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Exhibit No. 2-A

NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Group Chairman's Factual Report

(41 Pages)

(4 Photos)

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

November 14, 2016

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA16MA204

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A. ACCIDENT

Location: Lockhart, Texas
Date: July 30, 2016
Time: 0742 central daylight time (1242Z)[1]
Balloon: Balony Kubicek BB85Z, registration N2469L

B. OPERATIONAL FACTORS GROUP

David Lawrence
Group Chairman
Operational Factors Division (AS-30)
National Transportation Safety Board (NTSB)

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Federal Aviation Administration (FAA)

C. SUMMARY

On July 30, 2016, at 0742 central daylight time, a Balony Kubicek BB85Z hot air balloon,[2] N2469L, crashed into a field near Lockhart, Texas. The pilot and 15 passengers onboard were fatally injured and the balloon was destroyed due to impact forces and post-crash fire. The flight was operated by Heart of Texas Hot Air Balloon Rides under 14 *Code of Federal Regulations* (CFR) Part 91 as a sightseeing passenger flight.

D. DETAILS OF THE INVESTIGATION

NTSB investigators traveled to Lockhart, Texas on July 30, 2016. The Operations (Ops) group was formed and conducted the initial field phase of the investigation on scene from July 30, 2016 to August 1, 2016.

On July 30, 2016, the Ops group received a briefing from local officials and emergency response. On scene examination was conducted, and FAA documentation on the flight, pilot and company were requested. Social media photos from the gondola during the accident flight were received and reviewed. Witness statements were obtained, and the Ops group Chairman assisted the Texas Department of Public Safety with a helicopter surveillance of the accident site and video documentation of the accident flight path from launch to accident site.

On July 31, 2016, additional files, photos and videos from social media were downloaded, and the accident site was again reviewed. Data plates from the basket[3] and envelope were recorded, and FAA toxicology examinations were requested. The aircraft logbook, Flight Manual and Maintenance Manual were obtained. The Ops Group and Investigator-in-Charge (IIC) received a

[1] All times are central daylight time (CDT) unless otherwise noted.
[2] According to FAA Advisory Circular (AC) 91-71 (dated June 13, 1996), a hot air balloon is a lighter-than-air aircraft that is not engine-driven and uses hot air for lift.
[3] According to AC 91-71, a gondola is a compartment occupied by the pilot and passengers. It is usually constructed of wicker, metal, or fiberglass. For the purposes of this Factual Report, gondola and basket are synonymous.

briefing from the sky dive school located at Fentress Airpark where the balloon launched from. Additional information regarding the pilot and operator were requested from the FAA.

On August 1, 2016, the Ops Group conducted interviews of the three ground crew for the accident flight. Additional maintenance documentation was received from the ground crew chief. The Group also received a briefing from the Caldwell County Sheriff's Office. A request from the balloon operator's insurance company for passenger release forms was directed to NTSB General Counsel (GC). Subpoenas were issued for the pilot and ground crew chief's phone records. Additional FAA documentation requests were submitted, along with Lockheed Martin recordings of the pilot's weather briefing. Additional information on operator's 2014 hard landing event was requested of the FAA. An out-brief was conducted by the IIC, and the field phase of the investigation was complete.

Following the field phase of the investigation, additional documentation regarding the pilot and balloon were obtained, and additional interviews conducted from August 3, 2016 to September 1, 2016.

From October 6, 2016 to October 7, 2016, the NTSB Ops group observed FAA inspectors conduct surveillance activities at the Albuquerque Balloon Festival in Albuquerque, New Mexico, and observed several Balloon Federation of America (BFA) meetings.

E. FACTUAL INFORMATION

1.0 History of Flight

The sight-seeing passenger balloon flight was scheduled for a launch at sunrise (0649) on July 30, 2016. According to the company website at the time of the accident, each balloon flight was planned for about one hour. According to interviews, the pilot and ground crew chief resided together, and the pilot woke up at about 0330 on the morning of the accident. At 0506 the pilot contacted the Lockheed Martin Flight Service (LMFS) and requested a weather briefing for 0630 to 0830 in the area of the San Marcus Regional Airport (HYI). During the briefing, the LMFS briefer stated "those clouds may be a problem for you, I don't know how low you want to stay but" and the accident pilot responded "well we just fly in between them" and "we find a hole and we go."[4]

According to the ground crew chief, the 15 passengers met the pilot, ground crew chief and two ground crew members at the Walmart parking lot in San Marcus Texas about 0545, where they signed liability release forms and were briefed by the ground crew chief. While at the Walmart parking lot, the pilot released a Pibal[5] helium balloon to test the winds and assist in determination of the launch site. Following release of the Pibal, the pilot elected to launch from Fentress Airpark (XS90) in Fentress, Texas.[6]

[4] For LMFS transcript, detailed weather and pilot weather briefing information, see Meteorological Group Chairman's Factual Report.
[5] According to AC 91-71, a Pibal (Pilot Balloon) is a small, helium-filled balloon launched before a flight to determine wind direction and velocity and identify windshear. It is used as an aid in selecting a launch site and/or landing site.
[6] For additional information, see Section 9.3 – Launch Site, of this Factual Report.

The ground crew and pilot drove the passengers to the Fentress Airpark for the launch, and according to witness statements and interviews with the ground crew, there was patchy fog on the drive to and in the area of Fentress Airpark. After arrival, the pilot released another Pibal to test the winds. The ground crew stated that the balloon setup was normal and uneventful, and according to data retrieved from the accident pilot's iPad, the balloon launched about 0658.[7] HYI was the closest official weather station and located about 5 miles west of the accident site. HYI had an Automated Weather Observing System (AWOS),[8] and at 0646, about 12 minutes prior to the launch, HYI recorded winds from 160 degrees at 4 knots, 2 statute miles visibility with mist, and a broken ceiling at 700 feet above ground level (agl).[9]

According to interviews, the balloon was seen by the ground crew chief entering "a little bit of fog," and the fog got "thicker" and the balloon basket was observed underneath low clouds. The ground crew lost visual contact with the balloon about 10 to 15 minutes after the launch as it flew into the clouds, and they then attempted to track the balloon's progress via a Glympse app[10] that was on the ground crew chief's phone and the pilot's iPad onboard the balloon. Multiple witnesses reported seeing the balloon flying in the fog.[11] According to interviews, at 0726 the pilot sent a Glympse message to the ground crew chief to indicate the position of the balloon. There were no further communications between the ground crew and the pilot, and the ground crew chief's attempts to contact the pilot via Glympse and cell phone were unsuccessful. Multiple photos were retrieved from electronic devices onboard the balloon that showed the balloon flying over cloud cover during the flight.[12]

According to the Lower Colorado River Authority (LCRA) records, the power lines adjacent to the accident site recorded a power trip at 0742 when the balloon contacted the power lines.[13] The balloon crashed about 8.3 miles from the launch site at North 29 53.136 West 97 45.669, [14] and the pilot and 15 passengers were fatally injured. The basket was located below a power line, and the envelope was located about one half mile downrange. At 0747, about 5 minutes after the accident, HYI recorded winds from 180 degrees at 4 knots, 2 statute miles visibility in mist, and an overcast ceiling at 300 feet agl.

2.0 Pilot Information

The pilot was 49 years old and resided in Kyle, Texas. He was the owner and sole pilot for Heart of Texas Hot Air Balloon Rides. According to the BFA, the accident pilot was not a member of

[7] See Electronic Devices Factual Report – Pilot.
[8] Automated Weather Observing System (AWOS) is equipped with meteorological instruments to observe and report temperature, dewpoint, wind speed and direction, visibility, cloud coverage and ceiling up to twelve thousand feet, and altimeter setting.
[9] For aviation purposes, a 'ceiling' is defined as the lowest layer of clouds reported as being broken or overcast, or the vertical visibility into an obscuration like fog or haze.
[10] According to it's website, Glympse is a mobile service that allows GPS-enabled mobile phone users to share their location via a Web-based map for a pre-set period of time. Source: https://www.glympse.com/about.
[11] See Attachment 2 – Witness Statements.
[12] See Electronic Devices Factual Report – Pilot and Meteorological Group Chairman's Factual Report.
[13] See Attachment 3 – LCRA Data.
[14] Source: Federal Bureau of Investigation (FBI).

BFA or the Professional Ride Operators (a part of the BFA), and had not participated in any local BFA sponsored safety meetings.

A search of FAA PTRS[15] found no records identifying the pilot, and revealed no accident/incident records pertaining to the pilot.

2.1 Pilot Certification[16]

On January 30, 1992, the accident pilot applied for a balloon student pilot Lighter-Than-Air (LTA) certificate, which was issued on February 6, 1992. On September 9, 1993, he applied for another balloon LTA student pilot certificate, which was issued on September 10, 1993. On the accident pilot's January 30, 1992 and September 9, 1993 student pilot Airman Certificate Application form, and October 22, 1993 commercial plot Airman Certificate Application form (form 8710-1), for question "U" (Have you ever been convicted for violation of Federal or State statues pertaining to narcotic drugs, marijuana, and depressant or stimulant drugs or substances, or motor vehicle operation involving alcohol related offences) the pilot answered "No." In addition, on each of these forms, the pilot signed and dated the Medical Statement, which stated "I have no known physical defect which makes me unable to pilot a glider or free balloon."

On October 19, 1993 the accident pilot took the Commercial Pilot Free Balloon – Hot Air written exam and scored an 83. On October 22, 1993, he applied for a Commercial Pilot LTA certificate and received the certificate on October 24, 1993, having conducted his FAA check ride at Hanover County Municipal Airport near Ashland, Virginia in an Eagle C-7.[17]

The pilot's commercial pilot license was reissued on December 14, 2006 to remove his social security number, and again on July 10, 2014 for a lost license.

2.1.1 Commercial Balloon Pilot Requirements

Title 14 CFR 61.129(h) Aeronautical experience (commercial pilot), stated the following experience requirements for a commercial balloon pilot:[18]

> *(h) For a balloon rating. A person who applies for a commercial pilot certificate with a lighter-than-air category and a balloon class rating must log at least 35 hours of flight time as a pilot, which includes at least the following requirements:*
>
> *(1) 20 hours in balloons;*

[15] The Program Tracking and Reporting Subsystem (PTRS) was a comprehensive information management and analysis system used in many Flight Standards Service (AFS) job functions. It provides the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety Inspectors (ASIs) in the field, the regions, and headquarters. This system provides managers and inspectors with the current data on airmen, air agencies, air operators, and many other facets of the air transportation system. Source: FAA.

[16] See Attachment 4– Pilot Information.

[17] The check ride was conducted in balloon N8519H or N851SH for 1.2 hours of flight time, and 5.5 hours of ground time.

[18] The experience requirements for a commercial pilot airplane category include 250 hours of flight time, 100 hours pilot in command time, and 50 hours of cross-country time.

