reference maintenance guide item 4.3.7.4)

2. Means of installing the hoses

- The maintenance engineers install the hoses in the burner first, the threads connecting the hoses with the burner are only unfastened in the case of maintenance or the case of installing new hose.
- The hoses are connected to the gas cylinders only immediately before the flight through the TEMA.



- Reference to maintenance guide the torque necessary to install the hoses are per the following tables:

| Fitting | Thread Form | Max. Torque (NM) |
|------------------|--------------|------------------|
| MK21 Liquid Hose | 3/8 inch BSP | 20 |
| MK21 Liquid Hose | 1/4 inch NPT | 15-20 |

- Reference to maintenance guide, after replacing any hose, the hose must be tested by being pressurized by air to 7 bars, in addition to testing the connections with both the burner and cylinder using liquid Soapy water according to item 4.3.11.4 of the maintenance guide.
 - The maintenance engineers and the balloon captains must keep the cables and hoses inside an envelop fixed in one of the balloon frame side far of erosion factors as shown in the flight guide issued by the manufacturer, item 6.2.3.
- ## 3. Checks (inspections) carried out on the hoses:

A. PDC Checks:

The Flight Manual issued by the manufacturer in its appendix C, requires performing the following actions (concerning inspecting the hoses) through the P.D.C. (Pre Departure Check)

- 1) Check the burner, all valves and hoses for damage and leaks.
- 2) Ensure the hoses are connected and secured to the cylinders and the connections are leak free.
- 3) FM Section 4 Standard Procedures, item 4.5.2 "Rigging the basket and burner", page 4/4 (as part of the standard procedures for preparing the aerostat balloon for flight) includes the phrase " Check that all fuel lines are in good condition, and then connect them to the cylinders, the vapor feeds (where fitted) to the regulators, and the liquid feeds to the main valves."

The Flight guide, in its item 4.8.2.1 states that the balloon captain must warn the passengers through the briefing, to avoid holding the fuel hoses

B. 100 hrs Check (Annual check):

The Flight guide requires the maintenance engineers to do the following:

“Check the condition of hoses and connectors; ensure there are no cuts or damages”.

C. Preventive Maintenance:

The maintenance Manual in article 4.3.10.6, requires performing preventive maintenance as follows "**checking the condition of the fuel hoses. Look for any signs of abrasion, kinking, or other forms of damage. If any of the above are detected, the hose must be replaced in accordance with the instructions in section 4.3.11.4. Fuel hoses must be obtained from Ultramagic**

D. Storing:

. Preventive Maintenance:

The maintenance guide, requires that the hoses should be stored in a dry place far from dust.

4. Wreckage inspection for hoses:

Through its technical examination, the hoses were inspected immediately after the accident according to item 1.12.1 (2-4)

5. Hoses history tracking:

The manufacturer was asked about the hoses that were still holding the part Numbers while performing the second examination (with the participation of the manufacturer) (item 1). The manufacturer stated that the hoses are produced by BINSÁ Company (Spanish), they were delivered to Ultramagic company according to the following schedule:

- A. The BINSÁ company delivered 66 hose of the part number PV0500178 to Ultramagic company on January 2005 (Exhibit # 8 including hoses information)
- B. The BINSÁ company delivered 80 hose of the part number PV8015730 to Ultramagic company on April 2008 (Exhibit # 9 including hoses information))
- C. The Ultramagic company delivered 30 hose to “Egyptian Airship and Balloon” company on April 2008
- D. Based on the manufacturer’s invoices, it has been confirmed that in May 2005 it was sold to the operator Sky Cruise a complete balloon with quad MK21 burners and PV0500178/1 hoses, burners S/N 314 to 317 and basket C12/4.
- E. The first two figures in the P/N (the “05...”) of the hose batches made by BINSÁ indicate the year of manufacture.
- F. As stated by the manufacturer, he never supplied Sky Cruise hoses with P/N PV0500178/1, except for those installed on the balloon sold in May 2005.

1.18.6 Limitations and instructions for operating balloon in Luxor City applied by ECAA (Egyptian Civil Aviation Authority) the time of the accident:

A letter (number 5107) was issued by the ECAA chairman on 9 August, 2011 and directed to all the balloon companies operating in Luxor city. The letter included about 25 instructions for the purpose of enhancing level of safety and to be mandatory for all balloon operators

1.18.7 Safety bulletins issued by the manufacturer regarding balloons:

Airworthiness Directives & Service Bulletin Ultramagic Balloons

| AD NO | A D Issue date | SB No | SB date | Description | Applicable | N/A |
|--------|-------------------|--------------|----------------|--|------------|--------------------------------------|
| 03/99 | 14/10/99 | SB 1/99 | 26/08/1999 | Fisher M220M valve replacement in cylinders | | √ |
| 01/03 | 01/06/03 | SB1/03 | 26/3/2003 | Inspection of load tape loop attachment to flying wires | | √ |
| 01/10 | | SB 01/10 | 04/03/2010 | Inspection of lower frame of partitioned baskets | | √ |
| 01/11 | 07/7/2011 | SB 01/11 | | Inspection of burner frame after road transportation | | |
| 12-053 | | SB NO.12/ | 25-05- 2012 | Equipment / Furnishings – Female ACME Thread Hose -Connectors Inspection | Advisory | N/A for using TEMA coupling not REGO |

1.18.8 Pre Departure Check (Exhibit #10):

The Pre Departure list includes:

Section 6 –inspection Schedules included in the Flight/ Maintenance Manuals issued by “Ultramagic” company, 6.1 pre-Flight checks (A type), the balloon manufacturer, the section addressing the inspection of the burners and the fuel system as follows:

1. Check the burner, the valves and hoses for damage and leaks.

2. Ensure the hoses are connected and secure to the cylinders and that the connections are leak free.
3. Ensure that the cylinders are securely attached, free of damage and that there are no signs of leaks.
4. Check fuel pressure is in accordance with stated requirements.
5. Carry out burner functional check ensuring all valves open and close correctly.
6. Check that pilot light is burning correctly and is strong and not too noisy or too quiet.

1.18.9 Fuel approved for use in hot air balloons:

- Use of the Propane gas or the Butane gas, or mixture of both is approved by the manufacturer and ECAA

1.18.10 Flight Manual:

1.18.10.1 Emergency procedures included in the Flight Manual:

The Flight Manual issued by Ultramagic company, the manufacturer of the balloon included in Section 3, Emergency procedures, item 3-8 regarding case of Fire in the Air, included the following:

- Should a fire occur during flight then follow the instructions below in the order shown:
 1. Turn off the propane valve at the cylinder.
 2. Use the fire extinguisher on the source of the flame.
 3. Once the fire is extinguished, determine the location of the fire and correct it if possible.
 4. Use another burner / valve unit if necessary.
 5. Maintain control of the height of the balloon all times.
 6. Land as soon as possible.

Note:

In no section of the Flight Manual is described the operation of the balloon using a drop line rope), the PC (Part Catalogue) page A.2 includes information about two kinds of drop line (25 meter, 50 meter). In addition, the Flight Manual, page 4/4 point 4.11 states the use of handling line during landing.

1.18.10.2 Operation limitations:

- The flight manual, issued by Ultramagic Company, manufacturer of the balloon, chapter 2 included limits of use. Item 2.10 addressing deflation system included the following:
 - **WARNING:** It is forbidden to use the red rope of the FDS rapid deflation system at an altitude higher than 10 m (30 feet) above the ground
 - **CAUTION:** In flight use of the parachute vent system should be no longer than 3 seconds at any one time. Re use must not be attempted until the envelope as re-inflated.

1.18.10.3 Fuel utilization:

It was mentioned in part 2 of flight manual issued by Ultramagic company, balloon manufacturer, limitations of use item 5-2 concerning fuel;

The approved fuel is commercial propane which can contain some butane. Butane may also be used as long as the pressure is greater than 3 bars. This pressure can be achieved by pressurizing the cylinders with nitrogen.

WARNING:

Minimum dynamic pressure accepted for use with the burner is 3 bars.
Maximum authorized dynamic pressure allowed for use of the burner is 10 bars and the maximum cylinder pressure allowed for use of the burner is 12 bars.

1.18.11 Minutes of the coordination meeting between Luxor Airport/ Air Traffic Control/ and the balloon companies chairmen (CEO'S)”:

- On 27 August, 2008, a meeting was held to update the minutes of cooperation and coordination between the balloon companies in Luxor city and Luxor airport management/ Air Traffic Control tower. The balloon companies were strictly requested to follow the following procedures:
 1. All flights shall be west of the river Nile over the monuments area.
 2. Presenting the flight plan for each individual balloon 48 hrs (at least) before every balloon flight to secure air movements.
 3. Establishing telephone calls with the ATC (Air Traffic control), at least 30 minutes before take off to obtain the last meteorological report and clearance for take off.
 4. Establish radio communication with the ATC through VHF immediately after take off notifying about the actual timing for take off and the

remaining flight information (registration letter, pilot name, flight plan, height, crew number, passengers number).

5. Establish continuous communication during flight with ATC to follow up the weather condition, and immediate notification in case of crossing the river Nile, emergency landing for the balloon east of the river Nile or in case of facing emergency conditions for the balloon, e.g. adverse weather condition, deviation from flight plan or human injuries.
6. Ensuring validity of balloon airworthiness issued from ECAA (Egyptian Civil Aviation Authority), and the annual approval issued by Army Operation Department.
7. Avoiding balloon flight within the area of the airport and the air force base, in a circle of 10 km radius, in addition of the restricted, forbidden and dangerous areas.
8. Its is not allowed to have more than one balloon belonging to the same company simultaneously in the air to get easier control and balloon security, with the immediate notification to the control tower in case of incident or accident to the balloon or balloon vanishing behind the mountainous areas at the west side land, to promptly take the decisions for balloon search and rescue. If it is not possible to that through the balloon, the company operation must make this notification
9. Balloon height should not exceed 1500 ft.
10. All balloon companies are committed to make contracts with the metrological department to be able to obtain the metrological report at 1500 ft (according to ECAA relevant instructions). In case contracting is not made, this shall be considered as a violation, the ECAA must be notified.

The control tower was instructed to perform the following:

1. Restricting the violations made by the flying balloons at Luxor area by writing reports about these violations that takes place using the forms dedicated for that.
2. Committed to implement all the standard rules and technical regulations related to balloon operation and air traffic management.

3. Delivering the daily operation form to the Ministry operation center, and the ECAA operation department on the relevant form prepared for that purpose

1.18.12 Minutes of the coordination between Luxor airport and “Egyptian Airship and balloon” company:

- On 5 May, 2009, a Minute of the coordination between Luxor airport and “Egyptian Airship and balloon” company was issued. The agreement included the following:
 1. Adherence to the instructions included into the Flight manual, Arab Republic of Egypt
 2. Adherence to the military side instructions and standards, concerning the annual approval for experiencing the balloon activities for the company.
 3. Flying west of the river Nile over the monument ts areas
 4. An effective mean of communication via satellites or a mobile (in case of emergency) via must be available on board of the balloon to communicate with Luxor International Airport control tower in case of loosing communication on the frequency 118.1 Mega Hz.
 5. The company shall present the flight plan)registration letter, timing, height, departure site, flight plan, balloon pilot name, number of passengers) to the “common air center” and data base center at Luxor international airport, at least 48 hours before implementation, to secure the air movement
 6. Establishing telephone communication with Luxor international airport, Air Traffic Control Tower 30 minutes before performing the balloon flight to obtain the meteorological report and take off clearance.
 7. Establishing radio communication through the frequency 118.1 MHz with the control tower immediately after take off, to notify about the actual time for take off and the remaining flight information (registration letters, the pilot name, height, number of passengers, number of crew, working area)
 8. keeping continuous communication with the control tower to follow up the weather conditions and to make an immediate notification in case of crossing/ emergency landing east of the river Nile.

9. Notifying the tower and the balloon company operation department immediately in case of facing balloon emergency conditions or facing bad weather conditions or crossing the river Nile east or deviation from the working area, or emergency landing.
10. Commitment to present the flight clearance issued for the balloon by the ECAA.
11. It is not allowed to have more than one balloon in the air for the same company.
12. The maximum height for the balloon is 1500 ft.
13. GPS system should be available for use in case of emergency landing and notifying the tower through telephone number 09523762 or the airport switch 0952374655 ext 0 40136.

1.18.13 Remarks about the accident video clips:

- Several video clips that have been created for the accident by several witnesses were watched and studied by the investigation committee as follows:
 1. A private video clip for the accident since the beginning of collecting the tourist passengers until the take off. Video duration is 11 minutes, 17 seconds. The following has been observed:
 - The video clip did not include the installation of the balloon parts.
 - Appearance of the balloon started during cold inflation.
 - The basket appeared with the envelop installed on it in a horizontal position. The hoses were previously installed.
 - Appearance of the balloon captain with a view for the balloon behind it, the time it was about to be completely charged with air
 - Beginning of passengers boarding in the basket under the supervision of the balloon captain.



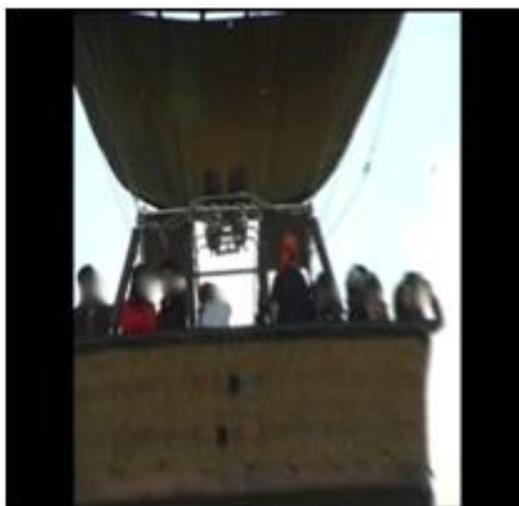
- Appearance of the worker leader the time he was completely engaged in preparing the balloon raising his hands towards the burners.
- The company ground crew workers while surrounding the balloon during boarding of the tourists in it.
- Heating of the balloon was made by an external bottle, through the right aft burner.
- The captain jumped in the balloon from the forward side towards the aft side.



- The captain lifted the hose connected to the aft burner.
- The captain made a briefing to the passengers about the landing position, they responded to him and made a simulation for the landing position.
- The English passenger (the only survivor passenger) was sitting to the right side of the balloon captain from the aft part of the basket. He looked relatively taller and stronger than the other passengers



- The wires attaching the envelop to the basket Appearance of the metallic cover above the basket and below the burners. It seemed to be in good condition.



- Appearance of the metallic cover above the basket and below the burners. It seemed to be in a good condition.
- The ignition in only two burners out of the four burners was visible (Left forward and aft)
- The Drop line appeared attached to the basket pulling rope with the car.



