Aviation Investigation Final Report

Location:	Phoenixville, Pennsylvania	**Accident Number:**	NYC08FA307
Date & Time:	September 7, 2008, 18:36 Local	**Registration:**	N844LB
Aircraft:	Lindstrand Balloons 150A	**Aircraft Damage:**	Substantial
Defining Event:	Hard landing	**Injuries:**	1 Fatal, 4 Serious, 3 Minor
Flight Conducted Under:	Part 91: General aviation - Aerial observation		

Analysis

Prior to the flight the pilot was observed expressing concerns over the wind direction that would have them track toward Phoenixville. While in flight the pilot was in communication with ground personnel and he did not mention any trouble. The pilot told several of the passengers that the wind was taking them in the direction of Phoenixville and the flight was going to be "cut short." One passenger reported that the balloon "headed to the ground too fast," and another passenger was told by the pilot "don't get out under any circumstances." The balloon basket struck the tops of pine trees that surrounded the field in which they were trying to land, impacted the ground "very hard," bounced, tilted toward one side, bounced again, up righted, then tilted over, and came to rest on the side of the basket containing the fuel cylinders. Several passengers reported immediately after the first bounce the heat inside the basket was "extremely intense," and the pilot had told everyone to "get out." Fire was present in the basket area. Several passengers reported having difficulty exiting since several of the passengers had fallen on top of each other. Examination showed a fuel fitting had separated the fuel delivery system. Components from the fuel delivery system were submitted to the Safety Board Materials Laboratory for analysis. The material of the fitting body and female end of the fitting was consistent with brass and was fractured due to overstress. The manufacturer's checklist requires that "immediately before touchdown, turn off the pilot lights and if possible close the liquid valves and vent the fuel lines." One valve was in the full open position after the accident. The balloon had been modified by the operator by installation of a third fuel tank and the fitting that was found separated. The mechanic that performed the last inspection on the balloon reported that the owner utilized three different manufacturer's fuel tanks.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The separation of a portion of a fuel fitting during a hard landing resulting in release of fuel and a fire in the balloons basket area. Contributing to the accident was the pilot's failure to follow the manufacturer's published procedures to shut down the fuel system prior to landing and the operator's installation of a third fuel tank and the fuel fitting that separated during the hard landing.

Findings

Aircraft	(general) - Failure
Personnel issues	Use of policy/procedure - Pilot
Aircraft	(general) - Incorrect service/maintenance
Organizational issues	Equipment design - Operator

Factual Information

History of Flight

Landing	Hard landing (Defining event)
Landing	Sys/Comp malf/fail (non-power)
Post-impact	Fire/smoke (post-impact)

HISTORY OF FLIGHT

On September 7, 2008, at 1836 eastern daylight time (EDT), a Lindstrand Balloons USA Model 150A, N844LB, was substantially damaged by fire during landing. The certificated commercial pilot was fatally injured, four passengers were seriously injured, and three passengers sustained minor injuries. Visual meteorological conditions prevailed, and no flight plan was filed for the flight which departed from an empty lot approximately 5 miles from the accident location. The sightseeing flight was conducted under the provisions of 14 Code of Federal Regulations Part 91.

One of the passenger's video taped the set-up and preflight of the balloon. The pilot was seen releasing, on two separate occasions, a "black helium type" balloon, known as "pible," and watching their direction of travel, connecting the hoses to the tank valves, routing the hoses up the side of the basket to the burner, and testing the burner as part of his preflight actions. The video also showed the inflation of the envelope utilizing a portable circular fan, which was the procedure required during the inflation process. The operator utilized some of the passengers to assist in the process, by having them hold the envelope open during the inflation process. Numerous passengers reported that after the balloon envelope was inflated the ground personnel required the seven passengers to "expeditiously" get in to the two compartment basket. During this process there were two passengers in the front compartment with the pilot and five in the rear compartment. The ground personnel moved one of the passengers from the rear to the forward compartment. The flight departed at 1807 and proceeded on a course of approximately 073 degrees magnetic for the planned one hour flight.

Four of the passengers were from one family and they reported to the Safety Board investigator that they were instructed to call the balloon company at 1430 the day of the flight to confirm that everything was on schedule. They further reported that about 1400 they received a call from the operator and that "everything looked good" and the location they were going to depart from was known as "Ludwig's corner." When they arrived at that location they noticed that there were two balloons that were going to depart. They were met by the balloon operator and were given a health disclosure statement and were told to read and sign that form. Two of the family members and another passenger went to utilize a restroom nearby and upon their return the balloon operator was in the process of completing the safety briefing; however the briefing was not repeated for them. Several of the passengers reported seeing the

accident pilot watching the "helium type" balloons for a longer period of time than the pilot of the other balloon. One of the passengers overhead the accident pilot stating that he was concerned that the wind would take them in the direction of Phoenixville and several passengers reported that up until about 10 minutes prior to the flight departing they were being told there was a "50/50 chance they can go." Several passengers reported to the Safety Board investigator that the ascent was smooth but that they were surprised at how "cramped the accommodations were" and how much heat and noise was emitted from the burner assembly.

Through the flight one of the passengers, who was also an off duty police officer, reported that the pilot seemed to be very "apprehensive" and was very "concerned about something." Numerous passengers reported that the pilot was "very focused and quiet with what he was doing." Approximately 1.9 miles from the accident location a witness on the ground saw and took photos of the accident balloon. The photos did not indicate any problems with the balloon and the ground witness observed the passengers "waving and having a good time." The passengers stated that a few minutes prior to the landing the pilot informed them that the wind was taking them in the direction of Phoenixville and that there were few landing areas so the flight was going to be "cut short." Several of the passengers felt that the approach seemed normal and that the pilot had told them to "bend your knees everything is normal," one of the passengers, who had taken balloon flights previously thought the balloon was "headed to the ground to fast," another passenger had asked the pilot if they should exit the basket as soon as it was on the ground. The pilot replied "don't get out under any circumstances" and kept his hand near the burner during the descent.