(2) 10 flights in balloons;
(3) Two flights in balloons as the pilot in command; and
(4) 10 hours of flight training that includes at least 10 training flights with an authorized instructor in balloons on the areas of operation listed in §61.127(b)(8) of this part, which consists of at least—
(i) For a gas balloon—
(A) Two training flights of 2 hours each in a gas balloon with an authorized instructor in preparation for the practical test within the preceding 2 calendar months from the month of the test;
(B) 2 flights performing the duties of pilot in command in a gas balloon with an authorized instructor on the appropriate areas of operation; and
(C) One flight involving a controlled ascent to 5,000 feet above the launch site.
(ii) For a balloon with an airborne heater—
(A) Two training flights of 1 hour each in a balloon with an airborne heater with an authorized instructor in preparation for the practical test within the preceding 2 calendar months from the month of the test;
(B) Two solo flights in a balloon with an airborne heater on the appropriate areas of operation; and
(C) One flight involving a controlled ascent to 3,000 feet above the launch site.

To be eligible for a commercial pilot certificate with a balloon rating, an applicant must be 18 years of age, complete the specific training requirements described in 14 CFR 61, pass the required knowledge tests, and pass another practical test. The FAA has specified the aeronautical knowledge and flight proficiency that must be demonstrated to earn a commercial certificate as listed below.

Aeronautical Knowledge, Commercial Pilot, 14 CFR 61.125 requirements included the following:

(a) General. A person who applies for a commercial pilot certificate must receive and log ground training from an authorized instructor, or complete a home- study course, on the aeronautical knowledge areas of paragraph (b) of this section that apply to the aircraft category and class rating sought.
(b) Aeronautical knowledge areas.
1. Applicable Federal Aviation Regulations of this chapter that relate to commercial pilot privileges, limitations, and flight operations;
2. Accident reporting requirements of the National Transportation Safety Board;
3. Basic aerodynamics and the principles of flight;
4. Meteorology to include recognition of critical weather situations, windshear recognition and avoidance, and the use of aeronautical weather reports and forecasts;
5. Safe and efficient operation of aircraft;
6. Weight and balance computations;
7. Use of performance charts;

8. Significance and effects of exceeding aircraft performance limitations;
9. Use of aeronautical charts and a magnetic compass for pilotage and dead reckoning;
10. Use of air navigation facilities;
11. Aeronautical decision-making and judgment;
12. Principles and functions of aircraft systems;
13. Maneuvers, procedures, and emergency operations appropriate to the aircraft;
14. Night and high-altitude operations;
15. Procedures for operating within the National Airspace System; and
16. Procedures for flight and ground training for lighter-than-air ratings.

Flight Proficiency, Commercial Pilot, 14 CFR 61.127(b) requirements included the following:

(8) For a lighter-than-air category rating with a balloon class rating:
i. Fundamentals of instructing;[19]
ii. Technical subjects;
iii. Preflight preparation;
iv. Preflight lesson on a maneuver to be performed in flight;
v. Preflight procedures;
vi. Airport operations;
vii. Launches and landings;
viii. Performance maneuvers;
ix. Navigation;
x. Emergency operations; and
xi. Postflight procedures.

2.2 Recent Flight Experience

Title 14 CFR Part 61.57 Recent flight experience: Pilot in command, stated, in part, the following:

(a) General experience. (1) Except as provided in paragraph (e) of this section, no person may act as a pilot in command of an aircraft carrying passengers or of an aircraft certificated for more than one pilot flight crewmember unless that person has made at least three takeoffs and three landings within the preceding 90 days.

The pilot's personal flight logs were not recovered. According to information provided by the pilot's mother, between May 4, 2016 and July 25, 2016, the accident pilot flew on 20 separate days prior to the day of the accident.

2.3 Pilot Flight Times[20]

The pilot's estimated flight times:

[19] Commercial balloon rated pilots are authorized to conduct flight instruction.
[20] Times do not include accident flight. Flight times were derived from a review of the pilot's iPad data and times provided by the pilot's mother. For further information, see Electronic Devices Factual Report – Pilot.

Total pilot flying time	unknown
Total flying time last 24 hours	0
Total flying time last 7 days	1.15
Total flying time last 90 days	25.89
Total flying time last year	118.02

2.4 Flight Review

According to 14 CFR 61.56, no person may act as pilot in command of an aircraft unless, since the beginning of the 24th calendar month before the month in which that pilot acts as pilot in command, that person has:

> *(1) Accomplished a flight review given in an aircraft for which that pilot is rated by an authorized instructor and*
>
> *(2) A logbook endorsed from an authorized instructor who gave the review certifying that the person has satisfactorily completed the review.*

The regulation also stated that the review must consist of a minimum of 1 hour of flight training and 1 hour of ground training. The pilot's personal logbook was not recovered and the investigation could not verify that the pilot had a current 14 CFR 61.56 flight review.

2.5 Medical Certificate

According to the FAA, the accident pilot obtained a third class medical certificate (FAA Form 8500-9) on July 29, 1996.[21] A review of the medical application (FAA Form 8500-8) provided to the NTSB indicated that the accident pilot answered "No" to a history of any convictions involving driving while intoxicated , impaired, or under the influence of alcohol or a drug, and "No" to a history of non-traffic convictions.

Title 14 CFR Part 61.23 required pilots to hold a second class medical certificate when exercising the privileges of a commercial pilot certificate, and was valid for 12 calendar months.

However, 14 CFR 61.23(b) exempted commercial balloon pilots, and stated the following:

[21] The source indicating the pilot held a 3rd class medical certificate was an FAA review of the airman's information file made on July 30, 2016 at 2037. The FAA subsequently provided the NTSB an electronically generated summary of information from the original medical application form. The electronically retained information was a summary sheet related to the date of the application. Prior to October 1999, applications and medical examination findings were maintained in paper files as part of the FAA's Medical System of Records. In the transition to an electronic System of Records, one of three things occurred: original FAA 8500-8 paper records were scanned into templates in the electronic system, limited data were migrated from other systems onto templates in the electronic system, or paper records with no significant positive findings were destroyed after 3 years in accordance with the Federal Records Act and FAA Order 1350.14B, Records Management, and are not retained in the electronic system. Application information from FAA Form 8500-8 was rendered on an electronically generated summary sheet provided to the NTSB. The accident pilot did not have a medical certificate when he obtained his commercial balloon license in 1993, and it was not required per 14 CFR 61.23(b).

(b) Operations not requiring a medical certificate. A person is not required to hold a medical certificate—

(1) When exercising the privileges of a student pilot certificate while seeking—

(i) A sport pilot certificate with glider or balloon privileges; or

(ii) A pilot certificate with a glider category rating or balloon class rating;

(2) When exercising the privileges of a sport pilot certificate with privileges in a glider or balloon;

On September 6, 2016 the NTSB requested the FAA to provide a background/history and basis for excluding commercial balloon pilots from holding a medical certificate. In an email response received on November 4, 2016, the FAA indicated that the balloon pilot exclusion for 14 CFR 61.23 "has been around since the 1930's. The FAA does not have any information from the 1930's or before on the subject."[22]

The Balloon Flying Handbook (FAA-H-8083-11A), page 9-11, stated, in part, the following:

Balloon pilots and glider pilots are unique in that they "self-certify" they are physically fit to conduct flight duties. This is an individual responsibility and must not be abused. The ability to "self-certify" becomes particularly problematic after the balloon pilot has had a major medical issue arise, such as a heart attack, angina, major surgery, and other items in this category. While they may be perfectly capable of piloting a balloon after triple bypass surgery, for example, it may not be the recommended course of action.

The best recommendation is to be aware of the provisions of 14 CFR part 61. If a medical issue may be medically disqualifying for other pilots, the balloon pilot would be well advised to consult with an AME, and obtain recommendations on how best to proceed.

2.6 Pilot Background

According to FBI National Crime Information Center records and Missouri driving records, the accident pilot had multiple arrests, convictions, and incarcerations. Additionally, at the time of the accident the balloon pilot did not have a valid Missouri driver's license and was not eligible to obtain one until 2020.[23] A historical summary was provided by the NTSB Senior Advisor Special Ops and Interagency Coordination, and included the following:

- 1987 - Arrested twice, possession of drugs - Felony
  - Given 3 years of probation starting October 1987
  - Complete with extensive drug counseling
- 1996 - Interfering with an arrest - Misdemeanor
- 1998 - Driving While Intoxicated (DWI) /Alcohol and possession of a controlled substance - Felony
- 1999 - Possession of a controlled substance - Felony
- 1999 - Distribution and delivery of manufactured substance

[22] Email received by the NTSB Ops Group Chairman from the FAA on November 4, 2016.

[23] The accident pilot did not hold a Texas Driver's License. He was issued a Texas ID (identification) card, dated April 2016.

    - Convicted and sentenced for 10 years August 2002
- 2000 - DWI/Alcohol "persistent offender"
    - Sentenced to 1 year, guilty as of September 2002
    - Incarcerated from October 2002 to April 2004
- 2007 - Leaving the scene of an accident and operating with suspended Driver's License (DL)
- 2010 - DWI/Alcohol "aggravated offender" and operating with a revoked DL
    - DL revoked until 2020
    - Incarcerated July 10, 2010 - released into probation on January 28, 2012
    - Complete release (finished jail and probation period) as of August 26, 2013

According to an email sent to the NTSB, a balloon pilot in Austin, Texas contacted the FAA in December 2012 and January 2013 regarding the accident pilot's "unreported DWI."[24] On July 22, 2013, the FAA sent a memorandum to the Civil Aerospace Medical Institute (CAMI) AAM-313 office detailing the accident pilot's multiple driving convictions between August 30, 1985 and May 25, 2010. According to the memorandum, the FAA (AMC-700) recommended no enforcement action on the accident pilot.[25]

Title 14 CFR 61.15 Offenses involving alcohol or drugs, stated, in part, the following:

> *(a) A conviction for the violation of any Federal or State statute relating to the growing, processing, manufacture, sale, disposition, possession, transportation, or importation of narcotic drugs, marijuana, or depressant or stimulant drugs or substances is grounds for:*
>
> *(1) Denial of an application for any certificate, rating, or authorization issued under this part for a period of up to 1 year after the date of final conviction; or*
>
> *(2) Suspension or revocation of any certificate, rating, or authorization issued under this part.*
>
> *(b) Committing an act prohibited by §91.17(a) or §91.19(a)[26] of this chapter is grounds for:*
>
> *(1) Denial of an application for a certificate, rating, or authorization issued under this part for a period of up to 1 year after the date of that act; or*
>
> *(2) Suspension or revocation of any certificate, rating, or authorization issued under this part.*
>
> *(c) For the purposes of paragraphs (d), (e), and (f) of this section, a motor vehicle action means:*
>
> *(1) A conviction after November 29, 1990, for the violation of any Federal or State statute relating to the operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug, or while under the influence of alcohol or a drug;*

[24] See Attachment 2 – Witness Statements.
[25] See Attachment 5– FAA Memorandum.
[26] Title 14 CFR 91.17 stated no person may act or attempt to act as a crewmember of a civil aircraft within 8 hours after the consumption of any alcoholic beverage, while under the influence of alcohol, or while using any drug that affects the person's faculties in any way contrary to safety. Title 14 CFR 91.19 prohibited the carriage of narcotic drugs, marihuana, and depressant or stimulant drugs or substances.