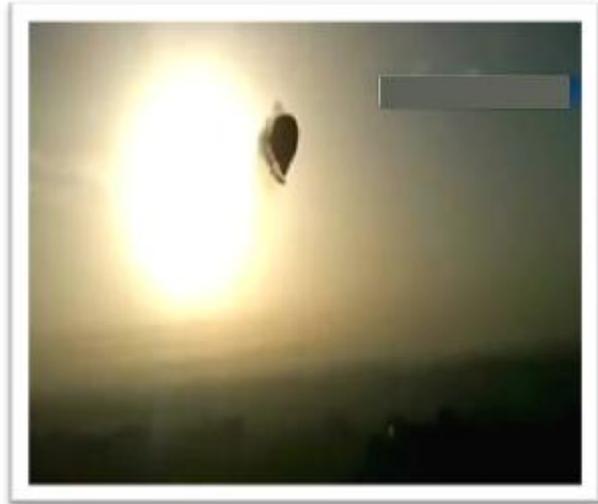
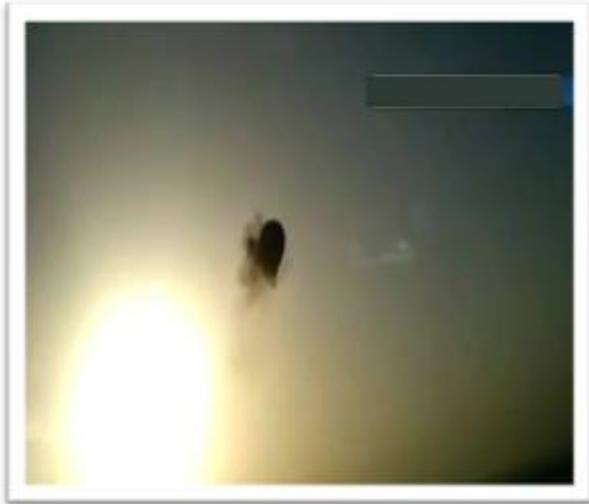
- Appearance of the four covers on the four hoses connected to the burners.

Remark:

The aft part of the balloon was identified through the connecting point with the car rope that is used to position the basket lower part on the ground instead of its side by pulling it.



- The position of the basket was confirmed through the position of the balloon captain during take off, and during briefing procedure to the passengers regarding the landing position before take off.
2. A video clip showing the last moments of the accident, since the appearance of the balloon until its impact with the ground. The video clip duration is one minute and 2 seconds. The following was observed:
- The sun rise is shown indicating the east direction



- The appearance of black smoke started at the left side of the balloon and the continued growing.
- The balloon height was increasing with smoke growing.
- The smoke was severely growing until both the envelop and the balloon totally changed to a heavy smoke flame.
- The balloon and its parts fell down on the ground



- Few meters before the fall, a flame appears from the lower side until the collision with the ground.

3. A video clip showing the last moments of the accident (in a more closer way with reference to the previous pre mentioned video in item 2)). The video clip duration is one minute and 25 seconds. The following was observed:

- Visible flame in the balloon basket



- Black smoke was rising from the left side of the balloon
- Smoke and flame was growing until they covered the left side of the balloon.
- Fall down of four objects, most probably these objects were some of the passengers
- Fall down of the balloon as a piece of close with black smoke ending with a red colored flame..
- The balloon continued falling down until the collision with the ground.

1.18.14 Examining the fire extinguisher:

The fire extinguisher for the event flight was examined, following has been noticed:

- The extinguisher contains chemical dry powder, with the capacity of 2 kg. it was totally burned

1.18.15 Operation Manual:

- The Operation Manual for Egyptian Airship and Balloon included definition for the duties and responsibilities (Chapter 3) as follows :

1.18.15.1 Duties and responsibilities of the Operation manager:

3.1 Operations manager:

The operations manager will be responsible for:

- A. Ensuring, that the flight and duty times of all air crew are within the mandatory limitations for public transport Flights carried out by the company.
- B. Keeping records of all public transport flight time and duty time of all air crew to ensure that mandatory limits are not exceeded.
- C. Making available an adequate supply of maps, charts, flight guides and other equipment
- D. Keeping a record and check of the validity of air crew. This does not absolve the individual of any responsibility in keeping his own license and medical current.
- E. Liaison with the emergency company responsible for the balloon maintenance on matters concerning airworthiness, maintenance and certification.
- F. Supervising the training & qualification of ground crew, chief ground crew & retrieve.

1.18.15.2 Duties and responsibilities of the Operation Crew:

3.3 Operating crew:

- The minimum crew shall consist of one pilot.

If crew consist of more than one pilot, one pilot will be designated the captain the captain is responsible for briefing the passengers before and during flight. The captain will be responsible for the safe operation of the balloon throughout the flight. He will also be responsible for seeing that the balloon documents are correct and on board the balloon and that the technical log is checked and signed.

The captain is responsible for the correct loading of the balloon and for ensuring the sufficient fuel is carried for the intended flight.

1.18.15.3 Duties and responsibilities of the ground crew:

3.5 Ground crew:

Duties and responsibilities:

- The balloon will be prepared for flight and cold inflated under the supervision of the crew chief.
- A daily briefing is not required, although they will be advised of the number of the balloon to prepare and the location of any passenger who is to be collected.
- Their duties include
 1. Preparing all vehicles and inflation fans.
 2. Refueling.
 3. Pressurizing the fuel tanks.
 4. Assembling the balloon and checking that the fuel tanks are full and securely strapped and that the various sub-components are correctly orientated to each other before starting the fans for the cold inflation.
 5. Providing two met balloons.
 6. Assisting the pilot with the inflation of the balloon. For each balloon the minimum number of the crew is four, three are normally required for takeoff.
 7. After takeoff the crew will maintain visual contact with the balloon and will try to arrive at the landing area prior to touch down. There is no requirement for the crew to assist at the landing, but if available, they will follow the pilot's instructions.

(Accordingly, the ground crew may assist in the landing if required to do so by the captain as is in the case of the U.K. , there is no direct mention in the FM about using the drop line rope).

8. Removing the fuel tanks, disconnecting the various, components and packing the envelope and loading the balloon on the retrieve vehicle.
9. Returning with the balloon to the launch site or to the place where the balloon is stored.

1.18.16 Letter from the "Accredited representative from Spain".

The letter submitted from the "Accredited representative in Spain" dated 18 December, 2013 and directed to the "Head of the Central Directorate of Aircraft Accident Investigation" in response to the Accident Investigation Committee, is included in the report as Exhibit #11.

1.19 Useful or Effective Investigation Technology:

None

2 Analysis

Analysis:

All the analysis in this chapter is based on information included in the Factual Information Chapter.

Some of the information included in this chapter summarizes and add some highlights to the factual information.

2.1 Balloon captain:

A. summary and highlights on the most relevant factual information

- He was licensed for flying the balloon, qualified on the type, and medically fit.
- He has a total flying hours on the all types of balloons of 1012 hours, 55 minutes.
- He was approved to carry out the Pre. Departures Check, PDC on the event balloon.
- He signed the PDC for the accident flight.
- He briefed the passengers about the landing position, the passengers responded for his instructions.
- He used the left forward and aft cylinders for the first 35 minutes until consuming about $\frac{3}{4}$ of the quantity of two cylinders, then he started using the right side cylinders.
- He started the landing procedure, and selected a suitable site where the balloon can land on it.
- He did not smell any gas smell, he did hear any explosion sound.
- He turned towards the aft side of the basket (towards the ground crew personnel) and dropped the “drop line rope”
- He was subjected to sudden flame of fire originating from the forward side of the balloon, the fire was fixed and coming from one direction, the fire intensity increased after that.

- He was injured by the fire. The fire caused several burns at his left side. The hospital receiving the captain after the accident estimated his burns as 70 % including the three levels of burns. As a result he was shocked and consequently he lost control on the balloon.
- He jumped from his side to the aft right side of the basket, and then he jumped to the ground.

B. Based on above information, following could be concluded:

- The captain was eligible to assume all his responsibilities including flying the event balloon (regarding training, qualification, experience and medical aspects).
- He was eligible to sign the PDC. He carried out the PDC on the event balloon before departure and signed the relevant PDC form indicating that he completed this procedure. He mentioned that, the hoses connections to the burner's area are higher in level than the normal vision scope resulting in difficulty for inspecting the hoses.
- His decision regarding landing location was consistent with the flying limitations
- He was badly injured by the fire; as a result he was not able to control the balloon or even to control himself.

2.2 Company maintenance engineer (performing also as company maintenance manager)

A. summary and highlights on the most relevant factual information

- He was licensed as balloon maintenance engineer, and approved as the company maintenance engineer by ECAA (Egyptian civil aviation authority)
- He carried out the 100 hours inspection on the balloon (annual inspection).

B. Based on above information, following could be concluded:

- He was eligible to assume all his responsibilities as maintenance engineer and maintenance manager.
- The balloon maintenance procedures were carried out as per the maintenance manual standards and procedures. The company maintenance manual was approved by ECAA. No Entries in the log book concerning the Annual/100-Hour Inspection regarding the S/N's on two of the burners

2.3 Company operations manager:

He was licensed as operations manager by ECAA (Egyptian civil aviation authority)

2.4 Ground crew:

A. summary and highlights on the most relevant factual information

- The ground crew prepared the balloon at the company store and then moved it to the take off site. Ground crew leader performed a hot inflation using an external cylinder. He also tested the “pilot light” before presenting the balloon to the balloon captain (This was shown in one of the recorded video clips, reference 1.18.13)
- The ground crew held the drop line rope after being dropped by the balloon captain for the purpose of helping landing of the basket on the site that been selected by the captain for landing, far from the sugar cane fields, but they could not do that.
- Some persons were busy in rescuing the balloon captain after jumping from the balloon.

B. Based on above information, following could be concluded:

- Balloon climb rate increased as a result of :
 - Effect of the severe fire leading to higher temperature, and consequently higher lift.
 - Balloon weight has been reduced (2 persons, captain & one passenger jumped from the balloon)
 - The ground crew was adversely distracted by the balloon fire at the moment of the accident.

The above factors would explain reasons why the ground crew was unable to keep holding the balloon.

2.5 Balloon:

A. summary and highlights on the most relevant factual information

- The balloon was registered within the Egyptian records and carries airworthiness certificate and flight approval valid at the time of the accident.
- It took off with a weight within allowed limitations

- The balloon wreckage parts were approved as original parts from the manufacturer.

B. Based on above information, following could be concluded:

- The balloon was Airworthy,
- The balloon was operated within standards and limitations in accordance with company operation manual approved by ECAA.

2.5.1 Cylinders

A. summary and highlights on the most relevant factual information

- Five fuel cylinders were identified. Four of them were used on the event flight , the remainder was used to heat the balloon before take off
- It was not possible to find any cylinders identification labels as a result of the aluminum rivets melting that were fixing all the cylinders
- Usage of the butane or propane gas or a mixture of them is allowed by the manufacture
- The gas used for the event flight cylinders was a mixture of propane and butane gases (commercially name is Buta gas)
- All the cylinders that were used during the accident flight are less then 10 years life (since production), therefore, they were not subjected to revalidation procedures, for their extended serviceably allowed by the manufacturer.
- Starting from the date 29 July, 2008, all balloon companies are committed by the ECAA (Egyptian civil aviation authority) to fill the cylinders at the approved organizations. and not to fill them in the companies stores to enhance safety procedures.

B. Based on above information, following could be concluded:

- Most probably, two cylinders on the left side were used for about 35 minutes, until consuming $\frac{3}{4}$ of the quantity for each of them, as a source of fuel, then the two remaining after cylinder (right ones) were used for almost five minutes until the accident.

- One of the bottles on the right side has exploded as a result of the accident. The explosions took place because of the gas high press. (from inside to outside), this is related to the temperature increase resulted from the fire and falling on its upper part resulting in its separation from the balloon), the separation was far from the cylinder welding lines.

- It is highly not reasonable that the leak could have originated at the hose side connecting to the cylinders, for the following considerations:
 - In case of the separation between the hose and cylinder TEMA, the non return valve in the cylinder (as a safety feature) will prevent the gas from leaking outside

 - The connection between the hose and cylinder TEMA needs two movements to separate them from the cylinder, this makes it harder regarding the probability of inadvertent separation.

 - In case of any defect in the cylinder valves causing gas leak, the leaking gas will be nitrogen and not the gas used for ignition (fuel itself)

- Most probably, the fourth cylinder connected to the burner number 193 was the source of the fire. The cylinder that exploded as a result of the accident is the cylinder that is connected to the right aft burner.

- The handling of the cylinders, before the flight, through the whole flight was consistent with relevant standards and regulations

2.5.2 Burners :

A. summary and highlights on the most relevant factual information

- The balloon four burners for the accident event were found connected to their metallic frames
- Three of the four burners (one of them is 191, the other two were not identified as the serial numbers were not sculptured on them) were connected to there hoses
- The hose connected to the burner 193 was separated, whilst the connector was attached with it.

The hose union nut was found connected to the burner and the hose was separated from the hose swaged on sleeve. The sleeve was found loose about the axial axis

B. Based on above information, following could be concluded:

- The side of the frame, where the burners were fixed, was identified as an aft side. This conclusion was reached through the observation of the three karabiners, connecting the rope that is used by the car for pulling the basket.
- The sequence of the burners in the balloon wrecker was deduced as follows:-
 - Forward direction: on the right burners number 193 and on the left side another burner with unknown serial number
 - Aft direction: on the right side with unknown serial number another left side the burner number 191.

- The visual condition for the four burners shows that they were in good condition and there were no defect in them
- The burners no 193 was subjected to most highest direct heat with comparison with the other burners, this was indicated by the following:
 - Partial melting of the Cow burner valves handle.
 - Hose separation from its end fitting connected to the burner.
- No defects were noticed in the cow burners valves for the burners (burner 191, and the two other burners with unknown serial numbers)
- Since the numbers of burners 190 and 192 are within the approximate batch production number 200, therefore we could assume that these burners' serial numbers were placed in the lower area that was totally burned and lost in the fire, meanwhile the burner in question (193) S/N has been identified.

2.5.3 Hoses:

- A. summary and highlights on the most relevant factual information
- The four hoses life time were less than 10 years.
 - The manufacturer part number is recorded on one side of the hose. It is sculptured on the metal of the hose connection with the burner or the connection with the TEMA. There are no serial numbers for the hoses.
- B. Based on above information, following could be concluded:
- The external rubber material for the four hoses were burned except for some limited areas, the metallic wire layer was visible.
 - The lengths and cross section diameters were not similar in dimensions because of the following:
 - Two types of hoses were used (lengths 2.5 meter and 3.0 meter)

- The hoses were subjected to burning
- The hoses were subjected to drawing (pulling) forces during the fall and rescue operations
- The separation of the hose connected to burner number 193 from its relevant connector at the burner side was the result of the burning of the inner and outer rubber layers. It is not easy for the hoses to separate from the connection between it and the burner under normal conditions. This can be explained by the existence of teeth pressing on the rubber and the reinforcing metallic wire preventing that.
- No evidences of cracks at any metallic nut in the hose connection with the burners were noticed. This excludes the idea that they might be the source of leakage.
- The probable reason for the fracture in the hose connection with the cylinder TEMA related to the burner number 191, was the fall of the wreckage as a result of the accident causing shear stress, breaking the connection.
- It was noticed that the weakest area in the hose (that might be subjected to cracks allowing gas leaking) are the hose positions before being connected to the connector attaching it to the burner, that is subject to bending, heat and the environmental factors.
- The manufacturer did not announce for definite working hours or definite working time (since the beginning of utilization of the hose) to discard it. The manufacturer recommended checking the hose condition through the checks that are performed on the balloon.