(2) The cancellation, suspension, or revocation of a license to operate a motor vehicle after November 29, 1990, for a cause related to the operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug, or while under the influence of alcohol or a drug; or

(3) The denial after November 29, 1990, of an application for a license to operate a motor vehicle for a cause related to the operation of a motor vehicle while intoxicated by alcohol or a drug, while impaired by alcohol or a drug, or while under the influence of alcohol or a drug.

(d) Except for a motor vehicle action that results from the same incident or arises out of the same factual circumstances, a motor vehicle action occurring within 3 years of a previous motor vehicle action is grounds for:

(1) Denial of an application for any certificate, rating, or authorization issued under this part for a period of up to 1 year after the date of the last motor vehicle action; or

(2) Suspension or revocation of any certificate, rating, or authorization issued under this part.

Title 14 CFR 61.15 further stated, in part, the following:

(e) Each person holding a certificate issued under this part shall provide a written report of each motor vehicle action to the FAA, Civil Aviation Security Division (AMC-700), P.O. Box 25810, Oklahoma City, OK 73125, not later than 60 days after the motor vehicle action. The report must include:

(1) The person's name, address, date of birth, and airman certificate number;

(2) The type of violation that resulted in the conviction or the administrative action;

(3) The date of the conviction or administrative action;

(4) The State that holds the record of conviction or administrative action; and

(5) A statement of whether the motor vehicle action resulted from the same incident or arose out of the same factual circumstances related to a previously reported motor vehicle action.

(f) Failure to comply with paragraph (e) of this section is grounds for:

(1) Denial of an application for any certificate, rating, or authorization issued under this part for a period of up to 1 year after the date of the motor vehicle action; or

(2) Suspension or revocation of any certificate, rating, or authorization issued under this part.

A review of FAA records found no written report from the accident pilot per 14 CFR 61.15(e) for his convictions between 1993 and 2010 while he held a commercial balloon license.

3.0 Balloon Information[27]

Photo 1: Photo of accident balloon (N2469L).[28]

The accident balloon was manufactured in 2014. According to the Kubicek Maintenance Manual, the envelope of a balloon was considered the aircraft component of the balloon, and was identified by a serial number and a registration.[29] The FAA registration for the accident balloon was N2469L, and the serial number was 1076.

According to the bill of sale, the balloon was purchased from Kubicek by the accident pilot on July 8, 2014. FAA records indicated that N2469L was certificated by the FAA on August 7, 2014 (expiration August 31, 2017) to the accident pilot in Indialantic, Florida.[30]

The balloon held an FAA Standard Airworthiness Certificate (balloon category) dated August 15, 2014. The original certificate was provided to the NTSB by the ground crew chief on August 1, 2016 and was not in the balloon at the time of the accident.[31]

Title 14 CFR 91.203(a) Civil Aircraft: Certifications required, stated, in part, the following:

> *(a) Except as provided in §91.715, no person may operate a civil aircraft unless it has within it the following:*

[27] According to 14 CFR Part 1.1, an aircraft was "a device that is used or intended to be used for flight in the air," and a balloon was "a lighter-than-air aircraft that is not engine driven, and that sustains flight through the use of either gas buoyancy or an airborne heater." According to AC 91-71, an airborne heater is a device carried in the balloon used to generate heat to maintain the temperature of the air inside the balloon envelope, normally a propane-powered burner assembly. Lighter-than-air is an aircraft that is not engine-driven and uses hot air for lift.

[28] Photo of accident balloon provided by Tom Latson, NTSB (date unknown). The photo does not depict the accident flight.

[29] Source: Kubicek Maintenance Manual, page 2-1.

[30] See Attachment 6– Balloon Information.

[31] See Attachment 6 – Balloon Information.

(1) An appropriate and current airworthiness certificate.

The effective U.S. registration certificate for N2469L, issued to the owner and also required by 14 CFR 91.203(2) to be onboard the balloon, was not recovered.

According to the Kubicek Flight Manual, the minimum crew for the balloon was one pilot "suitably qualified to carry out the flight."[32]

3.1 Envelope

According to the Order Specifications, the envelope was a "ready-to-fly hot-air balloon envelope" made of polyester fabric with a total volume of 300,000 cubic feet. It was also equipped with a Flytec TT34 sensor to monitor envelope temperature.

The data plate, recovered at the accident site, indicated the envelope was a BB85Z, serial #1076, and weighed 701 pounds (See Photo 2).

Photo 2: Photo of N2469L data plate found on balloon envelope.[33]

3.2 Basket

The basket was a Kubicek K60 double T partition (base outside dimensions 1.60 x 3.80 meters, total height 1.32 meters, inside height 1.16 meters). According to the Kubicek Flight Manual, it was constructed with traditional wicker sides above a marine grade plywood floor. The basket walls had small openings to permit straps to be fed through for securing the fuel cylinders. Flexible

[32] Source: Kubicek Flight Manual, page 2-3.
[33] Photo of balloon data plate taken at the accident site, taken by Ops Group Chairman on July 31, 2016.

rods fit into sockets on the top rim of the basket and into sockets on the underside of the burner frame to support the burner.

Load bearing basket cables formed a continuous sling around the basket and were connected at both ends to the burner frame to support the weight of the basket when the balloon was in flight.[34]

The K60 had internal "double T" partitions woven into the walls and floor of the basket. These partitions provided additional structural integrity to the basket and separation between groups of passengers (See Photo 3).

Photo 3: Kubicek photo of 18 passenger balloon basket. [35]

According to the Kubicek website, the K60 had a pilot's compartment (center compartment) and four passenger compartments. The pilot's compartment was designed for the pilot plus up to six fuel cylinders. There was an option to have an extra crew person or passenger in the pilot compartment, however, the number of fuel cylinders would have to be reduced in accordance with the Flight Manual. According to an examination of the accident site, four 20-gallon propane tanks were onboard the basket.

According to the Kubicek Flight Manual, a maximum of four passengers could occupy each of the four passenger compartments, and one pilot and one passenger could occupy the center pilot compartment (See Figure 1). The maximum capacity of the K60 basket was 18 occupants. There were 16 occupants on the accident flight.

[34] For additional information see Airworthiness Group Chairman's Factual Report.
[35] Source: http://www.kubicekballoons.eu/baskets/tt-baskets.

Occupancy of Compartmentalised Baskets:

Basket	Max. Occupancy of Passenger Compartments	Max. Occupancy of Pilot Compartment	Pilot Compartment Floor Area	
			[m^2]	[sq. ft]
K28	3 persons	pilot + 1 person	1.32 (variant T) 1.12 (variant Y)	14.2 (variant T) 12.1 (variant Y)
K32T	4 persons	pilot + 1 person	1.32	14.2
K32Y	4 persons	pilot + 1 person	1.12	12.1
K32TT	2 persons	pilot + 1 person	1.32	14.2
K40T	5 persons	pilot + 1 person	1.32	14.2
K40Y	5 persons	pilot + 1 person	1.12	12.1
K50	6 persons	pilot + 1 person	1.32 (variant T) 1.12 (variant Y)	14.2 (variant T) 12.0 (variant Y)
K50TT	3 persons	pilot + 1 person	1.32	14.2
K60	4 persons	pilot + 1 person	1.32	14.2
K70	5 persons	pilot + 1 person		
K80	6 persons	pilot + 1 person		
K85	6 person	pilot + 1 person	1.32 (1.84 option)	14.2 (19.8 option)
K90	outer comp.: 2 persons inner comp.: 4 persons	pilot + 1 person	1.32 (1.84 option)	14.2 (19.8 option)
K100	outer comp.: 3 persons inner comp.: 4 persons	pilot + 1 person	1.84	19.8
K110	4 persons	pilot + 1 person	1.84	19.8

NOTE:

The number of fuel cylinders is to be established according to instructions given in the Appendix 2.

A simplified general practice for passenger compartments is: "one cylinder in - one person out".

Figure 1: : Kubicek compartment occupancy limits.[36]

The data plate for the basket, recovered from the accident site, indicated the basket was a Type – BB, Type Certificate – B04CL, size – K60 (serial # 551) with a production date of June 2014. The basket weight was 785 pounds (See Photo 4).

[36] Source: Kubicek Flight Manual, page 2-7.

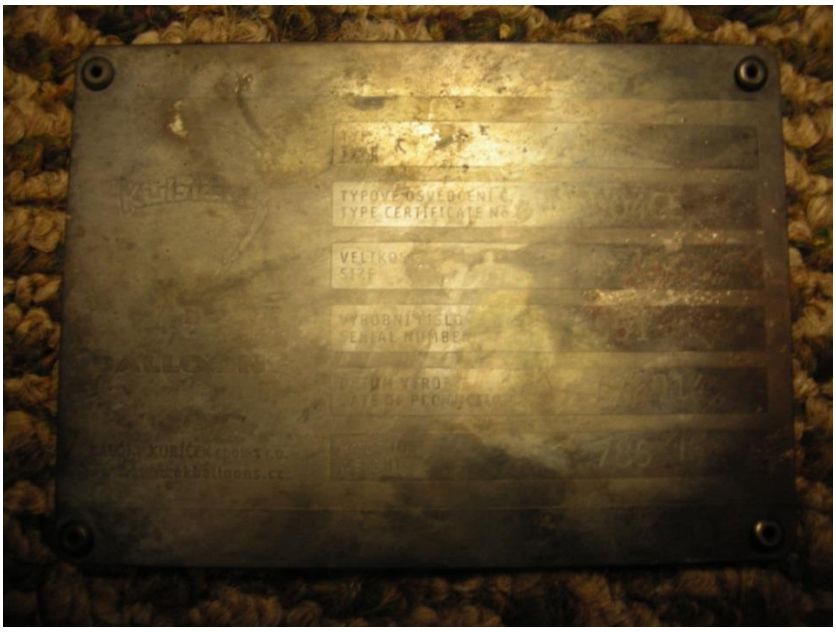

Photo 4: Photo of basket data plate indicating a K60 empty weight of the basket of 785 pounds.[37]

According to the order specifications, the balloon was equipped with an Ignis triple-burner system used to fill and heat the air mass inside the envelope. There were four Ultramagic MD40D propane cylinders recovered at the accident site. For additional information on the burner system and propane cylinders, see the Airworthiness Group Chairman's Factual Report.

3.3 N2469L Annual Inspection

Balloons were required to have annual airworthiness inspections. Title 14 CFR 91.409 Inspections, stated, in part, the following:

> *(a) Except as provided in paragraph (c) of this section, no person may operate an aircraft unless, within the preceding 12 calendar months, it has had—*
>
> *(1) An annual inspection in accordance with part 43 of this chapter and has been approved for return to service by a person authorized by §43.7 of this chapter; or*
>
> *(2) An inspection for the issuance of an airworthiness certificate in accordance with part 21 of this chapter.*
>
> *No inspection performed under paragraph (b) of this section may be substituted for any inspection required by this paragraph unless it is performed by a person authorized to perform annual inspections and is entered as an "annual" inspection in the required maintenance records.*

According to the Kubicek Flight Manual, the manufacturer prescribed annual inspections every 100 hours or 12 calendar months, whichever occurred first.[38] The inspection was to include review of the balloon envelope, basket, burner, fuel cylinders, instruments, equipment and accessories.

[37] Photo taken by Ops Group Chairman on July 31, 2016.
[38] Source: Kubicek Flight Manual page 7-1.

According to the Kubicek Flight Manual, all balloon maintenance and repairs were to be carried out in accordance with the Kubicek Balloons Maintenance Manual (document no. B2205). Annual inspections procedures were contained in the Kubicek Maintenance Manual, Section 4.1.[39]

A review of the balloon logbook provided to the NTSB by the ground crew chief indicated that an annual inspection was conducted on N2469L on May 23, 2015 when the balloon had a total of 54 flight hours.[40] The annual inspection for N2469L expired on May 31, 2016.

A work order dated August 9, 2015 was provided to the NTSB by the ground crew chief that indicated a "Complete Annual." In an August 6, 2016 email to the NTSB Ops Group Chairman, the inspector stated that the work order was used only as an "invoice" for unpaid services, and the last annual inspection he performed on N2469L was on May 23, 2015.[41] The investigation was unable to locate any records indicating a current annual inspection for N2469L at the time of the accident.

4.0 Weight Information

Operational weight limitations were found in the Kubicek Flight Manual. The passenger weights were derived from the flight manifest information provided by the pilot's mother, and included passenger-provided weights during the online booking process.[42]

The propane tanks were filled previously at the Martindale Guadalupe Gas Company on July 25, 2016 to include four 20-gallon tanks and one 16-gallon inflation tank.[43] The inflation tank was used prior to launch to inflate the balloon, and was not carried during flight. According to ground crew chief, each 20-gallon propane tank was filled to capacity and had an endurance of about 1:25 hours. According to the Kubicek Flight Manual (Section 2.3 Fuel), the minimum fuel quantity required in the basket is one full fuel cylinder for each burner unit. The accident balloon had a 3-burner system.

Estimated weights

	Passenger weight	2,380
	Pilot weight[44]	227
	Total occupant weight	2,607
	Propane weight tank weight[45]	192.4
	Propane (80 gallons @ 4.23 lbs./gallon)	338.4
	Total basket load	3,137.8
	Basket Load Capacity	**3,965**
	Basket Weight	701
	Total basket weight	3,838.8

[39] See Attachment 7 - N2469L Inspection Record.
[40] See Attachment 8 – N2469L Logbook.
[41] See Attachment 7 – N2469L Inspection Record, and Attachment 2 – Witness Statements.
[42] See Attachment 9 - Flight Manifest.
[43] See Attachment 9 - Flight Manifest.
[44] Source: Accident pilot's 3rd class medical certificate application (FAA Form 2120-0034) dated July 29, 1996.
[45] The balloon carried four Ultramagic M-40 20-gallon propane tanks. Each tank weighed 48.1 pounds.

	Envelope weight	785
	Burner weight (triple burner)	123
	Takeoff weight	4,746.8
	Maximum Takeoff Weight (MTOW)	**6,217**
	Minimum Landing Weight	**2,976**

The maximum envelope weight limits were defined in the Kubicek Flight Manual. The maximum takeoff weight for a BB85Z (the accident envelope) was 6,217 pounds (see Figure 2). The estimated takeoff weight for the accident flight was 4,746.8 pounds.

Envelope Weight Limits:

Envelope Model	Max. Take-off Weight (MTOW)		Min. Landing Weight (MLW)	
	[kg]	[lb]	[kg]	[lb]
BB17GP, BB17XR	495	1 090	250	551
BB20, BB20E, BB20ED	630	1 389	280	617
BB20GP, BB20XR	730	1 609	280	617
BB22E, BB22ED	680	1 498	300	661
BB22, BB22D, BB22N, BB22Z	730	1 609	300	661
BB22XR	780	1 720	300	661
BB26E, BB26ED	730	1 609	340	749
BB26, BB26D, BB26N, BB26Z, BB26XR	840	1 852	340	749
BB30ED	840	1 852	410	904
BB30D, BB30N, BB30Z, BB30XR	945	2 083	410	904
BB34ED	945	2 083	455	1 003
BB34D, BB34Z	1 040	2 291	455	1 003
BB37D, BB37N, BB37Z	1 150	2 535	500	1 102
BB40D, BB40Z	1 310	2 885	580	1 278
BB42D, BB42Z	1 410	3 109	630	1 389
BB45D, BB45N, BB45Z	1 520	3 351	670	1 477
BB51D, BB51Z	1 690	3 726	780	1 720
BB60D, BB60N, BB60Z	1 940	4 277	930	2 050
BB70D, BB70Z	2 300	5 071	1 060	2 337
BB85D, BB85Z	2 820	6 217	1 350	2 976
BB100D, BB100Z	3 200	7 055	1 600	3 527
BB120P	3 700	8 150	1 850	4 075
BB142P	4 500	9 912	2 000	4 405

Check on page I of this Manual that the MTOW has not been reduced by the operator. If a reduction has been made then the weight, shown on the page I of this Manual as Applicable MTOW, must not be exceeded.

Figure 2: Kubicek envelope weight limitations.[46]

According to the Kubicek Flight Manual, each occupant within a basket must be provided reasonable space for comfort during the flight and safety on landing. Within a compartment there must be at least one hand hold for each passenger.

[46] Source: Kubicek Flight Manual, page 2-5.

The load capacity for the accident balloon was 3,965 pounds with a maximum of 18 occupants (1 pilot and 17 passengers (see Figure 3). The estimated occupant and fuel weight was 3,137.8 pounds.

Baskets Limitations:

Basket	Minimum floor area		Load capacity		Max. Number of Occupants
	[m²]	[sq. ft]	[kg]	[lb]	
K10	0.99	10.7	600	1 322	3
K11	1.14	12.2	650	1 432	4
K12, K12A	1.35	14.5	700	1 542	5
K13	1.22	13.1	700	1 542	4
K13S	1,20	12,9	550	1 210	3
K15	1.57	16.9	800	1 762	5
K16	1.68	18.1	900	1 982	6
K17	1.42	15.3	900	1 982	6
K18	1.80	19.4	950	2 093	7
K22	2.25	24.2	980	2 159	8
K25P	2.62	28.2	1 000	2 203	8
K28	3.52	37.9	1 100	2 423	8
K32Y, K32T	3.84	41.3	1 100	2 423	10
K32TT	4.00	43.1	1 100	2 423	10
K40Y, K40T	4.32	46.5	1 200	2 643	12
K50	4.80	51.7	1 400	3 084	14
K50TT	4.80	51.7	1 400	3 084	14
K60	6.08	65.4	1 800	3 965	18
K70	7.04	75.8	3 000	6 608	22
K80	7.68	82.7	3 400	7 489	26
K85	8.32 (8.80 option)	89.6 (94.7 option)	3 400	7 489	26
K90	8.32 (8.80 option)	89.6 (94.7 option)	3 400	7 489	26
K100	9.76	105.1	4 000	8 811	30
K110	10.56	113.7	4 000	8 811	34

Figure 3: Kubicek basket load limitations.[47]

The Kubicek Flight Manual, page 8-7, further stated, in part, the following:

> *In addition to the limitations in section 2 (Operational Limitations) and Section 5 (Weight) the following factors should be considered when deciding how many occupants may be carried in a basket. This guidance assumes that the standard occupant is an adult with a weight of 77 kg. (170 lb).*
>
> *The pilot should take into account the relative weight of the passengers and evenly distribute the payload when a compartmentalized basket is used.*
>
> *For all baskets each passenger should have a minimum of 0.25 m² (2.6 sq ft) of floor area.*
>
> *Each fuel cylinder occupies a floor area of 0.1 m² (1 sq ft) and this area multiplied by the number of cylinders carried must be deducted from the total floor area before the*

[47] Source: Kubicek Flight Manual, page 2-6.

remaining floor area can be divided to 0.25 m² to determine how many people may be safely within the basket compartment.

The minimum floor area for a K60TT basket was 65.4 square feet. The minimum floor area taking into account the 4 propane cylinders was 61.4 square feet. The 16 occupants on the accident flight had a floor area of 3.83 square feet in the basket.

5.0 Performance

Balloon performance information was contained in Kubicek Flight Manual, and included charts with information regarding the balloon's maximum lifting capacity, minimum climb rate in the first 60 seconds, maximum rate of descent, altitude loss during a maximum descent, and maximum rate of climb or descent. For detailed information, see Attachment 10 – Kubicek Performance Information.

According to multiple balloon pilots, there was a performance difference between smaller and larger balloons. According to one pilot who flew the accident balloon, "the 300 balloon was a larger balloon and with less maneuverability than smaller balloons that had more space to turn around. The 300 simply had more mass and inertia to handle." The same pilot further said "big balloons like the 300 were new to the US over the past 10 years. Those balloons were much different and involved a higher skill level to fly. Little balloons were easy to handle." The ground crew chief said "the [accident] balloon was 9.5 stories tall, and once it gained a little bit of speed it was hard to slow it down in a descent. That was why they never flew in winds above 9 miles an hour." He added "you would have to grab 'all three burners' on the balloon to get it to go up, and even then there was a pause."[48]

The Balloon Flying Handbook, page 2-14, stated, in part, the following:

Different balloon sizes offer different advantages. The size of the balloon purchased should be determined according to planned use(s). Most pilots think smaller balloons are easier to handle, fly, and pack up. Bigger balloons use less fuel, operate cooler, and last longer. Higher elevations or hotter climates or passengers indicate a larger balloon. Balloon competitions and sport flying require a smaller balloon.