2.6 Maintenance works:

The following can be concluded:

It was observed that, upon recording the maintenance works, on the burners, the engineer in charge sometimes uses the serial number for reference and sometimes he uses their positions for reference, without recording the full maintenance procedures including the Part Numbers or the Serial numbers. The maintenance procedures related to hoses were also recorded without referring to the Part Number.

2.7 Weather Conditions:

- The weather conditions were suitable, allowing for the balloon flight. There were no abnormal phenomena or conditions. It can be concluded that the accident is not related to weather.
- The balloon captains are normally informed about the meteorological report before take off from the Luxor airport take off area and not from the balloon take off area.

2.8 Communication:

- The balloon captain did not perform any communication action with Luxor control tower concerning the accident flight either before the beginning of the flight or through the flight.
- The ATC controller in charge was informed about the accident by Luxor operations responsible after the accident.

2.9 Airports Company:

- The airports company supervises the balloon departures at the balloon departure (take off) site according to the instructions of the ECAA (Egyptian Civil Aviation Authority)
- The performance of the crew allocated by Luxor airport management to manage the balloon area the day of the accident was conforming with:
 - The ECAA instructions concerning the management of the departure area and the follow up of the balloon flights, directed to the Egyptian company for airports 09 August, 2011.
 - Job description included in balloon take off site organization instructions dated 2 December, 2009

2.10 Egyptian Civil Aviation Authority ECAA:

- The ECAA issued its first regulations concerning the balloons on 1996. Updating was made to these regulations since that date up to May 2012 (the amendment that was valid the time of the accident).
- The ECAA issued on 9 August, 2011 the standards and instructions regarding the balloon operation.
- The ECAA performed an audit on the balloon company operator on 14-16 February, 2013 for the purpose of renewal of Air Operator Certificate (AOC)

2.11 Organizational factors (for the operating company):

Balloon company documents were conforming with ECAA requirements and regulations.

2.12 The accident flight:

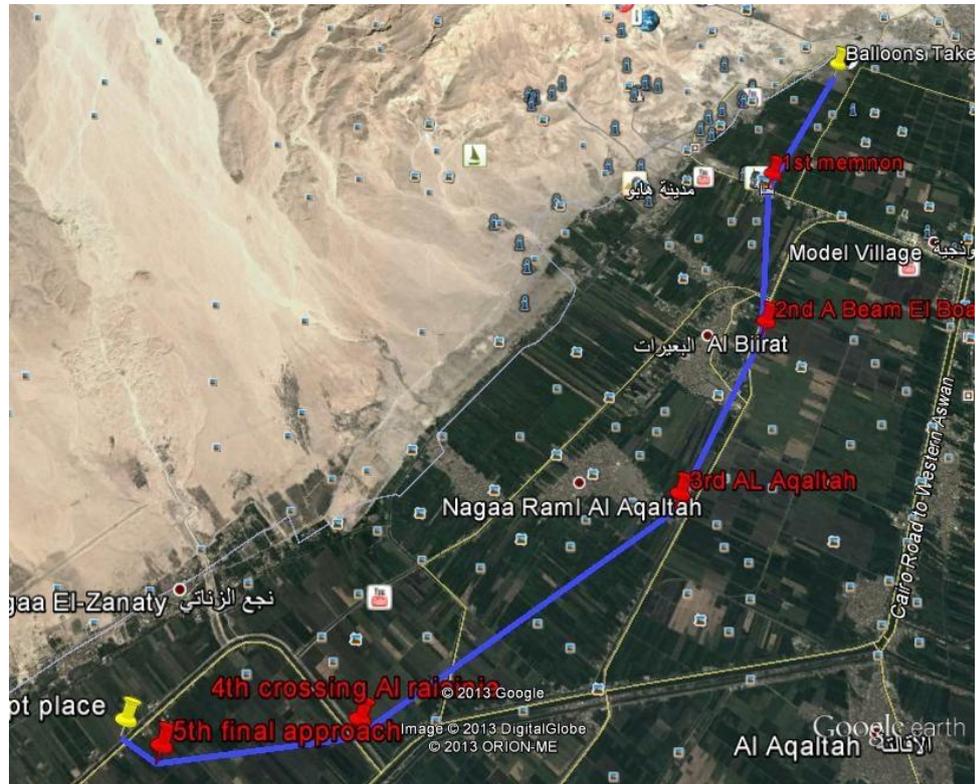


Photo showing the estimated flight path of the accident flight

- The balloon took off in a normal way from the area assigned for departure.
- The balloon continued flying normally for about 35 minutes.
- The balloon captain selected an open area for landing the balloon
- The distance between the take off site and the first landing attempt site is about 8.27 km. Considering that the flight, including the beginning of the landing procedures by the captain took about 40 minutes, the average balloon speed was about 12.4 km/ hr.
- Communication was made between the balloon captain and the ground crew leader to inform him about the selected location for landing the balloon.
- The balloon captain crossed the electric wires and then the water canal, directing the balloon to the selected site for landing
- The balloon captain dropped the “Drop line” rope to the ground crew.

- The ground crew picked the “Drop line” rope to draw the balloon and trying not to land the balloon into the sugar cane fields.
- The balloon continued approaching the sugar cane fields while the ground crew was still holding the “Drop line” rope
- The captain asked the ground crew to pull the balloon far from the sugar cane fields so as he can land the passengers safely and preserve the envelop in good condition when it is deflated and protect it against being damaged.
- At that time, fire flame was originated, at the upper portion of the forward right hose resulting in a direct injury to the balloon captain.
- The captain jumped to ground under the effect of the shock, passing through the right aft part of the basket where the English passenger was sitting (the only survivor from the accident among passengers).
- After that, the English passenger jumped from the balloon basket.
- The fire continued growing up resulting in increasing the lifting force. In addition, the basket weight decreased as, two of the passengers left it by jumping on ground.
- The ground crew tried to continue drawing the balloon far from the sugar cane fields, they could not manage to do that.
- One of the passengers jumped from the balloon on the ground, however, he was still alive, but he passed away after reaching the hospital.
- The balloon continued climbing without control, the passengers continued jumping on the sugar cane fields.
- The fire continued growing up at the balloon and its parts, until it was not able to carry the basket, it fell down in the wreckage site

2.13 Probable scenarios for the fire event:

- A hose fuel leak causing fire at the upper portion of the forward right hose connected to burner number 193 (ignition was brought by the heat

source from the burner). Then the fire was intensified due to enlarging fuel leakage area.

- The investigation committee could not rule out two probable causes for the fire event as follows:
 - Failure in the hose at the upper portion.
 - Separation of the hose from its end fitting at of the upper portion of the hose connection attachment with the burner number 193.

The metallurgical report does not support the second scenario making this occurrence probability highly remote.

3. Probable causes of the accident

3.1 Probable causes of the accident:

The probable cause for the accident as seen by the investigation committee is due to a hose fuel leak at the upper portion of the forward right hose connected to burner number 193 capturing its ignition source from burner's fire causing a fire that caused a major and direct injury to the balloon captain.

3.2 Contributing factors:

- Maintenance actions that were carried out on the hoses could not indicate the need to replace the hose that was the cause of the accident.
- The P/N of the hose connected to burner 193 was for a hose made in 2005 and therefore, it has accumulated high flight hours and sometimes under adverse conditions. This service life and conditions increase the likelihood that the hose experienced weaknesses/defects, that could have contribute to the gas leak.

4. SAFETY RECOMMENDATIONS

4. SAFETY RECOMMENDATIONS:

The accident investigation committee recommends the following:

4.1 Recommendations to ECAA (Egyptian Civil Aviation Authority):

- 1.** Consider reviewing the approved maintenance program for inspecting and maintaining the balloon hoses, including reviewing maintenance time intervals, maintenance actions, maintenance/inspection details etc (as applicable), for the purpose of enhancing capability of early detection of hoses potential failures.
- 2.** In light of the fact that landing with the help of a drop line rope seems commonplace in the operation of large balloons, and that this practice is not included as a standard procedure in the flight manual, *it is recommended that the ECAA either oversee the regulation and approval of drop line rope operations or forbid their use during routine operations with large balloons.*
- 3.** Issue instructions for balloon operators to strictly adhere to accurate technical log book data entries
- 4.** Issue necessary instructions to balloon companies to assure informing passengers when they reserve their flights that this kind of sports includes some degree of risk and for the purpose of adventure, in order that passengers would make there decisions from the beginning.

4.2 Recommendations to balloon manufacturer and its certifying authority:

- 1.** Consider setting a life time, or working hours for the hoses, at which the hoses must be replaced, and not relating the hoses replacement to the operator view.
- 2.** In light of the fact that landing with the help of a drop line rope seems commonplace in the operation of large balloons, and that this practice is not included as a standard procedure in the flight manual, it is recommended that the Certifying Authority and the manufacturer consider regulating its inclusion so as to standardize every aspect of this operation.
- 3.** Consider the revision of fuel system component serial number placement in a way, that would avoid loss under different conditions and to ensure proper tracing.

4. Reconsider the requirement to clearly define the details of steps and checks to be carried out during both preparation for flight and PDC clearly, defining duties and responsibilities of all concerned individuals, to ensure that all the checks are carried out to achieve safety requirements.

Exhibits

Exhibit #1

List of the cylindered owned by “Egyptian Airship and Balloon”
Company

Exhibit #1

List of the cylindered owned by "Egyptian Airship and Balloon" Company

Life Limit Items

| NO | Description | P/NO | S/NO | Validity | Test | Due at |
|----|---------------|-------|---------------|----------|--|--------------|
| 1 | Fuel cylinder | | UM-0039 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 2 | Fuel cylinder | | UM-0038 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 3 | Fuel cylinder | | UM-0100 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 4 | Fuel cylinder | | UM-0006 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/3/2017 |
| 5 | Fuel cylinder | | UM-0034 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 6 | Fuel cylinder | | UM-20050005 ✓ | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 27/4/2015 |
| 7 | Fuel cylinder | | UM-20050006 ✓ | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 27/4/2015 |
| 8 | Fuel cylinder | | UM-20050007 ✓ | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 27/4/2015 |
| 9 | Fuel cylinder | | UM-20050009 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 27/4/2015 |
| 10 | Fuel cylinder | | UM-20030013 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 26/6/2013 |
| 11 | Fuel cylinder | | UM-20050010 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 27/4/2015 |
| 12 | Fuel cylinder | | UM-20050090 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |

شركة ساقية صالح بالاسكندرية
 رقم الترخيص: 0090
 م.م. 0090

| | | | | | | |
|----|---------------|--------|---|----------|--|--|
| 13 | Fuel cylinder | | UM-20010206 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 1/2011 تم تجديد شم تم تكييفه ولا يعمل |
| 14 | Fuel cylinder | | UM-77 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 1/2011 |
| 15 | Fuel cylinder | | UM-0035 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | تم تكييفه ولا يعمل to 30/6/2015 |
| 16 | Fuel cylinder | | UM-0036 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 17 | Fuel cylinder | | UM-0037 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 30/6/2015 |
| 18 | Fuel cylinder | | UM-20030087 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | from 26/6/2003 to 26/6/2013 |
| 19 | Fuel cylinder | | UM-20030088 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | from 26/6/2003 to 26/6/2013 |
| 20 | Fuel cylinder | CB2903 | 00124 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 7/2015 |
| 21 | Fuel cylinder | | 00134 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 8/2015 |
| 22 | Fuel cylinder | | 00121 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 7/2015 |
| 24 | Fuel cylinder | | 0133 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | To 8/2015 |
| 25 | Fuel cylinder | | 33306896 تم تجديد شم تم تكييفه ولا يعمل | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 12/2011 and test done |
| 26 | Fuel cylinder | | 33306898 | 10 years | Hydraulic proof test must be carried out first after 10 years then every 5 years | to 12/2011 |

| | | | | | | |
|----|---------------|-----|-----|----------|---|--|
| 27 | Fuel cylinder | V40 | 557 | 10 years | carried out first after 10 years then every 5 years Hydraulic proof test must be carried out first after 10 years then every 5 years | and test done to 10/2012 and Test Done |
|----|---------------|-----|-----|----------|---|--|

شركة
إيجيبتيان إنترنيشنال كوربوريشن
شركة سلامة ربة بالأقصر

Exhibit #2

Technical Log details for the event balloon

Exhibit #3
Minutes of meeting (Hot Air Balloon SU-283, Ultramagic N-245 type
Accident)

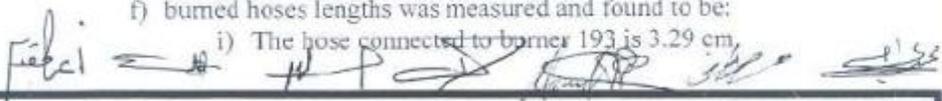
| | | |
|--|---|--|
| <p>ARAB REPUBLIC OF EGYPT MINISTRY OF CIVIL AVIATION GENERAL DIRECTORATE OF AIRCRAFT <u>ACCIDENT INVESTIGATION</u></p> |  | <p>جمهورية مصر العربية وزارة الطيران المدني الإدارة المركزية للحوادث</p> |
| <p>Minutes OF Meeting Hot Air Balloon SU-283, Ultra magic N-425 type Accident on Feb 26, 2013</p> | | |
| <p>1. on Mar 11&12,2013 at Luxor airport , Luxor , Egypt a meeting held between:</p> <ul style="list-style-type: none">a) Mr./ [REDACTED], Investigator , representing state of spainb) Mr./ [REDACTED], General manager, representing the Ultramagic Company.c) Capt./ [REDACTED], Chief of AAI Department & chief of the investigation committee.d) Eng./ [REDACTED], investigation committee member and .e) Eng./ [REDACTED], investigation committee member.f) Eng./ [REDACTED], investigation committee member.g) Mr./ [REDACTED], investigation committee member. | | |
| <p>2. the attendants Examined the wreckage of the balloon and re-assemble parts (cylinders – hoses - burners) together from the available wreckage parts and the following was noticed:</p> <ul style="list-style-type: none">a) All the parts seem to be from Ultramagic Company.b) Burners with serials 193 & 191 were recognized while the other two burner's serial numbers were not noticed.c) Hose connector that corresponds to burner 193 is different in shape from the other three connectors fixed on the other burners.d) We measured the connector head external dimension attached to the burners and found to be 194mm , 223mm, 225mm,220mm (with 194mm corresponds to burner 193).e) Burner 193 hose was de-attached from burner side while the other hoses were de-attached from the cylinder side.f) burned hoses lengths was measured and found to be:<ul style="list-style-type: none">i) The hose connected to burner 193 is 3.29 cm | | |
| <p><i>Fabci</i> </p> | | |
| <p>وزارة الطيران المدني - طريق مطار القاهرة الدولي ت: (02) 22688371 - تلفكس: (02) 22671888 CAIRO INTL AIRPORT ROAD. CAIRO. EGYPT - TEL (02) 22688371 . TELEFAX: (02) 22672888 EMAIL: diraaai@civilaviation.gov.eg</p> | | |
| <p>page 1 of 2</p> | | |

Exhibit #3

Minutes of meeting (Hot Air Balloon SU-283, Ultramagic N-245 type Accident)

ARAB REPUBLIC OF EGYPT
MINISTRY OF CIVIL AVIATION
CENTRAL DIRECTORATE OF AIRCRAFT
ACCIDENT INVESTIGATION



جمهورية مصر العربية
وزارة الطيران المدني
الإدارة المركزية للحوادث

- ii) The hose connected to burner 191 is 2.89 cm.
 - iii) Another hose of length 3.09 cm.
 - iv) Another hose of length 3.36 cm.
 - g) The handle of the cow burner valve attached to burner 193 was found melted.
 - h) One cylinder was found destroyed and the cuts were observed away from the welded parts of the cylinder and the position of the arm of the main valve showed freedom for slight movement and it was toward the closed position.
 - i) All cylinder identification plates were missing leaving the marks of six holes on the top protection crown of the cylinders.
 - j) The part number of the hose related to burner 193 and found to be: PV0500178/1 (corresponding to BINS A, 2005 as informed by the manufacturer representative).
 - k) The part number corresponding to hose 191 is PV8015730/01 (corresponding to BINS A, 2008 as informed by the manufacturer representative).
 - l) Tema attached to cylinder corresponding to burner 193 is holding a part number TEMA 3810 MADE IN SWEDEN.
 - m) The other three Tema are not attached to the other cylinders.
 - n) Visual inspection of hoses suggest no cracks on any metal net of the hoses but the external rubber not exist except to very small parts.
3. At the company we observed seven new hoses provided from Ultramagic Company on February 2012.
4. At the company storage we noticed the following:
- a) Simulation for the process of nitrogen pressurization was observed and it seems to be ok.
 - b) About 10 cylinders from Ultramagic Company were observed where the fixed identification plates found fixed with aluminum rivets on the cylinder crown and few of them found welded on the cylinder.