The Balloon Flying Handbook, page 2-14, provided a chart for the "most popular [balloon] size ranges in use today." The chart showed balloon volumes ranging from the smallest at 31,779 cubic feet to the largest at 141,240 cubic feet. The accident balloon was 300,000 cubic feet in volume. According to it's website, Kubicek manufactures balloons with volumes ranging from 31,000 cubic feet (BB9E) carrying a single pilot, to 500,000 cubic feet (BB142P) with the ability to carry the pilot and 24 to 28 passengers.[49]

The Kubicek Flight Manual, Section 4.2, stated the following caution:

[48] See Attachment 1 – Interview Summaries.
[49] Source: http://www.kubicekballoons.eu/envelopes/envelope-sizes.

Pay particular attention when intending to take off with an envelope of bigger size and only the minimum allowed fuel onboard. This situation will only provide enough fuel for a very short flight.

6.0 Navigation

According to interviews, the pilot used his iPad to navigate while airborne.[50] The pilot also had a Flytec[51] instrument used to monitor rate of climb, envelope temperature and altitude.

It is unknown if the accident pilot referenced a sectional chart during the accident flight (none was recovered). The power lines adjacent to the accident site were not depicted on the chart (see Figure 4).

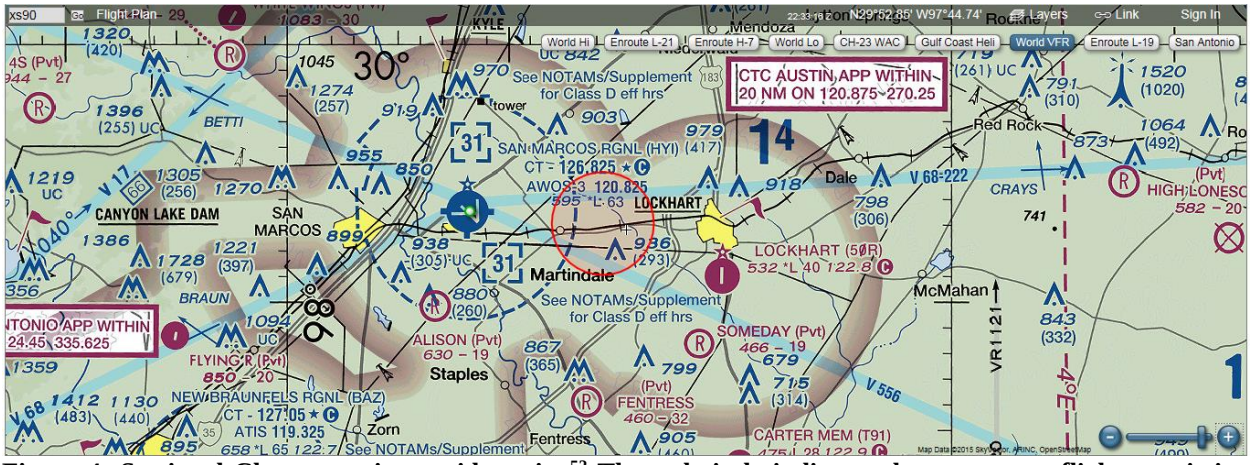

Figure 4: Sectional Chart covering accident site.[52] The red circle indicates the temporary flight restriction (TFR) over the accident site.

According to interviews, the pilot and ground crew used a Glympse app on their iPad and iPhones (respectively) to track the position of the balloon during flight. According to the ground crew chief, the pilot last sent a message through Glympse at 0726 to indicate his position and his intention to land.

The Balloon Flying Handbook, page 93-4, stated, in part, the following:

Navigation of a balloon is unlike that of any other aircraft because it cannot be steered in the conventional sense. Directional control is achieved through the use of differing wind directions at different altitudes. With effort, study, and some practice, it is possible for a

[50] For additional information, see Electronic Devices Factual Report – Pilot.
[51] According to the company website, the Flytec was a handheld (or strap-on) instrument that measured altimeter, variometer, chronometric and envelope temperature data (via aTT34 remote pyrometer). Source: http://www.flytec.com/3040.html. See also See Electronic Devices Factual Report – Pilot.
[52] Source: https://skyvector.com/.

balloon pilot to determine a point on the ground at some distance, and fly to it with relative ease and accuracy.

The Aeronautical Information Manual (AIM, dated April 3, 2014), Section 5-5-8 See and Avoid (dated April 3 2014), stated, in part, the following:

a. Pilot. When meteorological conditions permit, regardless of type of flight plan or whether or not under control of a radar facility, the pilot is responsible to see and avoid other traffic, terrain, or obstacles.

The Balloon Flying Handbook, page 1-5, stated, in part, the following in part:

With regards to balloon operations, the argument can be made that any discussion of collision avoidance applies when dealing with operations close to the ground. When contour flying, or during an approach to a landing site, the potential of collision with trees, power lines, and other obstacles is increased. The techniques used in collision avoidance can be extremely valuable, particularly in the evolution of a balloon flight, as the pilot is perhaps exposed more to the dangers of collision than any other aircraft.

The "See and Avoid" concept relies on knowledge of the limitations of the human eye, and the use of proper visual scanning techniques to help compensate for these limitations. The importance of, and the proper techniques for, visual scanning should be taught to a student pilot at the very beginning of flight training. The competent flight instructor should be familiar with the visual scanning and collision avoidance information contained in AC 90-48, Pilot's Role in Collision Avoidance, and the Aeronautical Information Manual (AIM).

7.0 Air Traffic Control [53]

The accident flight was not in communications with Air Traffic Control (ATC). Radar was obtained from the FAA's Austin Terminal Radar Approach Control facility (AUS) located in Austin, Texas. The data was from the AUS Airport Surveillance Radar (ASR-9) and was useable and of good quality. Primary radar data was consistent with N2469L traveling northeast near Maxwell, Texas near the time of the accident (0742).

[53] ATC information provided and reviewed by Andy Olvis, NTSB Senior Air Traffic Control Investigator.

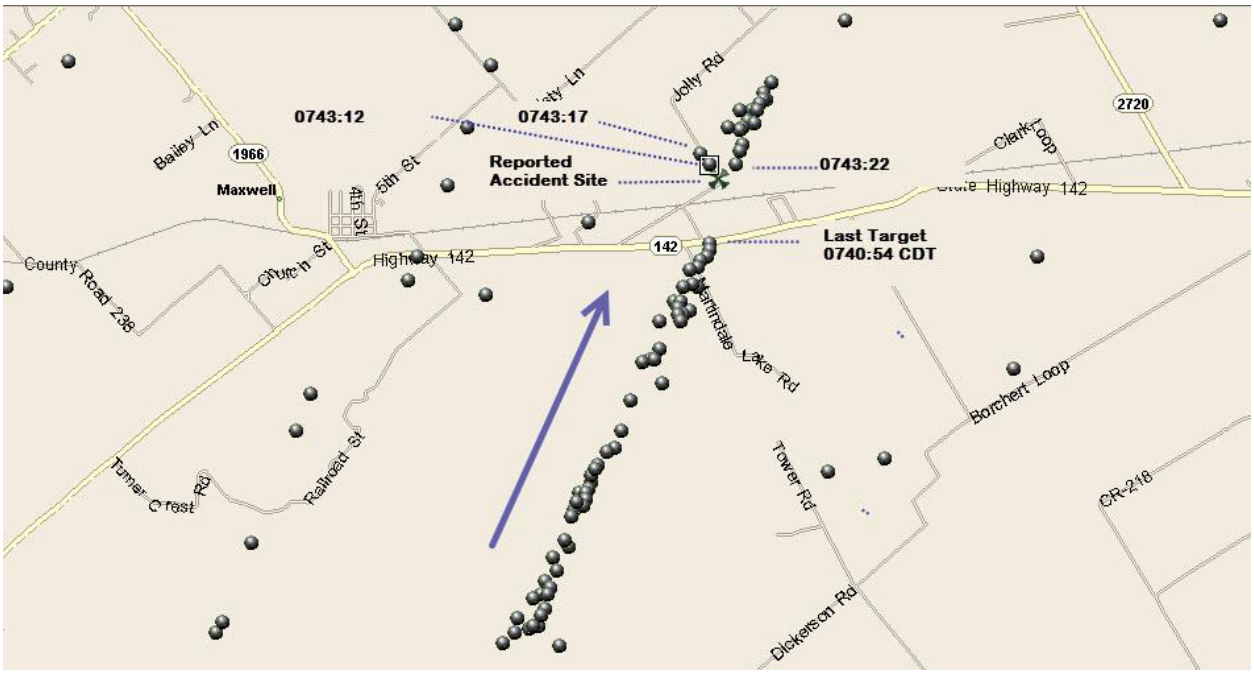

Figure 5: ATC primary radar data for the accident flight.

8.0 Communications

There were no known communication difficulties. The pilot did not issue a distress call to ATC or the ground crew during the accident flight.

9.0 Flight Planning

9.1 Decision to Fly

The Kubicek Flight Manual, Section 4.3.4 Deciding Whether to Fly, page 4-4, provided the following guidance for deciding whether or not to fly the balloon:

Weather	*Do not fly in thermals, turbulence or in strong wind*
Launch site	*No downwind obstacles*
Weight	*The balloon is within maximum takeoff weight*
Fuel	*The minimum fuel quantity required at takeoff is one full cylinder for each burner unit*

9.2 Launch Site Determination

According to the Kubicek Flight Manual, page 4-1, a launch site should be chosen that will, in the prevailing weather conditions, allow the balloon to be safely flown for the required amount of time. The site should be clear of obstructions on its downwind side and have a clear, ideally a grassy, area large enough to lay the balloon out safely. In addition, there should be no obstructions that could damage the balloon during the inflation or if it moved around on the ground before taking off.

The Kubicek Flight Manual, page 4-1, stated the following:

> *Before starting to prepare the balloon for flying the pilot must calculate the balloons loading and check the suitability of the actual and forecast weather for the flying area. When considering a particular flying area make sure that the wind direction from the site and the amount of fuel onboard will allow the balloon to be landed clear of natural and man made [sp] obstructions and away from restricted airspace*.

AC 91-71 stated the following:

> *The appropriateness of any launch site involves much more than its physical size and absence of obstructions, even though these are important considerations. Of equal or greater importance is the direction the balloon will track following the launch. Any site selection made should include consideration of local winds as determined by pibal, smoke, trees, or other physical indications; forecast and reported winds aloft; and local phenomena peculiar to the specific site (determined by personal knowledge or by consulting with local balloonists). Also, location of obstructions along the projected flightpath and available suitable landing sites down range should be considered. Once a launch site is selected and flight preparations have begun, any situation that may adversely affect or change the planned flight (wind shift, lowering clouds, or obscuring phenomena such as fog or smoke) should be carefully considered. If the change or adverse situation is unacceptable, the launch site should be moved to another location or the flight should be canceled. The adage, "better to cancel and fly another day than to make a mistake along the way," is a useful guideline.*

9.3 Launch Site

Following release of a Pibal in the Walmart parking lot on the morning of the accident, the pilot elected to launch the balloon from the southern portion of Fentress Airpark in Fentress, Texas near the intersection of Highway 80 (San Marcus Highway) and Airfield Road. Fentress Airpark (FAA airport identifier XS90) was a private-use and privately owned airport located at coordinates North 29 46 12.59 and West 97 46 24.29, and had a field elevation of 460 mean sea level (msl). The airpark was 7 nautical miles (nm) southwest of Lockhart Municipal Airport (FAA airport identifier 50R), 9 nm southeast of the San Marcus Regional Airport (HYI), and 26 nm south of Austin-Bergstrom International Airport (KAUS). The airpark did not have ATC facilities or weather reporting capabilities, and did not have an instrument approach. The airpark was not listed by the FAA in the Chart Supplement database (formerly the Airport/Facility Directory).[54]

Fentress Airpark was the primary base of operations for Skydive San Marcus, located at 517 Airfield Road, Fentress, Texas 78622. According to the owner of Skydive San Marcus, the accident pilot would typically launch about 0700 "without the property owner's permission" about once a month. On the morning of the accident, he observed fog at about 0800 at the airpark, which prevented Skydive San Marcus from launching one of its airplanes until about 1000 that morning.

[54] Source: https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dafd/search/.

According to one of his employees who witnessed the launch, the balloon was observed rising into the fog after takeoff.

9.4 Passenger Briefing

The passenger safety briefing requirements of 14 CFR 91.519 do not include balloon passengers. The passengers of the accident flight were required to sign liability release forms. According to the ground crew chief, the accident pilot conducted a safety briefing prior to the accident flight, and told the passengers where to position themselves in the basket in case of an emergency or a descent involving a "fast approach." The briefing was verbal, and the accident pilot did not reference a checklist.[55]

The Kubicek Fight Manual included passenger briefings for both open and partitioned baskets. For additional information see Attachment 14 – Kubicek Passenger Briefing.

10.0 Weather Assessment

Prior to launch on the morning of the accident, the pilot obtained a weather briefing from LMFS at 0506, and according to information from the pilot's iPad, he reviewed weather from two different websites.[56]

Title 14 CFR 91.103 Preflight action, stated the following:

> *Each pilot in command shall, before beginning a flight, become familiar with all available information concerning that flight. This information must include—*
>
> *(a) For a flight under IFR or a flight not in the vicinity of an airport, weather reports and forecasts, fuel requirements, alternatives available if the planned flight cannot be completed, and any known traffic delays of which the pilot in command has been advised by ATC;*
> *(b) For any flight, runway lengths at airports of intended use, and the following takeoff and landing distance information:*
>
> > *(1) For civil aircraft for which an approved Airplane or Rotorcraft Flight Manual containing takeoff and landing distance data is required, the takeoff and landing distance data contained therein; and*
> > *(2) For civil aircraft other than those specified in paragraph (b)(1) of this section, other reliable information appropriate to the aircraft, relating to aircraft performance under expected values of airport elevation and runway slope, aircraft gross weight, and wind and temperature.*

The AIM, Section 3−3−2 VFR (Visual Flight Rules) Requirements, stated, in part, the following:

[55] See Attachment 1 – Interview Summaries.
[56] For additional information, see Meteorological Group Chairman's Factual Report.

Rules governing VFR flight have been adopted to assist the pilot in meeting the responsibility to see and avoid other aircraft. Minimum flight visibility and distance from clouds required for VFR flight are contained in 14 CFR Section 91.155.

The accident flight launched in Class G airspace. Title 14 CFR 91.155 defined Class G airspace as uncontrolled airspace (no ATC control) generally 700 or 1,200 feet, or less, above the surface (regardless of msl altitude). There were no communications requirements to operate in Class G airspace, and the visual flight rules (VFR) weather minimums for day operations required 1 statute mile visibility and to remain clear of clouds. During the flight, the balloon climbed to a maximum altitude of about 1,080 feet msl, or about 620 feet above the ground.[57] Class E airspace was controlled airspace which was neither class A, B, C nor D airspace that lay above Class G airspace, and when below 10,000 feet msl required a 3 statute mile visibility and a distance from clouds that included 500 feet below, 1,000 feet above, and 2,000 feet horizontal.

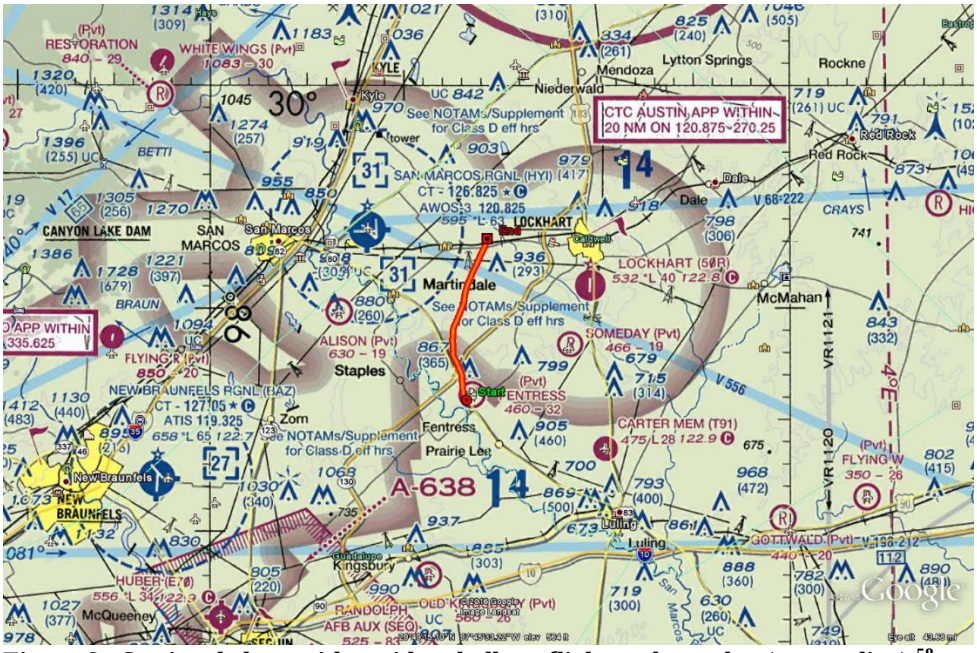

Figure 6: Sectional chart with accident balloon flight path overlay (orange line).[58]

The Balloon Flying Handbook, page 4-41, stated the following:

A thorough understanding of the weather is a "make or break" item for the balloon pilot; without a complete picture of the weather, a pilot may make an ill-advised decision to launch that may result in injury, damage to the balloon, or worse. It is imperative that a pilot use as many resources as he can, understanding the variables potentially affecting flight, and making an informed decision to conduct a safe flight.

Perhaps the most valuable point to be made is that the balloon pilot must use and exercise common sense. When flying a balloon, the most desirable conditions are good visibility, light winds, and no precipitation. Anything other than that scenario should be reason to

[57] See Electronic Devices Factual Report – Pilot.
[58] Source: FAA.

pause and consider the possible outcome of a launch. There is never an absolute requirement to fly—there is always the possibility of making the decision to try again another day.

The Kubicek Flight Manual, Section 4.2, stated the following caution:

The pilot must make a final assessment of the weather before takeoff. During flight the pilot must be constantly on the look out [sp] for changes in the weather, wind direction and speed.

A former pilot for Heart of Texas Hot Air Balloon Rides was asked by the NTSB if he had ever seen the accident pilot launch through a cloud layer, and he replied "yes, he would go up through a hole in the clouds. Sometimes the temperature would drop as you climbed through the clouds, and the balloon would want to climb with the temperature drop and the balloon would pop you out of the top of the clouds."[59]

10.1 Kubicek Weather Limitations

The Kubicek Flight Manual, pages 2-1 and 2-2, listed specific weather limitations, including maximum allowable winds for free-flight takeoffs and tethered operations. For specific limitations, see Attachment 11 – Kubicek Weather Limitations.

11.0 Minimum Safe Altitudes

Title 14 CFR 91.119 required balloons to maintain a safe minimum altitude above the surface and safe minimum distances from obstacles. Title 14 CFR 91.119(b) required that all aircraft, except when necessary for takeoff and landing, operate over congested areas of cities, towns, or settlements or over open air assemblies of persons at an altitude no lower than 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft. (See Figure 7).

[59] See Attachment 1 – Interview Summaries.

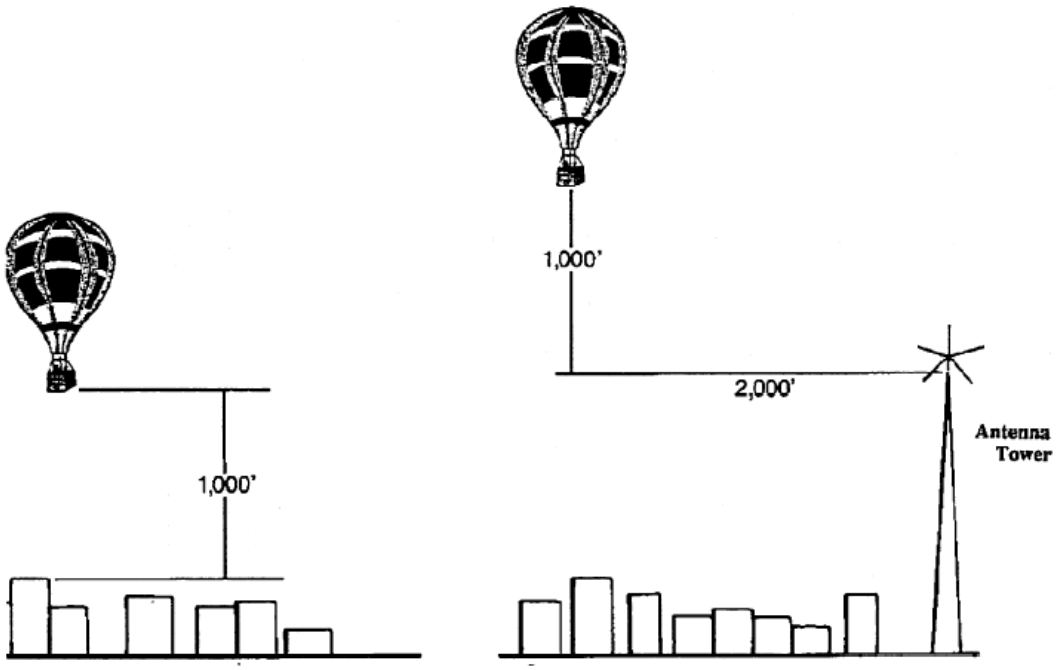

Figure 7: Flight over congested areas.[60]

Title 14 CFR Section 91.119(c) required that all aircraft, except when necessary for takeoff and landing, operate over other than congested areas at an altitude of 500 feet above the surface except over open water or sparsely populated areas (See Figure 8).