إعتراف

وزارة الطيران المدني - طريق مطار القاهرة الدولي ت: (02) 22688371 - تليفاكس: (02) 22672888
CAIRO INT'L AIRPORT ROAD. CAIRO. EGYPT - TEL (02) 22688371 . TELEFAX: (02) 22672888
EMAIL: direcai@civilaviation.gov.eg

page 2 of 2

Exhibit #4
CMRDI report

Exhibit #4
CMRDI report



CENTRAL METALLURGICAL RESEARCH
AND DEVELOPMENT INSTITUTE,

**Report on
Material Investigations
Of crashed hot air balloon (SU-283)
near Luxor on Feb.26th,2013**

**The report is submitted to
Central directorate of aircraft accident investigation**

Introduction

A balloon model Ultra Magic N425 was flying on Feb. 26, 2013, on a regular touristic trip at Luxor, Egypt. During the trip, the balloon caught fire, failed and crashed on the ground.

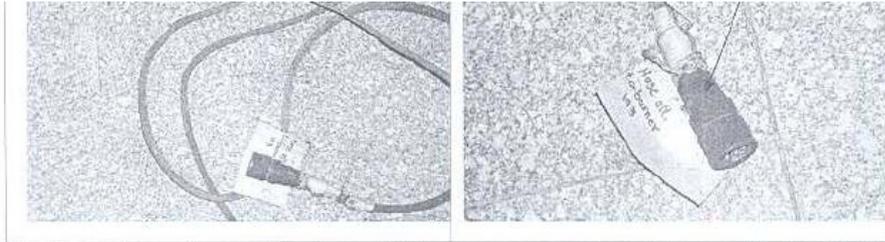
Materials under investigation

A technical visit of a representative research team from CMRDI of Egypt was executed on March 8, 2013 to have a look on the wreckage samples of the balloon. The following parts were supplied by the Central Directorate of Aircraft Accident Investigation.

| # | Item |
|----|--|
| 1 | Hose attached to burner (193) with TEMA connector (fast link with cylinder) |
| 2 | Connector to burner (193) "connecting hose to burner 193" |
| 3 | Cow burner vlv. attached to burner (193) |
| 4 | Hose attached to burner (191) |
| 5 | Cow vlv. attached to burner (191) |
| 6 | Hose of one of the two unidentified burner serial number (left front side) |
| 7 | Cow vlv. of one of the two unidentified burner serial number (left front side) |
| 8 | Hose of one of the two unidentified burner serial number (right rear side) |
| 9 | Cow vlv. of one of the two unidentified burner serial number (right rear side) |
| 10 | Wreckage of one of the cylinders |

1

P.O.Box: 87 Helwan - Cairo - Egypt Tel.: 25010642 - 25010643 Fax : 25010639 - 25011185
Info@cmrdi.sci.eg www.cmrtdi.sci.eg

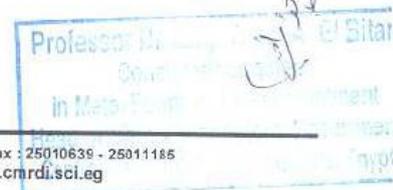


By visual inspection to the hose which was connected to burner 193, the TEMA was found connected to the hose.

The connector to the burner wasn't connected to the hose.

- It was found that the hose lost totally the outer rubber layer as a result of a fire exposure.
- The hose contains different diameter areas as a result of a pulling force of fragments. The hose diameter was found deformed and varies between 13 mm to 6.8 mm.
- The hose was expanded due to pulling with its length measuring 323cm.

2



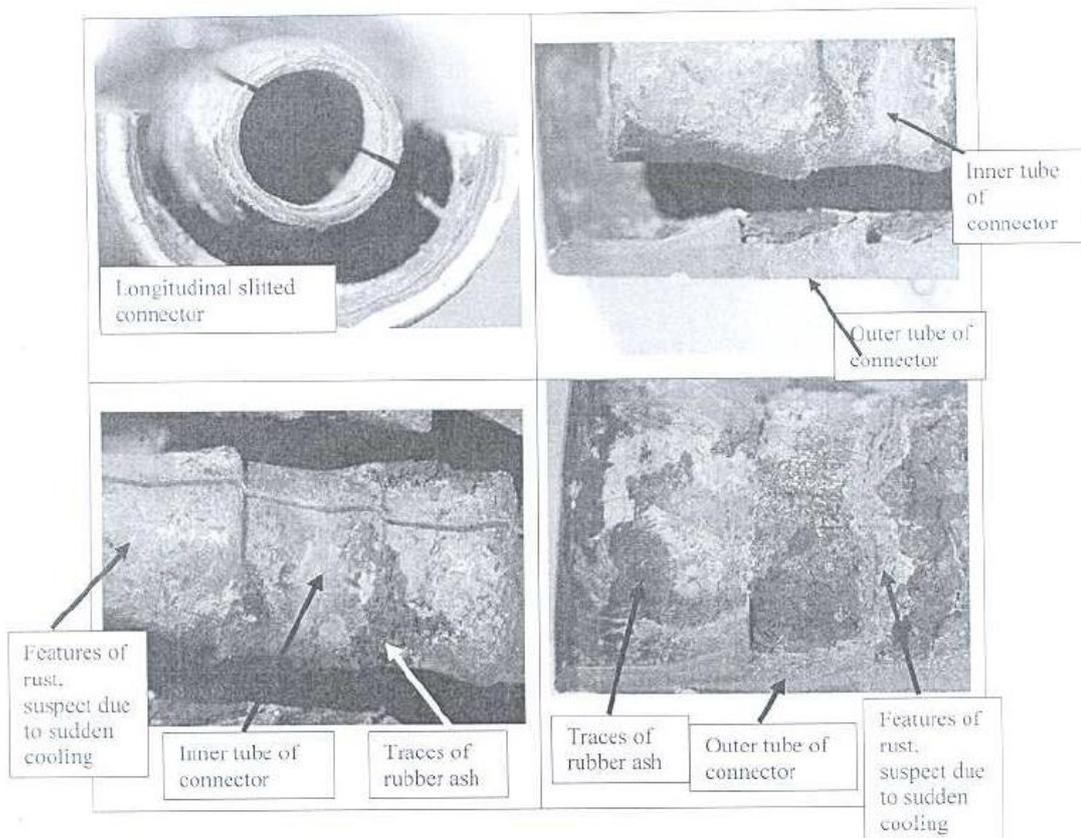
P.O.Box: 87 Helwan - Cairo - Egypt Tel.: 25010642 - 25010643 Fax : 25010639 - 25011185
Info@cmrdi.sci.eg www.cmrdsi.sci.eg



Item #2: Connector to burner (193)

Connector to burner 193 was found unconnected to its hose.
The connector is extensively investigated by slitting into longitudinal cross section by wire cutting to avoid contamination of the inner contents.

The following photos shows the details of the connector to burner 193 (item #2)



3





**CENTRAL METALLURGICAL RESEARCH
AND DEVELOPMENT INSTITUTE,**

- The inner as well as the outer tube of the connector were found containing traces of rubber ash.
- The surfaces of the inner as well as the outer tube of connector were covered with rust, suspect as a result of sudden cooling with water.
- The traces of rubber ashes suggest that connector was subjected to extensive fire that burned rubber inside connector.
- It was observed that longitudinal cross section indicates teeth that is supposed to bite the hose preventing it from separation under normal circumstances.
- A chemical analysis has been carried on the connector alloy. The chemical composition is stated in the following table:

| Element | C | Si < | Mn | P | S | Pb | Fe |
|---------|-------|-------|------|-------|------|------|-------|
| Wt., % | 0.084 | 0.001 | 1.18 | 0.064 | 0.27 | 0.45 | 97.88 |

Consequently, the connector material is a free cutting steel alloy, with material No.1.0718 & grade A9G-RV.

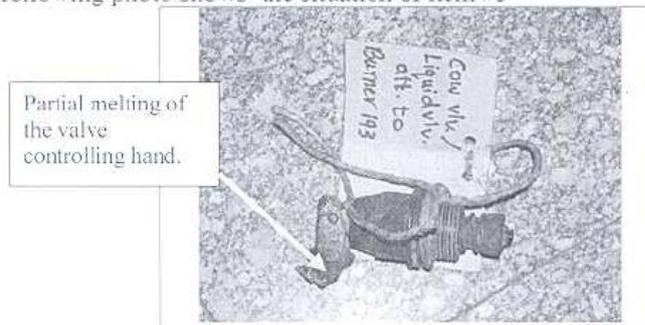
4





Item #3: Cow burner vlv. attached to burner (193)

The following photo shows the situation of item #3



The cow valve connected to burner 193 was found with partial melting of the valve controlling handle.

The cow valve was subjected to a direct fire, which caused partial melting of the valve controlling handle manufactured of Aluminum alloy - 6000 series (Magnesium Mg and Silicon Si are major alloying elements) AlSi1Mg0.5Mn with UNS. No. (A96351) alloy with an approximate 650 °C melting temperature. The following table represents the chemical composition for partial melted handle of controlling valve attached to burner 193 (item#3).

| Element | Si | Fe | Cu | Mn | Mg | Al |
|---------|-------|-------|-------|-------|-------|-------|
| Wt. % | 0.985 | 0.433 | 0.033 | 0.781 | 0.726 | 96.95 |

The mechanical properties of AlSi1Mg0.5Mn alloy on the annealed state are stated below:

| | |
|---------------------------------|-----|
| Tensile strength (MPa) | 160 |
| Yield strength (MPa) | 110 |
| Min. elongation at fracture (%) | 14 |
| Brinell hardness (HB) | 35 |

5





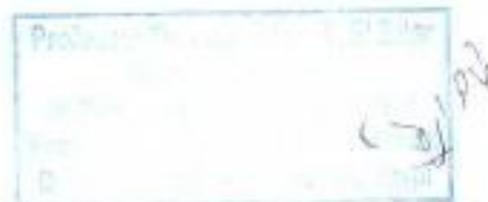
Item #4: Hose attached to burner (191) with its connector to the burner

By visual inspection to the hose connected to burner 191, the connector to the burner was found connected to its hose. The connector to the TEMA was found failed by a shear force, where a part of the connector was separated from the TEMA and the other part was connected to the hose as shown in the following photos.

| | | |
|------------------------------------|--|--|
| | | |
| <p>Hose attached to burner 191</p> | <p>A part of the connector was separated and connected to the TEMA</p> | <p>Features of a part of the connector which was separated and connected to the TEMA</p> |

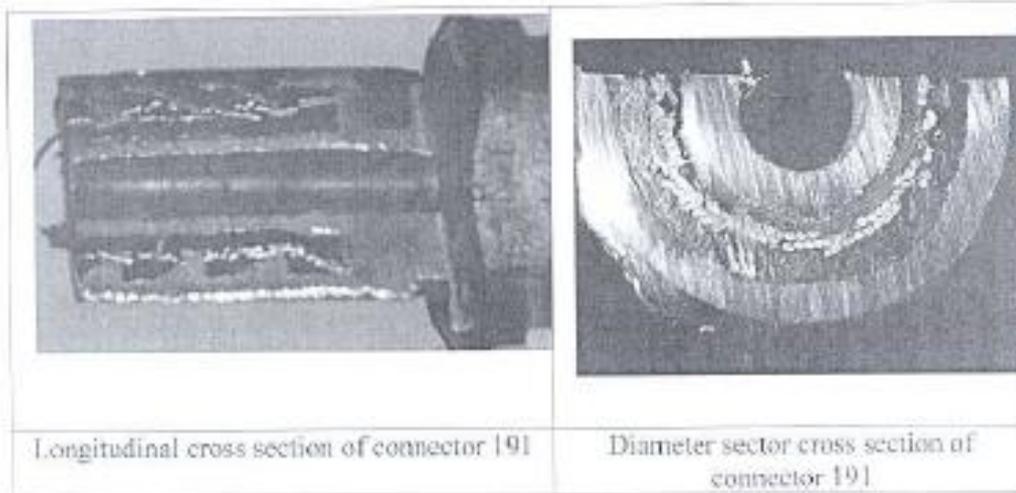
It was noticed that the hose contains two areas still covered with rubber. The rest of the hose was burned showing the internal fiber steel reinforcement with an average diameter 12 mm. The approximate length of the hose is 275 cm.

6

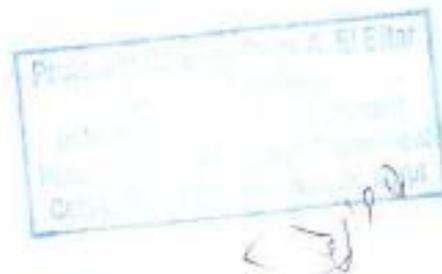


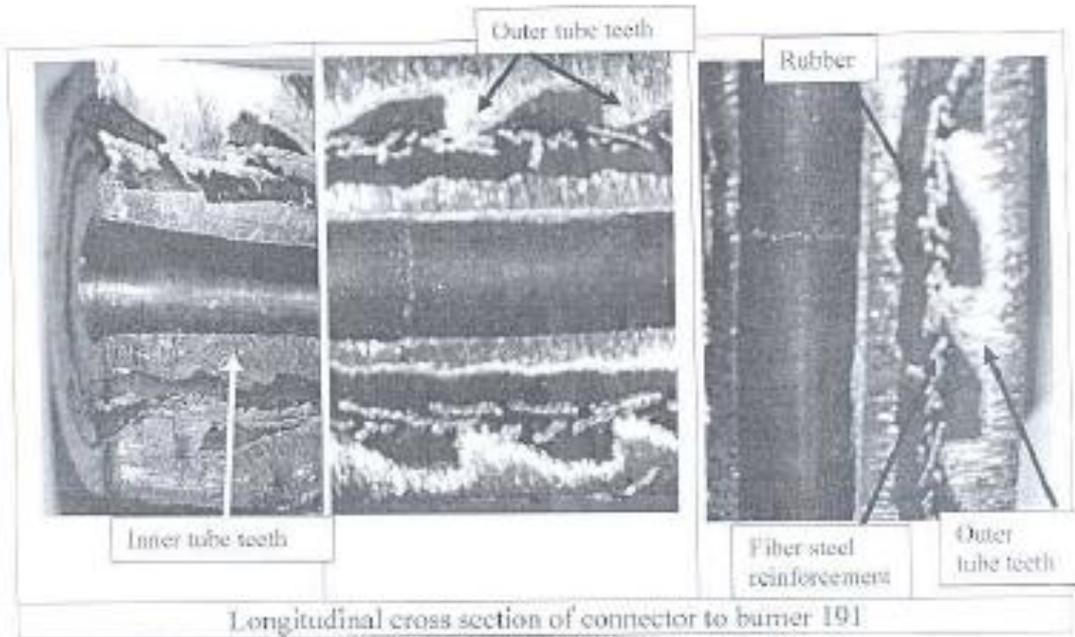


The following photos represent both longitudinal and diameter sector cross sections of connector to burner 191.



After longitudinal cutting of connector to burner 191, it was noticed that the inner as well as the outer tubes contains teeth that bite the rubber layer of the hose. Biting continues to the fiber steel reinforcement. The biting mechanism clearly shown in the following photos suggest it is a remote possibility that the hose could release from its connector under normal circumstances unless it is subjected to an external pulling force.





8





Item #5: Cow vlv. attached to burner (191)

The following photo shows the situation of item #5.



The cow valve attached to burner 191 was found in a right situation (undamaged).

Item #6: Hose of one of the two unidentified burner serial no. (left front side)

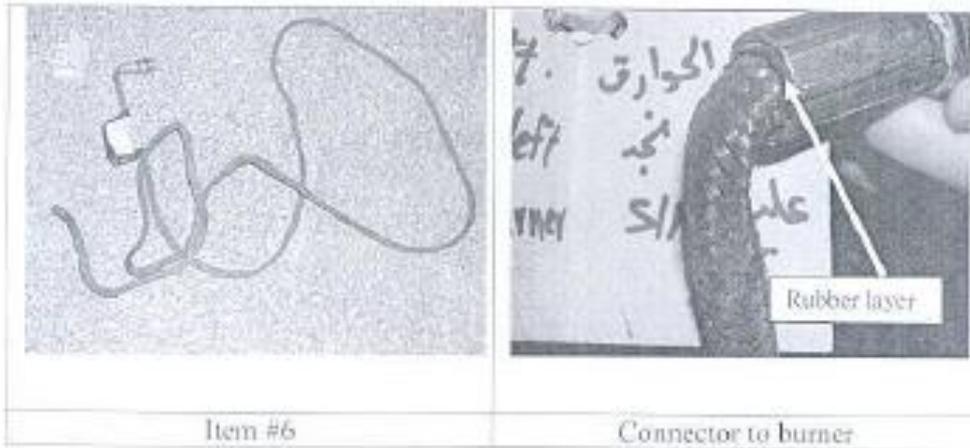
Item# 6 represents a hose attached to its connector. The connector was found containing the rubber hose between the outer & inner tubes.

The end of the hose was released from the connector to the TEMA. It is clear that hose was subjected to extensive fire where its approximate length 320 cm.

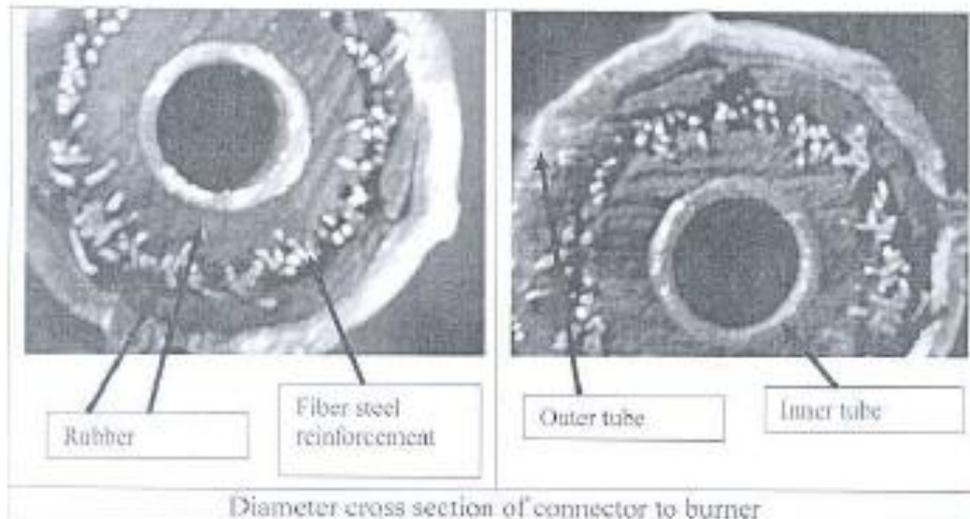
It is also noticed that there is great variety between the hose diameter (8.9 -12.7 mm) as a result of a pulling force.

The following photos describes the situation of item #6





The following photos show that the connector to burner contains rubber hose between the inner and outer tubes. The fiber steel reinforcement is clearly impeded in the rubber layer.





Item #7: Cow vlv. of one of the two unidentified burner serial No.
(left front side)

The following photo contains the cow valve of one of the two unidentified burners (left front side) item #7.



By visual inspection, it contains no damage at any part of the valve.

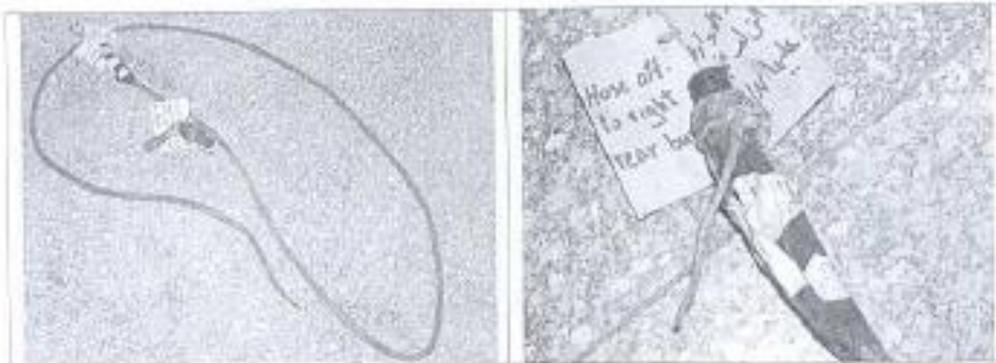
11





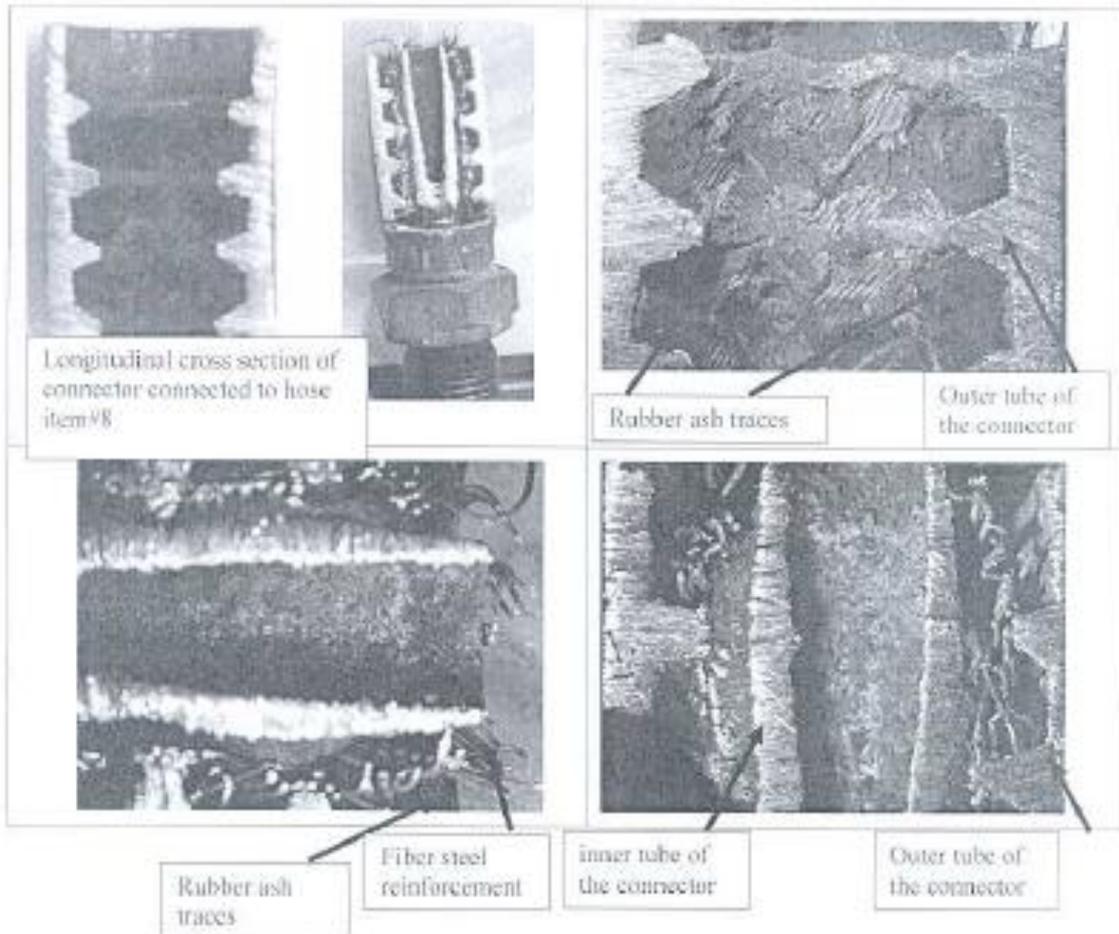
Item #8: Hose of one of the two unidentified burner serial No. (right rear side)

The following photos describes the situation of item #8. The hose contains one of the connectors, while the other end was found free (released from connector). The hose is highly damaged by a fire, where its length 293 cm. It is also noticed that there is great variety between the hose diameter (8.4-12.9 mm).



The connector was mechanically cut to longitudinal section to investigate the effect of fire. After longitudinal sectioning, it was found that rubber of the hose was totally fired and traces of rubber ashes was noticed at a different areas between the inner and outer tubes of the connector.





13

Handwritten signature and date in blue ink.



Item #9: Cow vlv. of one of the two unidentified burner serial No. (right rear side)

The following photo describes the situation of item #9



The cow valve item #9 of one of the two unidentified burner (right rear side) is undamaged.

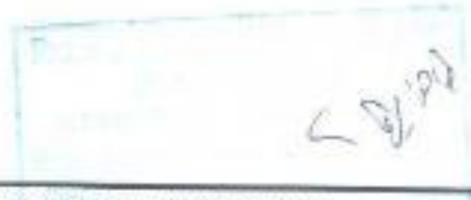
Item #10: Wreckage of one of the cylinders

Item # 10 has been received as wreckage of one of the cylinders that provide the balloon with the fuel gas. It is assumed that gas was reserved as liquid under high pressure in the cylinder.

The Wreckage of the cylinder clearly shows that:

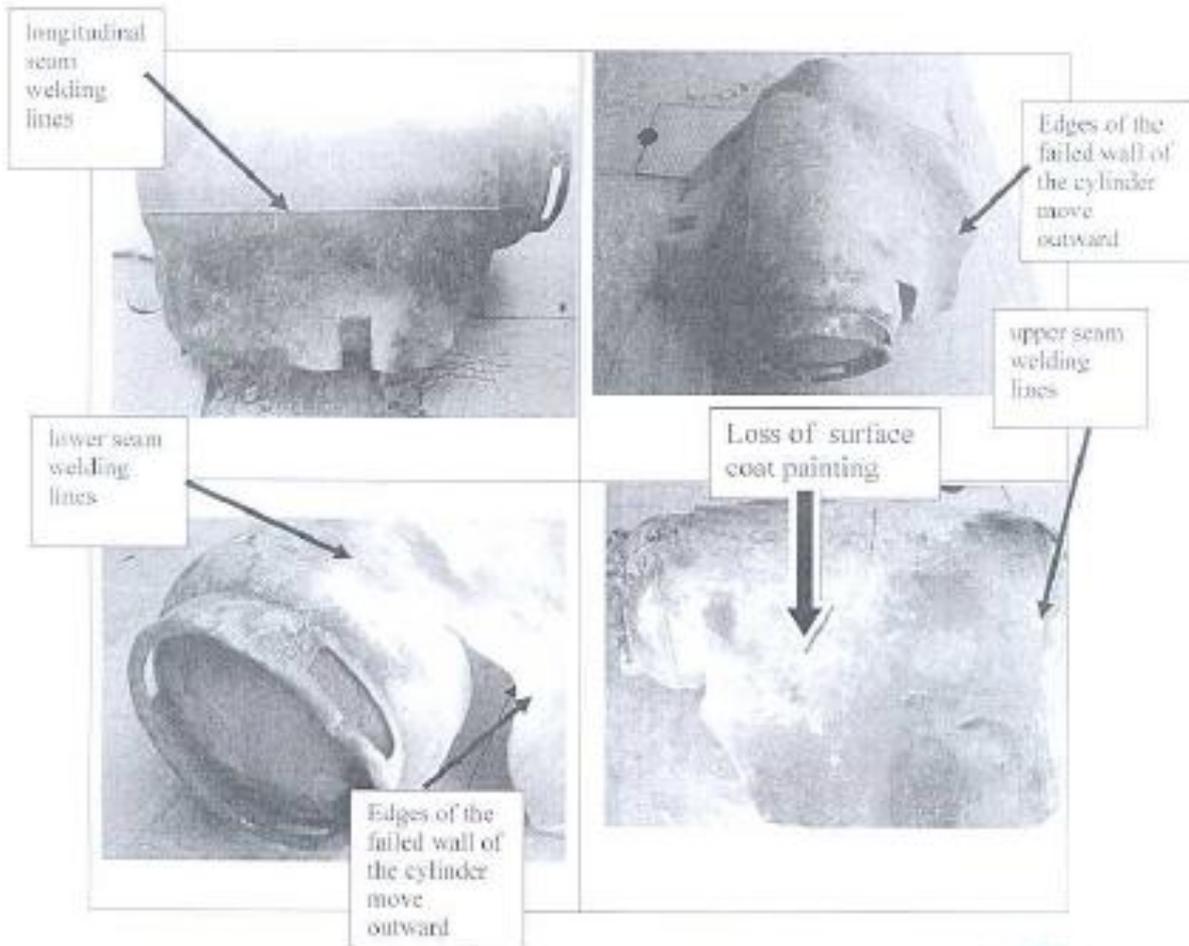
- An outburst happened from inner to outer of the cylinder, where the edges of the failed wall of the cylinder move outward.
- According to the general law of gases, increase of gas temperature is leading to increase of volume and consequently gas pressure. It is supposed that the gas cylinder was subjected to fire as its clear on the upper part of the wreckage of the cylinder surface. It was found that the opposite side of the failed edges lost the feature of the surface coat painting.
- Lower, upper and longitudinal seam welding lines still in a right way situation and were not subjected to any failure.