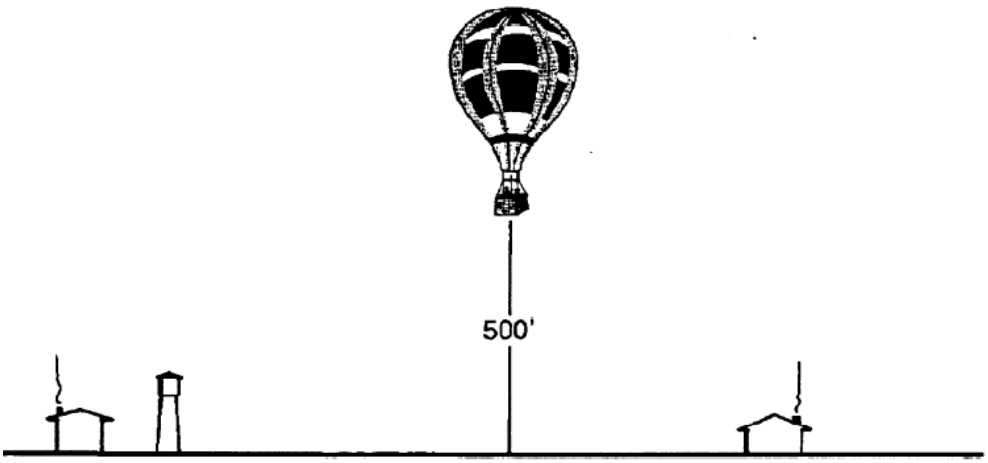

Figure 8: Flight over other than congested areas.[61]

[60] Source: AC 91-71, page 7.
[61] Source: AC 91-71, page 8.

12.0 Normal Procedures

Kubicek provided checklists for normal balloon operations in its Flight Manual, including Pre-takeoff, Inflight, and Landing checks. See Attachment 12 – Kubicek Checklists for additional information. According to interviews, the accident pilot did not use checklists during balloon setup or flight. The ground crew chief further stated that "for the preflight routine, they did not reference the manual, and used their experience. He was not sure if there was a copy of the balloon manual in the balloon and did not see a reason to have it in the balloon in flight."[62]

The Balloon Flying Handbook, page 1-6, Use of Checklists, stated, in part, the following:

> *Checklists are the foundation of pilot standardization and safety. Checklists aid the memory and help ensure that critical items necessary for the safe operation of the balloon are not overlooked or forgotten. Checklists have no value if they are not used. Pilots who fail to use checklists at the appropriate times are relying instead on memory, become complacent, and increase the odds of making a mistake.*
>
> *The consistent use of checklists in primary flight training establishes habit patterns that will serve the pilot well throughout his or her flying career*.

13.0 Approach and Landing

According to interviews, the 0726 Glympse message sent to the ground crew chief by the accident pilot indicated his intent to land the balloon. At 0742, the balloon struck power lines during its descent. The Kubicek Flight Manual contained an Approach Checklist that included briefing the passengers, rotating the basket to land on one of its longer sides using the rotation vents, checking the burners, and establishing a descent into the selected field.[63] The Approach Checklist included the following:

> *Select a field that is downwind and large enough for the prevailing wind conditions. The field should not have power lines in it nor any downwind obstructions.*

According to AC 91-71, when a landing site was being considered, consideration should be given to the site's suitability. For example, city streets and highways, small fields occupied by large gatherings of people not associated with the ballooning activity, and fields containing obstructions (such as power lines) may be inappropriate landing sites in certain instances. When considering the prevailing surface wind, pilots should make certain that adequate ingress/egress was available with respect to the above obstructions. Before descending below the cruise altitude, aeronauts[64] should keep in mind the need to fly a reasonable descent path to the proposed landing site. The approach to the site may be accomplished in several ways. In a no wind situation, simply settling vertically may suffice; however, when winds are involved, an approach path involving track and descent would be required.

[62] See Attachment 1 – Interview Summaries.
[63] See Attachment 12 - Kubicek Checklists.
[64] According to AC 91-71, an "aeronaut" was a pilot or passenger of a balloon or airship.

The AC further described two methods to accomplish an approach path involving a track and descent. The first method was a stairstep approach involving varying descent rates may be used. It is important to avoid any long level flight segments below minimum safe altitudes. (See Figure 9). This procedure may be used to determine lower level wind velocities and directions so that options may be considered until the final descent phase to touchdown.

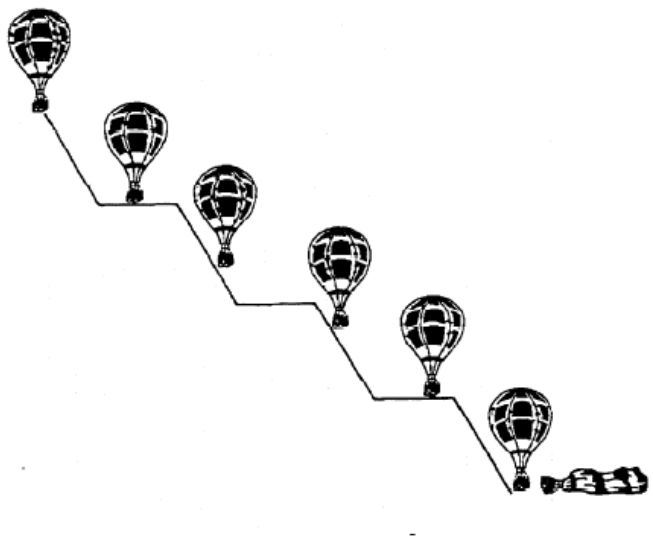

Figure 9: Stairstep approach.[65]

The second method was to establish a descent path of approximately 3 degrees, consistent with groundspeed, trading off altitude for distance traveled. However, in some cases, a steeper or shallower descent path may be more desirable. A shallow glidepath of approximately 3 degrees had been established as a general standard by the aviation industry for descents over congested areas. For hot air balloons, this general standard may need to be modified, but it was a good basic guideline. Achievement of a 3 degree glidepath at a forward groundspeed of 5 knots required a descent rate of 26 to 27 fpm.

It is unknown what method the pilot employed during the descent on the accident flight. AC 91-71 provided a descent rate chart based on ground speed (See Figure 10). HYI was the closest official weather station to the accident site, and indicated surface winds of 180 degrees at 4 knots about 5 minutes after the accident. San Antonio, Texas, (SAT) was the closest site to the accident site with a NWS winds and temperatures forecast with SAT located 39 miles southwest of the accident site. The SAT forecast indicated a wind at 3,000 feet from 180° at 17 knots. College Station, Texas, (CLL) was the next closest site with a NWS winds and temperatures forecast with CLL located 82 miles northeast of the accident site. The CLL forecast indicated a wind at 3,000 feet from 210° at 19 knots.

[65] Source: AC 91-71, page 9.

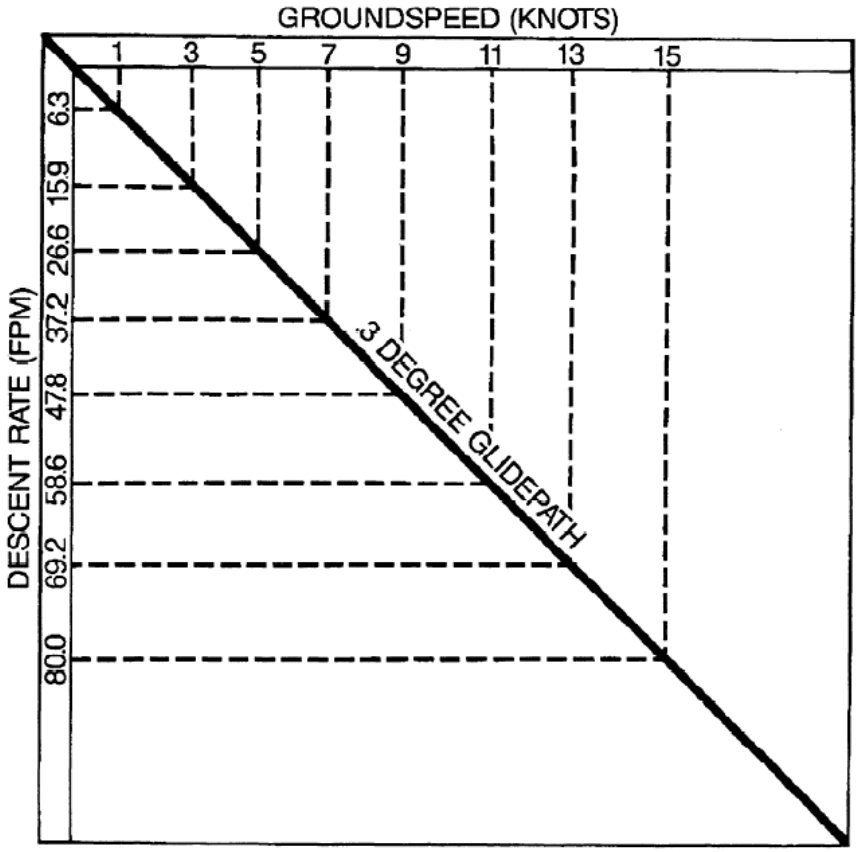

Figure 10: Descent rates for a 3 degree glidepath.[66]

According to AC 91-71, to successfully accomplish a desired descent path, pilots may elect to use an aim point reference. The aim point is a reference on the ground which, for any given rate of descent, remains constant in the pilot's field of vision during the descent and landing. It is also the point at which the basket will touch down. The aim point will be closer to the basket railing during steeper approaches and closer to the skirt during shallower approaches. However, if the rate of descent, windspeed, and wind direction all remained constant during the approach, the aim point would remain constant in the pilot's field of vision. If the rate of descent, windspeed, or wind direction change, the aim point will start to move. This indicated that the projected touchdown point also was changing. As the changing conditions and the approach stabilized, a new ground location would become constant in the pilot's field of vision, defining the new touchdown point. The new aim point would remain stationary and appear to grow larger as the balloon continued the approach.

The AC further stated that the challenge for the pilot was to control the rate of descent so that the desired landing point did remain constant in the field of vision throughout the approach. As the pilot looked down the descent path, if an obstacle blocked the pilot's view of the proposed landing site, the descent path was too low to clear the obstacle. Alternately, if the pilot looked down the descent path and no obstacles blocked the pilot's view of the aim point, the descent path was above

[66] Source: FAA AC 91-71, page 10.

obstacles. Use of the aim point reference could provide the pilot advance warning of impending problems.