14





The following photos show different positions of the gas cylinder (item #10)



15





**CENTRAL METALLURGICAL RESEARCH
AND DEVELOPMENT INSTITUTE,**

A sample has been cut from the wreckage of the cylinder Item #10 for thickness measurements as well as for chemical analysis.

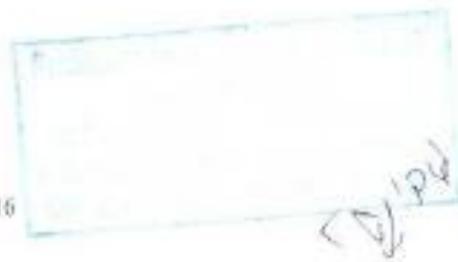
- The average thickness of the gas cylinder wall was 1.98 mm.
- The following table represents the average chemical composition of the sample taken from the wreckage of the gas cylinder;

| Element | C | Si | Mn | P | S | Cr | Mo | Ni | Al | Co | Cu |
|---------|-------|-------|------|-------|-------|------|------|------|-------|-------|-------|
| Wt. % | 0.022 | 0.364 | 1.45 | 0.024 | 0.002 | 21.5 | 3.18 | 6.04 | 0.025 | 0.124 | 0.256 |

- The chemical composition emphasizes that the material of the sample is austenitic-ferritic stainless steel alloy material No.1.4462 grade X2CrNiMoN22-5-3
- The expected (standard) mechanical properties of the alloy are listed in the following table:

| grade # | Yield Stress, MPa ≥ | Ultimate Strength, MPa | Elongation, % ≥ | Impact value, J ≥ |
|------------------------|------------------------|---------------------------|--------------------|----------------------|
| <u>X2CrNiMoN22-5-3</u> | 450 | 600-900 | 30 | 120 |

16

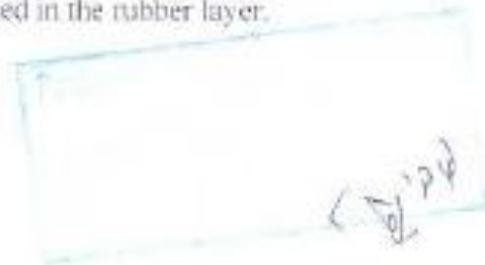




Conclusions based on material investigation :

1. The hose attached to burner 193 was found without the outer rubber layer and containing different diameters. The hose was expanded due to a pulling force.
2. The inner as well as the outer tube of the connector to burner 193 were found containing traces of rubber ash and covered with rust which is an evidence that connector was subjected to extensive fire. The connector material is a free cutting steel alloy, with material No.1.0718 & grade A9G-RV.
3. The cow valve connected to burner 193 was found with partial melting of the valve controlling handle. The valve controlling handle is AlSi1Mg 0.5Mn alloy.
4. The connector to the TEMA (hose attached to burner 191) was found failed by a shear force. The teeth of inner as well as the outer connector tubes bite the rubber layer of the hose, where biting continues to the fiber steel reinforcement preventing release of the rubber hose from the connector.
5. The cow valves attached to burner 191, and other cow valve connected to one of the two unidentified burners serial No were found in a right situation (undamaged) .
6. the connector to hose of the unidentified burner (item #6) contains the rubber hose between the inner and outer tubes. The fiber steel reinforcement is clearly impeded in the rubber layer.

17





**CENTRAL METALLURGICAL RESEARCH
AND DEVELOPMENT INSTITUTE,**

7. Hose of the unidentified burner serial no. (Item #8) was highly damaged by fire. It is found that rubber between the inner and outer tubes of the connector was totally fired and traces of rubber ashes were noticed at different areas.
8. An explosion happened from inner to outer of the cylinder, where the cylinder was subjected to fire on the upper part. the material of the cylinder is austenitic-ferritic stainless steel alloy with 1.98 mm thickness

Research team from CMRDI

Exhibit 5
ECAA letter directed to Egyptian Airports company 11/08/2011

Exhibit #5

ECAA letter directed to Egyptian Airports company 11/08/2011

Arab Republic of Egypt
Ministry of Civil Aviation
Egyptian Civil Aviation Authority

To: Chairman of Egyptian company for airports

Reference: ECAA letter number 9684 dated 22 October, 2009, concerning
implementation of the standards and operation instructions, for restarting
the balloon commercial operation on Sunday, 25 October 2009.

Please be informed that it has been decided to delete the 'above referred to' letter issued by ECAA, and based on evaluation and study for the operation obstacles that appeared since restarting the commercial operation, the ECAA decided to modify the previous standards and instructions shown above and to be as follows:

1. The balloon take off land existing at "Karana" area at "Houd El Sabeal" at the west side land of Luxor city, would be used for hot balloon take off, for the purpose of commercial operation only or flight training with passengers to acquire the "initial operating experience" IOE.
2. The air balloon training land located at the desert mountainous area north of the "queens valley" at the west side of Luxor governorate, determined by the site measurements (between latitude 33.8 -34 degree North, longitude 77.4-77.5 East) would be used for performing different types of balloon training without revenue passengers according to article 15.
3. A resident operation delegate shall exist at the balloon take off site, belonging to the Egyptian company for airports to control the operation of the hot air balloon as follows:
 - a. Coordinating with Luxor international airport control tower through the use of hot telephone line, to obtain a pre-clearance for the balloon take off, and obtaining the last meteorological report, in addition to audio follow up for radio communication (VHF) between different balloons operators and Luxor international airport tower and coordinating between the ECAA control department related to hot air balloon operation .

- b. Intervals for the hot air balloon operation shall be within two hours starting from the first light and not from the sunrise.
- c. Hot air balloon operating at the two balloon take off sites shall follow minimum limits for the air balloon working operation, based on what is available from the actual meteorological elements and the forecast elements by the automated meteorological station at the land site and the meteorological delegate at the site, or using the meteorological report issued from Luxor international airport tower, in case information is not available or defect in the meteorological station at the site as follows:
 1. Maximum surface prevailing wind speed should not exceed 8 knots.
 2. Operation at good meteorological environment according to ECAA conditions (VFR) and under the following conditions:
 - Visibility should not less be than 5 km, normally .
 - Weather should not be adverse.
 - No clouds below 5000 ft
 3. Balloon height shall not exceed 2000 ft above sea level. Routine meteorological measure elements (METAR) should be available, including the following elements :
 - A symbol indicting the type of report.
 - The time of the report.
 - Direction and speed of surface wind
 - Visibility range
 - Current weather condition
 - Amount and type of clouds (in case of cumulus clouds, or xxx cumulus clouds or near it), the height of the cloud base or the vertical visibility range.
 - Outside temp and the dew point
 - QNH
 4. The working operation for hot air balloon shall be restricted in case that the minimum limit of operation conditions is not met as show in the article above.
- d. It is not allowed to have more than one balloon belonging to the same company flying in the air at the same time, a second balloon take off is

allowed for the same company at the moment of first balloon landing procedure, with a time separation internal of not less the 30 minutes after the first balloon take off. This shall be under the responsibility of resident operation delegate belonging to the Egyptian company for airports.

- e. For the sake of the re-enforcing the safety procedures, the number of hot air balloon flights for each company is restricted, through summer time shall not exceed three flights (from, 1 may to 30 September every year) (the operation evaluation should be made Based on that)
 - f. The hot air balloon are not allowed to make a second take off or operation after the end of the revenue flight trip unless landing on ground is completed , the hot air volume is deflated from the balloon , and the balloon is carried to the defined take off area (revenue commercial operation).
 - g. Allowing the operation of the hot air balloon type (Cameron Z-600 belonging to the group-D of a volume of more than 425000 cubic feet.
 - h. A suitable time interval between the “take off” times of each balloon (at the balloon site) should be kept, to secure the take off procedures. The take off should be made according to the constraints of the take off area for each balloon, and also the inter between distances, between a take off site and another under the supervision of the resident operation delegate belonging to the Egyptian company for airports.
4. Air balloon companies shall carry only the insured passengers in the insurance document (against accidents risk) for all the passengers, cockpit crew and the hired party (existing on the ground), and according to the constraints of the max number of passengers allowed to be on board of each balloon according to the ECAA authority issued in this matter with the operation specifications issued by the company.
 5. All the operating balloon companies must immediately notify about the accidents and incidents in addition to emergency and abnormal operations of hot air balloon operation through the daily shift at the operation center, and crisis management at the following contact information
 - telephone: 02/22678535,02/24175605
 - fax : 02/22681375,02/22681371

6. All balloon companies are committed to make available the following equipment on board of each balloon before take off from the defined area for balloon in Luxor.
 - a- GPS (global positioning system) before 30/9/2011
 - b- VHF equipment
 - c- Fire extinguishing equipment
 - d- Mobile telephone with the balloon captain (mobile battery must be checked for full charging)
 - e- Site locator in case of emergency KANNAD XS-ER EPIREB before 31/10/2011
7. Submitting a report to the ECAA everyday after the termination of the daily utilization. The report should include actual flying hours for each balloon pilot participating in the hot air balloon flights for all the companies using what have been recorded as flight time for each flight by the resident operation delegate at the balloon take off side.
8. Verifying through the radio and audio follow up mean that all the balloon companies are committed to fly west of the river Nile on the monuments area only. In case of abnormal weather condition resulting in crossing the balloon east of the river Nile for landing , the balloon caption must contact Luxor control tower by radio to obtain the permission before the beginning of crossing the river Nile, for the purpose of coordinating the flight movement without the airport area. This action will be considered as violation threatening flight safety if the radio contact is not made.
9. Ensuring that all companies are committed to use the stores belonging to each company outside of the defined balloon operation land Each company shall move its special equipment to the land site before the beginning of operation. The companies are committed to clear the site and moving the equipment back to the stores after terminating the balloon flight work at the site.
10. All operation companies are committed to the standards and instructions of the military site regarding the annual permission, to implement the hot air balloon activity for each company of the working companies.
11. Pre coordination with Luxor aircraft base before executing the daily operation.

12. Ensuring though radio and audio follow, that the balloon captain establishes radio communication to obtain the clearance for take off , control throughout the flight and landing permission , according to the following:
 - a. Establishes radio communication with Luxor international airport control tower immediately after take off to inform about the actual time for take off, remaining balloon flight information (registration letters, name of balloon pilot, flight number of passengers and crew ,etc)
 - b. Establishes continuous communication with Luxor international airport control tower, to follow up the meteorological conditions, and the immediate notification in case of crossing / emergency landing for the balloon east of the river Nile.
 - c. Establishes continuous communication with Luxor international airport control tower, and the relevant balloon company operation, for the immediate notification in case of facing abnormal events for the balloon (facing bad weather, crossing the Nile east direction, deviation outside the working area, emergency landing, human injuries , etc) and required emergency procedures.
13. Ensuring that the hot air balloon will never fly in a circle of 10 km radius around Luxor air force base and avoiding flying the air balloon over the areas/ military targets, restricted/ prohibited/ dangerous areas (army operation department instructions).
14. Restriction of balloon company operation for those companies who have previously acquired AOC “Aircraft Operation Certificate” for each of them based on ministerial decree previously issued for the addition of hot air balloon activity for new companies at Luxor governorate
15. Ensuring the availability of the “operations specification” issued by ECAA on board of each balloon for every hot air balloon company as part of the its issued AOC “Aircraft Operation Certificate” “ and to include the operation constraint shown in article 3 c and article 4 shown above .
16. Hot air balloon captain must wear the official uniform for flying according the clause included in the relevant balloon company operation guide. In addition they must carry and show the ID, issued by the company before assuming the balloon flight duties.

17. Hot air balloon companies are committed to perform training on the balloon according to the following:

- a. Informing the ECAA, at least 15 days before the date of performing the training or tests.
- b. Every company is allowed for one training take off from the mountains training area, according to article “2” shown above ,in addition to the commercial operation limits (with passengers) from the balloon take off area at “karana” area according to article (1) shown above at the same time .
- c. All companies are not allowed to perform training on hot air balloon for the purpose of issuing pilot balloon license (private/ commercial)
- d. The balloon companies are allowed to perform the following trainings:
 - Adding the balloon higher group (Balloon Group B, C and D) to the balloon commercial pilot license issued from an approved training center either inside or outside (after relevant approval)
 - Adding Balloon Category for whom, carrying pilot commercial license (Airplane/ Helicopter)
 - Performing regular training.
 - Performing proficiency tests under the supervision of ECAA
 - Performing the necessary qualifications to create a hot air balloon trainer under the supervision of ECAA.
- e. It is not allowed to have more than two balloon pilots under training on board of the balloon accompanied by a trainer in charge of completing the training.
- f. It is not allowed to have more than two balloon pilots performing proficiency check on board of the hot air balloon accompanied by a trainer in charge of performing the test
- g. It is allowed to carry weights on board of the hot air balloon during the training or the examinations for the purpose of satisfying the minimum weight necessary for take off. (Ground staff from the company. It is forbidden to carry revenue passengers during that)

- h. It is allowed to use foreign trainer on the expense of each company to perform training and examinations according to above item D, under the supervision of ECAA.
 - i. It is allowed to perform balloon training from the defined take off site with passengers only for the purpose of performing Initial Operating Experience IOE training.
18. The balloon pilot is allowed to perform more than one flight throughout two hours starting from the day first light appearance. He is also allowed to fly the hot air balloon again by making a second take off after landing from the first take off and deflating the hot air volume during the available operating time.
19. All balloon companies are committed to prepare a list for the passengers to be submitted to the hot air balloon take off site responsible before the take off of the balloon belonging to it, on a special form, indicating the actual name of the passengers based on his passport, his nationality and his birth date
20. The Egyptian Civil Aviation Authority ECAA is committed to respond to all the requests received by it only from any balloon company holding an AOC. Correspondences and requests received by ECAA far from every balloon company are not considered.

Remark:

Ensuring the committed of each company regarding performing the necessary coordination with the Egyptian Company for Airports Operation delegate at the defined take off balloon site, the west side land in Luxor before the training or tests on the hot air balloon at the training land at the mountainous area according to article 2 shown above

ECAA Chairman

Exhibit #6a

ECAA letter directed to Egyptian Airports company 22/10/2009

Exhibit #6a

ECAA letter directed to Egyptian Airports company 22/10/2009

From: Egyptian civil aviation authority

To: Egyptian Company for Airports issued on 22/10/2009

Arab republic of Egypt

Ministry of civil aviation

Egyptian civil aviation authority

To: Chairman of Egyptian company for airports

Reference: - Minister of Egyptian Civil Aviation, concerning establishing of defined standards for the secured hot air balloon operation, as being one of the aviation activities practiced in A.R.E

- Army Operation department Chairman Deputy number 12823/c dated 20/10/2009 regarding the permission for revalidating the military approval until 31/12/2009 for the balloon operating companies in Luxor

Following standards and operational instructions shall be adhered to, when restarting the commercial operation scheduled on Sunday 25/10/2009:

1. Resident operation delegate shall exist at the balloon take off site, belonging to the Egyptian company for airports to control the operation of the hot air balloon as follows:
 - a. Coordinating with Luxor international airport control tower through the use of hot telephone line, to obtain a pre-clearance for the balloon take off , and obtaining the last meteorological report, in addition to audio follow up for radio communication (VHF) between different balloons operators and Luxor international airport tower and coordinating between the ECAA control department related to hot air balloon operation .
 - b. Intervals for the hot air balloon operation shall be within two hours starting from the first light and not from the sunrise.
 - c. Hot air balloon operating at the proposed balloon take off site shall follow minimum limits for the air balloon working operation, based on what is

available from the actual meteorological elements and the forecast elements by the automated meteorological station at the land site and the meteorological delegate at the site, represented by the following:

5. Maximum surface prevailing wind speed should not exceed 8 knots, and in air visibility environment of not less than 10 km.
 6. Balloon height shall not exceed 2000 ft above sea level.
Meteorological measure elements should be available (including the speed and direction of the wind, temperature, pressure, humidity), also the availability for the weather forecast at higher air levels (2000 ft) on condition of having the availability to measure the wind speed and direction every 200 ft up to the allowed flying height.
 7. The working operation for hot air balloon shall be restricted in case wind is available with more than 8 knots (surface wind or in cases of varying the direction of the surface wind resulting in crossing the river Nile to its east side for landing)
 - 8.
 - 9.
 10. that the minimum limit of operation conditions is not met as show in article above.
- d. It is not allowed to have more than one balloon belonging to the same company flying in the air at the same time, a second balloon take off is allowed for the same company after the first balloon landing.
 - e. The hot air balloon are not allowed to make a second take off or operation after the end of the revenue flight trip unless landing on ground is completed , the hot air volume is deflated from the balloon , and the balloon is carried to the defined take off area (revenue commercial operation).
 - f. Not allowing the operation of the hot air balloon type (Cameron Z-600 belonging to the group-D of a volume of more than 425000 cubic feet. (20 passengers)
 - g. Time interval separation should be considered between the departures of each balloon (8 companies) for securing the take off procedures. The take

off should be made according to the area constraints for each balloon take off site, in addition to the inter between distances between one site and another

2. Air balloon companies shall carry only the insured passengers in the insurance document (against accidents risk) for all the passengers, cockpit crew and the hired party (existing on the ground), and according to the constraints of the max number of passengers allowed to be on board of each balloon according to the ECAA authority issued in this matter with the operation specifications issued by the company.
3. Ensuring the commitment of each operating balloon company to obtain a daily permission for flying from the Air Transport Central Department, ECAA through the daily shifts at the operation center and crisis management within the ECAA.
4. All balloon companies are committed to make available the following equipment on board of the balloons, before taking off from the defined site for operation in Luxor:
 - Transponder
 - GPS
 - VHF
 - Fire Fighting Equipment
 - Mobile telephone with the balloon pilot
 - Optical signal flares
5. Submitting a form for the ECAA daily after the end of the daily operation, including the actual flying hours for each balloon pilot participated in the hot air balloon flights for all the companies, based on what has been recorded for the actual flight for each flight by the resident operation delegate at the balloon take off site.
6. Verifying through the radio and audio follow up mean that all the balloon companies are committed to fly west of the river Nile on the monuments area only. In case of abnormal weather condition resulting in crossing the balloon east of the river Nile for landing , the balloon captain must contact Luxor control tower by radio to obtain the permission before the beginning of crossing the river Nile, for the purpose of coordinating the flight movement without the airport

area. This action will be considered as violation threatening flight safety if the radio contact is not made.

7. Verifying before the balloon take off that there are no cameras or video or mobile telephone with a camera carried by the passengers for the purpose of preventing taking any photo from the air balloon (Army operation department instructions)
8. Companies are committed to use its private stores outside of the defined sole balloon operation. Each company must move its operational equipment to the land site before starting the operation. The company must evacuate the site and move them back to its stores after finishing the balloon flight operation on the site.
9. Adherence to the military side instructions and standards, concerning the annual approval for experiencing the balloon activities for the company.
10. Pre- Coordination commitment with Luxor Air Base before performing the daily operation utilization.
11. Ensuring, through the radio/ audio follow up, that radio communication is established to obtain the take off clearance and control through the flying duration, according to the following:
 - a. Establishing telephone calls with the ATC (Air Traffic control), at least 30 minutes before take off to obtain the last meteorological report and clearance for take off.
 - b. Establishes radio communication with Luxor international airport control tower immediately after take off to inform about the actual time for take off, remaining balloon flight information (registration letters, name of balloon pilot, flight number of passengers and crew ,etc)
 - c. Establishes continuous communication with Luxor international airport control tower, to follow up the meteorological conditions, and the immediate notification in case of crossing / emergency landing for the balloon east of the river Nile.
 - d. Establishes continuous communication with Luxor international airport control tower, and the relevant balloon company operation, for the

immediate notification in case of facing abnormal events for the balloon (facing bad weather, crossing the Nile east direction, deviation outside the working area, emergency landing, human injuries , etc) and required emergency procedures.

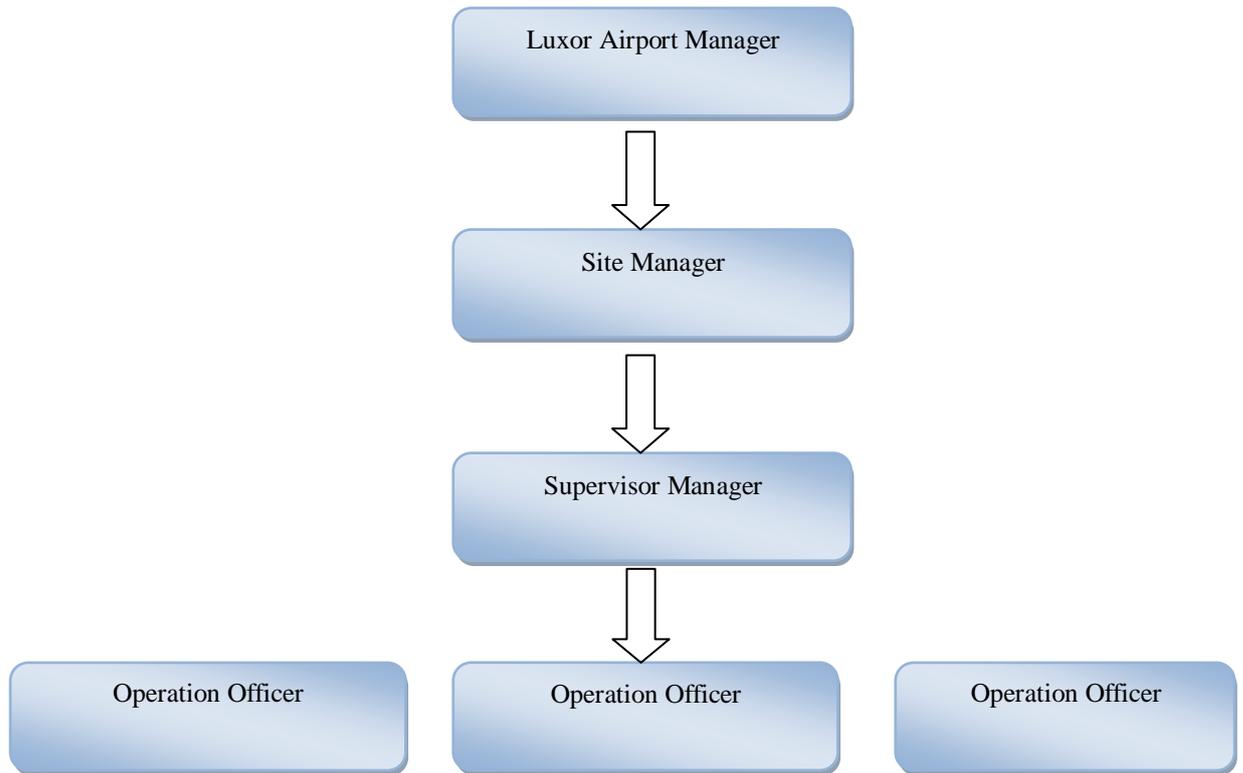
12. Ensuring that the hot air balloon will never fly in a circle of 10 km radius around Luxor air force base and avoiding flying the air balloon over the areas/ military targets, restricted/ prohibited/ dangerous areas (army operation department instructions).

ECAA Chairman

Exhibit #6b
Organization chart for balloon take off site at Luxor

Exhibit #6b
Organization chart for balloon take off site at Luxor

Ministry of Civil Aviation
Egyptian Holding Company for Airports and Air Navigation
Egyptian Company for Airports
Luxor International Airport



Approved by
Luxor International Airport Manager

Balloon Site Manager Job Description:

Complete Supervision on all what is related to, controlling and managing the take off site as follows:

1. All balloon companies shall be committed to follow the balloon operating instruction issued by the ECAA , and the operating standards approved by the authority (attached: copy of the instructions)
2. Ensure implementation of ECAA instructions that satisfy safety and security principles during balloon operation and at the balloon take off site.
3. Ensure with the site Supervisor, reviewing the flight clearances for all balloons existing on the balloon take off site, and ensuring the validity of the pilots license according to what is issued by ECAA.
4. Signing the letters that are submitted to balloon companies related to the administrative and organizing operation according to ECAA instructions .

Approved by
Luxor International Airport Manager

Balloon Site Manager Job Description:

1. Coordinating with the site manager concerning organizing and managing the work on the balloon take off site.
2. Ensuring reviewing the names of the operators belonging to the “Egyptian company for airports” according to the approved schedule from the airport management.
3. Reviewing the operation submitted from the balloon companies.
4. Follow up for the communication with the air control tower to obtain the meteorological report every hour, and informing the site general manager to ensure that all the elements of the meteorology (visibility, wind speed ...) did not exceed the permissible limits according to the instruction approved by ECAA in this aspect.
5. Distributing the site operation on the balloon existing in the site .
6. Ensuring that all the balloons existing in the site have valid flying permissions and all the pilots’ licenses are valid.
7. Ensuring that all the employees working on the site are committed to the operating standards concerning wearing the phosphoric jackets, each of them should have a radio unit to make the mutual communication more easy .
8. Obtaining the permission for take off from the air control tower and the approval of the site manager for balloon take off , and informing the air control tower about the completion of the daily operation and assuring (the tower) that all the balloons have landed safety .
9. Ensuring the safety and security principles at the time of balloon take off, by controlling the balloon take off one by one based on the surface wind direction at the site, (article 5 in the instruction of ECAA through the communication with air control tower, at Luxor airport.
10. Ensuring the availability of an ambulance, fire vehicle, and informing the site manager if they are not available.

Approved by
Luxor International Airport Manager

Balloon Site Operator Job Description:

1. Controlling the cars movement at the site to avoid random movement at the time of balloon take off.
2. Ensuring the availability of one responsible person from the balloon company, carrying a serviceable fire extinguisher during the operation of pushing the hot air to the balloon.
3. Ensuring that the number of passengers does not exceed the number approved by the ECAA according to the type and model of the balloon.
4. Ensuring that there are no children on board of the balloon less than 5 years old.
5. Ensuring that each pilots wear the company uniform and that he carries one VHF unit in the basket, in addition to a charged mobile telephone. Also ensuring the existence of a fire extinguisher and a first aid.
6. Ensuring that the balloon pilots have received the meteorological report.
7. Receiving the passenger list, signed by the balloon pilot.
8. Informing the site supervisor and site manager in case of any violation made by the companies to take the necessary actions.
9. Informing the site supervisor and the site manager about the balloon that is ready for take off throughout radio means to allow him for take off .
10. Preparing and writing a daily report , and the details of the daily flights on the relevant form dedicated for this, (including company name, the balloon number, pilot name, number of passengers , the time of balloon take off)
11. Keeping all the documents for reference when needed.

Approved by
Luxor International Airport Manager

Exhibit #7

ECAA instructions regarding charging of the gas cylinders:

Exhibit #7:

ECAA instructions regarding charging of the gas cylinders:

On 29 July, 2008 a letter was issued by the chairman of the ECAA and was circulated to the chairmen of the balloon companies regarding the procedures for charging the flying balloons cylinders with gas. (refer to Exhibit # 7). The procedures include the following:

A. Commitment to change the balloon gas cylinders at the gas charging factory in Luxor, and taking care of the following considerations:

1. Preparing a car to secure transferring the gas cylinders from the company store to the gas factory and vise-versa
2. A technical specialist from the company must attend the gas cylinders charging process at the gas cylinders charging factory
3. To ensure that the gas cylinder charging factory uses the gas filters allocated to balloon gas cylinder charging, and ensuring regular changes to them according to the manufacturer instructions
4. In case there is a problem taking place at the factory while charging the cylinders, or resulting from the charging procedures in the factory, the ECAA must be notified immediately about the problem

B. Charging of any gas cylinder through the company facilities is absolutely forbidden. The gas cylinder used to charge the company balloon cylinders should be kept in a secured place after deflating them from the inside gas

Exhibit # 8

The BINSa company letter to Ultramagic company on January 2005
regarding the information about the delivered 66 hose of the part number
PV0500178

| | | |
|--|-----------|----------------------|
| RECEPCION DE ELEMENTOS, PIEZAS O CONJUNTOS SUJETOS A CONTROL DOCUMENTAL NUMERO | | 5 |
| FECHA | PEDIDO N° | PROVEEDOR |
| 20/01/2005 | 14 | SUBMINISTRADOS BUNSA |
| DESCRIPCION DE LOS ELEMENTOS, PIEZAS O CONJUNTOS QUE SE RECEPCIONAN | | |
| TUB BINFLEX 1105 NEGRO 2500 ~ REF. 10130601x2 - 33 UNIDADES | | |
| TUB BINFLEX 1105 NEGRO 2500 ~ 3/8-1/4 - 33 UNIDADES | | |
| 17/02/2005 -> TUB BINFLEX 1105 NEGRO 2500 ~ REF. 10130605x2 - 7 UNIDADES | | |
| " -> TUB BINFLEX 1105 NEGRO 2500 ~ 3/8-1/4 - 7 UNIDADES | | |
| DOCUMENTOS QUE SE RECEPCIONAN | | |
| ALBAMAN N° AV0502821 | | |
| ALBAMAN N° AV0508985 | | |
| DISCREPANCIAS O INCIDENCIAS | | |
| RECEPCIONADO POR | | FIRMA |
| Rodrigo | | [Firma] |

Exhibit # 9

The BINSa company letter to Ultramagic company on April 2008
regarding the information about the delivered 80 hose of the part number
PV8015730

Exhibit # 9

The BINSÁ company letter to Ultramagic company on April 2008 regarding the information about the delivered 80 hose of the part number PV8015730



BINSA

Ctra N-340 km 1245,3
E-08750 MOLINS DE REI (Barcelona)
Tel: +34 932 44 00 50 Fax: +34 93 686 66 50
www.binsa.es

Venta - Alb. venta

NTRA REFERENCIA: PV8015730 FECHA EXPEDICION: 17/04/08 N° ALBARÁN: AV816792

DOMICILIO FISCAL
ULTRAMAGIC, S.A
SR SALVADOR BANUS
C/ AERODROM IGUALADA-ODENA
APARTADO DE CORREOS 171
08700 IGUALADA
BARCELONA
España