14.0 Emergency Procedures

The Kubicek Flight contained procedures to follow during an emergency, including Avoidance of Dangerous Obstacles, Contact with Electric Power Lines, and Fire in the Air.[67] The Emergency Procedures, Section 3.1, contained the following introduction:

> *This section provides checklists and procedures for dealing with emergencies. With proper pre-flight planning and properly maintained balloons, emergency situations are extremely rare. Should an emergency arise, the guidelines in this section are to be followed.*
>
> *If an emergency does occur, the pilot must remember that his or her reaction time should be appropriate to the prevailing conditions.*

For avoidance of dangerous obstacles, the Kubicek Flight Manual, page 3-1, provided the following guidance:

> *When confronted with an obstacle at low level the pilot must decide whether or not there is time to climb over the obstacle. If there is time to climb away, then the pilot must make sure that the maximum amount of fuel is passed to the burners. On a single burner open the main blast valve from one fuel supply and the quiet burner from the second fuel supply. On a double, triple or quad burner each burner should use its own fuel supply. Do not use the cross-flow (if one is fitted) or run two or more burners from a single fuel supply if it is possible to use separate fuel supplies.*
>
> *If the pilot believes that he cannot avoid a major obstruction on his flight path then he should take the following steps:*

Passengers	*Stow loose objects. Adopt the correct landing position. Holding on to the rope handles and face away from the direction of travel. Adopt a low position with legs well bent and backs and shoulders pressed against the leading edge of the basket. Heads should be level with the basket edge. Be prepared for impact. Do not leave the basket until it comes to a stop and on the instruction of the pilot only.*
Venting	*Vent so that the balloon will not fly on after contact with the obstruction.*
Cylinders	*Turn them off and empty the fuel hoses if time permits.*
Basket	*Once the balloon has stopped moving, secure it to the obstruction using the handling/drop line if this is appropriate.*

[67] See Attachment 13 – Kubicek Emergency Procedures.

Basket evacuation	*Evacuate the basket only when it is safe to do so and on the instruction of the pilot.*

Note: When making an emergency landing the Parachute, Smart Vent or Lite Vent may be partially opened at heights below 15 m (50 ft.)

For contact with electric power lines, the Kubicek Flight Manual, page 3-2, provided the following guidance:

If the pilot considers that contact with power lines is unavoidable the he should take the following action.

Passengers	*Assume the correct landing position using the basket edge away from the power lines. Hold on to the rope handles and avoid contact with the cylinders and other metal objects. Keep low in the basket with heads below the basket edge. Prepare for a hard landing.*
Venting	*Vent so that it will be the envelope and not the basket or flying cables that hit the power lines.*
Cylinders	*Turn them off and empty the fuel hoses if time permits.*
Leaving the Basket	*Evacuate the basket only when it is safe to do so and on the instruction of the pilot. If the basket is suspended from power lines then stay in the basket and away from the wires until rescue arrives.*
Equipment recovery	*Stay clear of anything attached to the power lines and do not attempt to remove any equipment until the electricity authorities have confirmed that it is safe to do so.*

According to the Balloon Flying Handbook, pilots should carefully study and memorize emergency checklists, and should not try to read a checklist during an emergency. During an emergency, pilots should take prompt action to resolve the problem, and when the situation permits, refer to the balloon's flight manual to ensure all necessary items have been accomplished. The single most important action in an emergency was to continue to fly the balloon and regain control of the situation.[68]

The FAA's publication of Powerlines and Thunderstorms (FAA-P-8740-34)[69] included the following information pertaining to ballooning and powerlines:

The hazard of power lines is generally accepted as ballooning's greatest danger. Contacting power lines below the equator of the envelope will generally result in burning through the flying wires as the envelope drags the gondola over the wires. If contact is

[68] Balloon Flying Handbook, page 6-2.
[69] See Attachment 15 – Powerlines and Thunderstorms.

made at or below the superstructure, a good chance of a fuel tank or fuel line rupture exists from power line arcing. Neither of these alternatives is acceptable. Power line contact above the equator is much less hazardous because the balloon will be forced to the ground by a combination of the obstruction and wind force. Thermic conditions may complicate the last option.

Obviously, the best was to promote your personal safety (including passengers) is to avoid power lines. Avoidance of power lines, while highly desirable, will not always be possible. Each of us will at some time in our balloon flying career make a serious in-flight decision about power line contact. This decision will be hard, perhaps terrifying and very serious.

Knowing that collision with a power line must occur in a precise way in order to minimize personal injury is a big part of the decision criteria. Acting quickly is also necessary. The decision involves "burn" or "rip". Emotionally, all pilots will want to "burn" because if you can fly over the wires – missing them completely – there are no complications once safe passage occurs. The nagging problem is predicting absolutely that you can clear the power lines. On the other hand, ripping [opening the top of the envelope and releasing the hot air] is a safer decision because there is almost no chance that the envelope will contact the power line incorrectly, i.e. below the equator. The problems with ripping are numerous; however, these problems are not as likely to be fatal.

Consider the possible problems of ripping: a. The pilot's ego may be severely wounded because there is the possibility of criticism for over reacting. b. The balloon envelope may sustain damage from the power lines. Consider the fact that your insurance company will be very pleased to pay for envelope damage as opposed to passenger liability. c. There is a chance that there could be injury to the pilot or passengers. Properly prepared for a heavy landing there is really very little chance of serious injury. A balloon ripped from 150 feet cannot exceed 1500 feet per minute descent rate. Landing at 1500 feet per minute is a hard jolt that can be successfully handled without injury. d. Like any hard landing the fuel should be secured and the pilot light extinguished before ground contact.

There are other possible problems such as rebound that could occur. Thinking out the problem in advance of a real power line collision threat will give the pilot more confidence to make the correct decision.

15.0 Company Information

The balloon was commanded by a single pilot who was the owner of the company, and was the sole employee of the company. According to the interviews, he started his balloon business in St. Louis, MO, and then moved to Texas three years prior to the accident for better weather and more flying opportunities during the year.

A ground crew of three supported the operation as a launch, chase, and recovery team. None of the ground crew were employees of the company, and received cash payments and tips for each flight. The flights typically booked online, usually at $199/flight, and according to the company website (since removed) flights lasted about an hour.

The ground crew chief was assisted by two others, and was also the pilot's roommate at his home in Kyle, Texas. He had performed ground support for the operation for about 3 years. A search of the FAA PTRS database found no FAA records identifying Heart of Texas Hot Air Balloon Rides.[70]

The pilot's mother performed administrative functions for the company from her residence near Melbourne, Florida and was not an employee for the company. She obtained each passenger's weight during the initial call for scheduling, and would enter that into the manifest that was created within the program she used for the scheduling. She further stated that she believed the accident pilot had registered the company as an LLC with the state of Texas. Inquiries to the Texas Secretary of State's office found no records for Heart of Texas Hot Air Balloon Rides.[71]

The NTSB received a report of a previous "hard landing" involving Heart of Texas Hot Air Balloon Rides on August 3, 2014 that resulted in an injury to an occupant.[72] The incident involved the accident balloon, but did not involve the accident pilot. A review of the NTSB and FAA databases did not find any filed reports for that 2014 event.

16.0 FAA Oversight

Title 14 CFR 119.1, which addressed the applicability of certification requirements for air carriers and commercial operators, exempted airplane, helicopter and balloon air tour operators from compliance with 14 CFR Parts 135 and 121.

Title 14 CFR 91.147 Passenger carrying flights for compensation or hire, stated that operators conducting passenger-carrying flights for compensation or hire must apply for and receive a Letter of Authorization (LOA) from the Flight Standards District Office nearest to its principal place of business. The Letter of Authorization required the following items:

> *(1) Name of Operator, agent, and any d/b/a (doing-business-as) under which that Operator does business;*
> *(2) Principal business address and mailing address;*
> *(3) Principal place of business (if different from business address);*
> *(4) Name of person responsible for management of the business;*
> *(5) Name of person responsible for aircraft maintenance;*
> *(6) Type of aircraft, registration number(s), and make/model/series; and*
> *(7) An Antidrug and Alcohol Misuse Prevention Program registration.*

The regulation covered operators conducting nonstop passenger-carrying flights in an airplane or helicopter for compensation or hire. Commercial balloon operators were not covered under 14 CFR 91.147.

[70] Source: FAA email August 9, 2016.
[71] Source: Email received from Texas Secretary of State's office on Monday August 8, 2016 at 0810.
[72] See Attachment 2 – Witness Statements (Previous Incident).

According to the ground crew chief and the pilot's mother, they had never seen the FAA conduct an inspection during any of their flight operations.

F. AVIATION SAFETY REPORTING SYSTEM (ASRS)

The investigation reviewed data contained in the ASRS[73] database (search request No. 77236) for reports of hot air balloon events involving power lines. Between May 1994 and June 2012, there were 88 voluntary reports submitted involving power lines and balloons, of which 62 reports involved contact with power lines.

G. PREVIOUS NTSB RECOMMENDATIONS

A-14-011
Amend 14 *Code of Federal Regulations* Section 91.147 to require commercial balloon operators to obtain a maintain a letter of authorization to conduct air tour flights. (Status: Open - Unacceptable Response)

A-14-012
Through appropriate revisions to FAA Order 1800.56J (current revision 1800.56Q, dated August 24, 2016), "National Flight Standards Work Program Guidelines, "encourage principal operations inspectors to include in their general surveillance activities commercial balloon operators that hold letters of operation (LOA), especially upon initial issuance of the LOA and then as necessary, particularly if the operator is involved in an accident. (Status: Open - Unacceptable Response)

H. FAA REFERENCES

Pilot's Handbook of Aeronautical Knowledge (FAA-H-8083-25)
Balloon Flying Handbook (FAA-H-8083-11A)
Aeronautical Information Manual (AIM)
AC 91-71 Operation of Hot Air Balloons with Airborne Heaters
AC 90-48 Pilot's Role in Collision Avoidance
AC 00-6 Aviation Weather
Balloon Safety Tips (FAA – P-8740-39)
Powerlines and Thunderstorms (FAA-P-8740-34)

I. LIST OF ATTACHMENTS

Attachment 1 - Interview Summaries
Attachment 2 - Witness Statements

[73] The Aviation Safety Reporting System (ASRS) receives, processes and analyzes voluntarily submitted incident reports from pilots, air traffic controllers, dispatchers, cabin crew, maintenance technicians, and others. Reports submitted to ASRS may describe both unsafe occurrences and hazardous situations. Source: https://asrs.arc.nasa.gov/overview/summary.html.

Attachment 3 - LCRA Data
Attachment 4 - Pilot Information
Attachment 5 - FAA Memorandum
Attachment 6 - Balloon Information
Attachment 7 - N2469L Inspection Record
Attachment 8 - N2469L Logbook
Attachment 9 - Flight Manifest
Attachment 10 - Kubicek Performance Information
Attachment 11 - Kubicek Weather Limitations
Attachment 12 - Kubicek Checklists
Attachment 13 - Kubicek Emergency Procedures
Attachment 14 - Kubicek Passenger Briefing
Attachment 15 – Powerlines and Thunderstorms

Submitted by:

_____
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