3107
SEUR 24
P.D.
4,00
68,00
938042202

DIRECCIÓN DE ENTREGA
ULTRAMAGIC, S.A.
C/ AERODROM IGUALADA-ODENA
08700 IGUALADA
BARCELONA
España

| CÓD. CLIENTE | C.I.F. | SU REFERENCIA | Vendedor | PÁGINA | |
|--------------|----------------------------------|---------------|----------|--------|--------|
| 3107 | A08808214 | | 9 | Pág. 1 | |
| N° | DESCRIPCIÓN | CANTIDAD | PRECIO | %D.TO. | TOTAL |
| CMPLA038137 | FLEX.BIN1105 R10130605 | 40 | 28,95 | 45 | 637,56 |
| CMPLA038136 | FLEX.BIN1105 R10130605 R10130405 | 40 | 29,74 | 45 | 654,28 |

Alb. 391

Facturado

IMPORTE EUROS IVA EXCLUIDO 1351,84

PORTES P.D.
AGENCIA SEUR 24
BULTOS: 4 KILOS: 68,00
OPERARIOS 11 PUNTO EXPEDICIÓN: BÓTIGA-2

Reg. Merc. B.C.N.: T. 5345, L. 4650, Seco 2º, F. 64, H. 5792, Inscrp. 1ª, CIF: A-08812585

| DOCUMENTACIÓN DE RECEPCIONES DE LOS PRODUCTOS DE ENTRADA | | | |
|---|---|-------------|--------|
| RECEPCION DE ELEMENTOS, PIEZAS O COMPONENTES SUJETOS A CONTROL DOCUMENTAL NUMERO | 338 | | |
| FECHA | 28/04/08 | RECIBIDO N° | 292 |
| DESCRIPCIÓN DE LOS ELEMENTOS, PIEZAS O COMPONENTES QUE SE RECEPCIONAN | PROVIEDORAS UNICREDITA BINA | | |
| | TUB BINFLEX NEGRO 2500 -- 3/8" x 3/8" BSP - 40 UNIDADES | | |
| | TUB BINFLEX NEGRO 2500 -- 3/8" x 1/4" BSP - 40 UNIDADES | | |
| DOCUMENTOS QUE SE RECEPCIONAN | ALBURN N° AV816792 | | |
| CONTROL DE CALIDAD REALIZADO | | | |
| Ejemplar de Certificado | Medidas conformes | ✓ | Origen |
| Observaciones | DADOS MUESTRAS / ANALISIS | | |
| RESERVAZAS O INDEBENCIAS | | | |
| RECEPCIONADO POR | Calderín | FECHA | 1/2 |
| FOLIO DE AUTORIZACIÓN DE DOCUMENTACIÓN FOTOCOPIADA | | | |
| AUTORIZADO POR PERSONA DE ESTABLECIMIENTO | | | |
| <div style="text-align: right;"> FOLIO 1 DE 1 </div> | | | |

| | | |
|--|-----------|----------------------|
| RECEPCION DE ELEMENTOS, PIEZAS O CONJUNTOS SUJETOS A CONTROL DOCUMENTAL NUMERO | | '5 |
| FECHA | PEDIDO N° | PROVEEDOR |
| 20/01/2005 | 14 | SUBMINISTRADOS BUNSA |
| DESCRIPCION DE LOS ELEMENTOS, PIEZAS O CONJUNTOS QUE SE RECEPCIONAN | | |
| TUB BINFLEX 1105 MEGRE 2700 ~ ~ ~ REF. 10130607x2 - 33 unidades | | |
| TUB BINFLEX 1105 MEGRE 2400 ~ ~ ~ 88-1/4 - 33 unidades | | |
| 17/02/2005 -> TUB BINFLEX 1105 MEGRE 2500 ~ ~ ~ REF. 10130605 x 2 - 7 unidades | | |
| " -> TUB BINFLEX 1105 MEGRE 2500 ~ ~ ~ 3/8 - 1/4 - 7 unidades | | |
| DOCUMENTOS QUE SE RECEPCIONAN | | |
| ALBARAN N° AV0502821 | | |
| ALBARAN N° AV0508985 | | |
| DISCREPANCIAS O INCIDENCIAS | | |
| RECEPCIONADO POR | | FIRMA |
| Rodrigo | | [Signature] |

Exhibit #10
Pre Departure check for the event flight.

Exhibit #10
Pre Departure check for the event flight.

Egyptian Airship & Balloon Co.

ECAA/EABC/Ultra Magic Balloon Preflight Inspection 01/2005

Ultra Magic Preflight inspection

Balloon Type : N-425
 Balloon Reg. : SU-283

Station : IXRTWR
 Date : 26/2/2013

| Item | Work Carried | Engineer | Inspector |
|------|---|-------------|-----------|
| A | <p><u>Envelope</u></p> <ol style="list-style-type: none"> 1. Ensure that any fabric damage does not exceed the Permitted Damage as follows. Damage to the fabric in the lower third of the envelope must be limited to an area affecting no more than 3 panels. These panels may be adjacent. Holes no greater than 10mm in diameter are permitted elsewhere on the envelope. These holes must not be within 25mm of a load tape, with no more than 5 in any one panel and be no closer than 50mm to each other. No more than 3 panels in the upper 2. two thirds of the envelope may have these small holes. 3. Ensure that there is no damage to any load tapes. 4. Ensure that there is no damage to the flying wires and that they are free of 5. twists. 6. Ensure that flying wires are connected correctly and that karabiners are closed, screwed shut and loaded lengthways. | <p>3 OK</p> | |

Revision 1

Date 1/01/2013

Page 1 of 3

| | |
|---|-----------|
| <p>correctly.</p> <p>6. Check that pilot light is burning correctly and is strong and not too noisy or too quiet.</p> | <p>OK</p> |
| <p>C Basket</p> <ol style="list-style-type: none"> 1. Check the general condition of the basket for damage. 2. Ensure that the basket wires are free of damage and twists. 3. Ensure that the burner frame and poles fit correctly and are free of damage. 4. Ensure that the attachment points are secure and that all karabiners are screwed locked. 5. Check for the presence of a fully charged fire extinguisher. | <p>OK</p> |

Inspection carried out by

Name



License No/approval No

Revision 1

Date 1/01/2013

Page 3 of 3

Exhibit #11

Letter from the "Accredited representative from Spain"



MINISTERIO
DE FOMENTO

SUBSECRETARIA

COMISION DE INVESTIGACION D
ACCIDENTES E INCIDENTES DE
AVIACION CIVIL

O F I C I O

S/REF.

N/REF. EXT A-002/2013 LUXOR

FECHA DIC 18th, 2013

ASUNTO Document to be appended to the
Final Report for Hot Air Balloon
Accident near Luxor

ATTN. Capt. Ayman El- Mokadem
Head Of the Central Directorate of Aircraft
Accident Investigation
Ministry of Civil Aviation
P.O Box 52
Cairo International Airport Road, Cairo, Egypt

Dear Sir,

Please find attached the document including the CIAIAC comments summary that have not been accepted by the Accident Investigation Committee on the draft technical report detailing the investigation into the balloon accident that took place on 26 February 2013.

We would like to thank you once more for the opportunity given to the CIAIAC to analyze the draft and provide you with our comments as well as your response to same.

We also appreciate your acceptance and inclusion of many of the comments the CIAIAC sent last 19th November of 2013 in your Final Report, and expect these have contributed to improve the Final Report.

Notwithstanding the forgoing the CIAIAC still believe that some of our Comments, that were not positively considered by the Committee, should be included, in accordance with the provisions of Annex 13, as a Document appended to your Final Report in order to clarify certain points in an effort to improve the overall comprehension of same.

We reiterate that the CIAIAC document has been issued with the interest of civil aviation safety in mind only and we hope that the efforts made by all the parties involved in the investigation and the issuance of this Final Report can avoid the occurrence of accidents like this one in the future.

We remain at your disposal for any further information that you may wish to obtain about this appended Document, if any.

Yours faithfully,

Manuel Fernández – Accredited Representative of Spain

MADRID
CORREO ELECTRONICO
5978960
ciaiac@fomento.es
4635535

C/ FRUELA, nº 6
28011

TEL: +34 91

FAX: +34 91



SPANISH CIAIAC APPENDIX WITH COMMENTS

1.-After having analysed the content of the draft of the Final Report you kindly submitted for the CIAIAC's attention and the findings included on same related to the identification marks of some of the balloon components, specifically the burners and the fuel hoses, as well as the interpretation the Committee provided to in that respect, the CIAIAC conducted an additional investigation with the manufacturer Ultramagic about those matters.

Said investigation revealed that, without a doubt, Ultramagic identifies during production each and every burner unit with a unique S/N which is located specifically as follows:

- Up to S/N 250 approximately, a unique S/N was engraved on one of the three brackets of the burner/vaporization coils (see picture 1).



VAPOURIZATION COIL OF A BURNER UNIT
INSTALLED ON A DOUBLE BURNER ASSEMBLY
WITH S/N 229 AND 230.

S/N LOCATED ON THE COIL BRACKET

PICTURE 1



- For units from S/N 250 and above, the S/N is solely engraved on a plate riveted to a cutdown (milled slot) machined on the lower part of the burner block. (see pictures 2 & 3).



PICTURES 2 & 3



Besides, the CIAIAC's investigation also confirmed that Ultramagic has always marked with consecutive numbers each and every burner unit that make up a burners assembly which will be then installed on a balloon (like the quadruple assembly in this case), this also ensuring that the S/N of all the burner units of any assembly are always marked in the same location during production (see picture 4).



PICTURE 4

The foregoing confirms that if a burner unit shows a dual S/N marking (one of them engraved on the vaporization coil and the other on the lower part of the block) or no S/N at all, it is because the previously referred parts were swapped at any time after production between two burner units which had been originally marked by the manufacturer using the locations explained above according to the time when these were installed on the balloon at factory.

The burners assembly installed in the event balloon showed two burner units with S/N's under 250 (specifically 191 and 193) which were engraved on the brackets of their vaporization coils. However the other two burner units (presumably 190 and 192 according to the original documents by the manufacturer) did show no S/N at all, either on their vaporization coils or their blocks. These two burner units did not either show any cutdown (milled slot) on the lower part of the block (see picture 5), what also confirms, without a doubt, that said burner units were modified after the balloon was sold by Ultramagic.



PICTURE 5

The referred modifications were not recorded by the Operator's maintenance personnel, and even, according to the Operations Manager's statement, there were other burner units with dual S/N engraved or with S/N not concurring with the ones on the logbooks.

The 100 hour/annual inspection is, according to the MM (section 6.3), the minimum inspection to be satisfactorily completed in order to obtain a Certificate of Release to Service for renewal of the Airworthiness Certificate on all Ultramagic Balloons. The 100 hour/annual inspection establishes (pg 6.2 of the MM) that it has to be checked, among other things, that all repairs and modifications are recorded on the logbook and that the equipment serial numbers on the logbook agree with the items submitted for inspection.

Therefore, the CIAIAC understands that the maintenance actions carried out by the Balloon Operator had not detected discrepancies on the material/components nor had these discrepancies been corrected and recorded on the balloon maintenance records.

Likewise and in respect of the fuel hoses, the CIAIAC checked and confirmed with the manufacturer that each and every hose belonging to a batch made by Binsa and ultimately used by Ultramagic to be installed on the production balloons or supplied to operators/clients was identified with a unique P/N common to all the units of the batch (batch number), whose two first digits corresponded to the year of manufacture.



2. The Flight Manual issued by the manufacturer and approved by the Certification Authority provides the flight Standard Procedures for the balloon (section 4) which should be followed/used by crews and operators.

Into the Flight Manual, on appendix C.- Quick reference pre-flight checklist (also called PDC - Pre Departure Check) it is specified that this appendix may be copied and used as a quick reference in conjunction with FM section 4, Standard Procedures.

The FM includes and provides enough information to perform inspections to prepare the balloon for a safety flight. Specifically and related to fuel lines – the point 4.5 of FM section 4.- “Preparing the aerostat (balloon) for flight”, establishes “check that all fuel lines are in good condition, and then connect them to the cylinders, the vapor feeds (where fitted) to the regulators, and the liquid feeds to the main valves”.

The PDC on the Appendix C, establishes: “Check the burner, all valves and hoses for damage and leaks” and also “Ensure that hoses are connected and secured to the cylinders”.

Additionally the point 4.5 of the Section 4 of the FM establishes: “Brief the crew as to the roles they are to perform”.

On the balloon captain’s statement, 1.5.1 C, the Captain stated to the Committee investigators that:

“When performing the procedures for PDC (Pre Departure Check) he checks the serviceability of the hose through smelling or hearing, and observing the white soapy powder on the TEMA if there is a case of leak.”

He also stated “PDC inspection procedures apply to parachutes, the karabiners, the wires and part of the hose that is close to its connection with the cylinder TEMA. The part that is connected to the burner is not inspected during the PDC as it is higher than normal vision scope level, and not listed in the check. The hose is not disconnected from the burner when transferring or storing the balloon....”

He also stated that he was “responsible about hot inflation and he was assisted by the ground crew”.

There are no evidences that during the flight preparation, assisted by the ground crew, the hoses were checked on their entire length and their connections to the burners. There are not evidences either which indicate that any kind of tasks sharing and roles were carried out. Nevertheless the captain signed the PDC like he had fully completed it.

As a conclusion in opinion of the CIAIAC, it is considered that the PDC was not fully completed by the Captain, this meaning that possible defects/damage to the top of the hoses near the area where they are attached to the burners might remain undetected.



3.- The CIAIAC understands the simultaneity or coincidence in time, of the action of pulling down the balloon by the ground crew through the drop line rope and the start of the gas leak and a further fire, should be considered as a significant condition for the accident scenario under which the fire broke out. Even though no evidence was found of any mechanical interference between the ropes and the hoses, it should be borne in mind that the rope was made up of non-metallic material as well as the outer rubber of the hoses, and that these were consumed by the fire, this making it impossible to obtain any evidences.

Associated with this matter we consider as important and misinterpreted the metallurgical report, where it is mentioned "the hose attached to burner 193 was found expanded due to pulling with its length measuring 323 cm (among other values of 275 cm, 320 cm and 293 cm for the rest of the hoses)". The CIAIAC considers this information means that the hose was stretched, this being compatible with an external action that could give rise to the second scenario in the Report point 2.13: "Separation of the hose from its end fitting at the upper portion of the hose connection attachment with the burner number 193".

This hypothesis is also supported by the condition found in the connector to burner S/N193 and also according to metallurgical report findings.

4.- Related to the balloon systems and components, there is only an element with a service life limit condition for maintenance and replacement, which is the pressure relief valve or safety valve of each gas cylinder, MM Airworthiness Limitations, section 7. The rest of components and systems on the balloon are maintained on an "on-condition" basis, according to the procedures and schedules included on Section 6.

The hoses, as well as the envelope and control lines for instance, are checked periodically to determine their condition, in order to ensure their capability to continue working properly and safely on the balloon. This maintenance policy for systems and components is a common practice applied by all the balloon manufacturers.

The on-condition maintenance for hoses according to Ultramagic, implies checking the hoses condition through preventive maintenance inspections that are performed on the balloon to detect abrasion, kinking or other damages in order to replace the hoses.

It is the opinion of the CIAIAC that the manufacturer instructions and procedures included on the Maintenance Manual provide good and sufficient information to assure that the hoses are replaced with enough time before they can fail and give place to a leakage.