The balloon basket struck the tops of pine trees that surrounded the field in which they were trying to land, impacted the ground "very hard," bounced, tilted toward one side, bounced again, uprighted, then tilted over, and came to rest on the side of the basket containing the fuel cylinders. Several passengers reported immediately after the first bounce the heat inside the basket was "extremely intense," and the pilot had told everyone to "get out." After the first bounce and prior to the second bounce at least one of the passengers was observed "flying out of the basket" while several of the passengers had fallen on top of each other. One of the passengers witnessed the pilot with his feet on the top rail "pulling on something," even though his arms and legs were on fire. After the passengers exited the basket the pilot was seen attempting to exit however the basket tilted over on the fuel cylinder side and the pilot was last seen being carried over with the basket through the flames. An eyewitness on the road observed the balloon impact the ground, slide, become airborne, and was approximately 5 to 6 feet in the air, the trailing edge of the balloon caught fire, impacted the ground a second time with the base of the envelope in flames, the basket was dragged, and the passenger compartment area was engulfed in flames.

In an interview with the operator's personnel that were in communication with the balloon pilot and were also following the progression of the balloon's flight from the "chase van" reported that approximately 10 to 15 minutes prior to the accident they could hear what sounded like "laughing in the background." The personnel also reported that they had the balloon in sight the

entire flight. They noticed that the pilot was "low over a horse area" which they felt was "very odd." During the balloon's approach to the intended field for landing their view became obscured by a house and a barn so they did not see the balloon touch down. However, they did observe the "top shift as if stopping" followed shortly by observing "the bottom of the basket on fire." They immediately began to navigate the van and trailer up the driveway at which point they observed some of the passengers running toward their vehicle. As they approached the balloon the basket and bottom portion of the envelope was "engulfed in flames" and they and a passenger attempted to extinguish the fire with the portable fire extinguishers that were in the van and the trailer. The communication between the pilot of the balloon and the "chase van" was not recorded.

PERSONNEL INFORMATION

The pilot, age 67, held a commercial pilot certificate, with a rating for airplane single-engine land, instrument airplane, and lighter-than-air free balloon. The latter included a limitation for hot air balloon with airborne heater. The pilot also held flight and ground instructor certificates. His most recent Federal Aviation Administration (FAA) second-class medical certificate was issued on March 13, 2008, and the pilot reported 1,143 total hours of flight experience as of that date. The pilot's logbook was not able to be located in order to determine the total number of hours of flight experience in balloons; however in a review of the balloon records revealed that between July 12, 2008 and the accident flight the pilot had flown the accident balloon for a total of 19 flight hours and was the only logged pilot to have flown it during that time. The logbook which dated back to December 17, 2004 revealed that the accident pilot had flown the balloon for a total of about 193.1 flight hours which was also 191 flights.

BALLOON INFORMATION

The Balloon consisted of a 24 gore A-Type envelope, a MINI-T type basket, a Lindstrand Sqieeze Trigger Main Valve double burner, a Flytec 3040 flight instrument, two 20-gallon stainless steel fuel tank, and one 10-gallon aluminum fuel tank. The balloon was issued a standard airworthiness certificate on December 30, 2004 and was registered to the operator on March 31, 2005. An annual inspection was recorded in the inspection and maintenance records and was dated March 28, 2008, at the time of the inspection the balloon had a recorded total time in service of 223.9 hours. A review of the balloon records revealed that the weeks preceding the accident the accident pilot was the only individual to have flown this balloon. Upon completion of the flight on September 5, 2008 the balloon had accrued 261.5 total hours and on that flight the maximum altitude recorded was 2,500 feet mean sea level (msl) during the weeks immediately preceding the accident. According to the inspection and maintenance records the highest recorded altitude flown was 4,500 msl with most of the flights being conducted in the 1,500 feet msl to 2,500 feet msl range.

According to the inspection and maintenance record, and flight manual, dated December 20, 2004, specifically prepared for the accident balloon, the equipment list contains only two fuel tanks with serial numbers 599 and 600. The only tank on the equipment list that was identified

was 599. The other stainless steel tank serial number was unable to be determined.

METEOROLOGICAL INFORMATION

The 1840 recorded weather at Wings Field Airport (LOM), Philadelphia, Pennsylvania, located approximately 18 miles to the east of the accident site, included winds from 250 degree at 6 knots, visibility 10 miles, clear skies, temperature 22 degrees C, dew point 18 degrees C, and an altimeter setting of 30.00 inches of mercury.

A review of the global position system (GPS) data readout from a similar balloon that departed the same location and approximately 5 minutes prior to the accident flight had a similar flight path as the accident flight and was reported to the Safety Board to have flown at a similar altitude; revealed that the winds were generally out of the south-west and varied in speed depending on altitude. The wind speed varied between 3 and 21 mph.

WRECKAGE AND IMPACT INFORMATION

The wreckage was oriented on a 088-degree heading and was located approximately 500 feet from a road, within a small, sloping field surrounded by trees of various heights ranging from approximately 45 feet to approximately 85 feet in height. The trees that were located within the approach path to the field were approximately 50 feet in height. Impact skid marks were located on the ground 192 feet to the west of the main wreckage. The vegetation surrounding the balloon was scorched by fire. The 24 gore A-Type envelope was separated from the basket, and was located 47 feet east of the basket. The envelope mouth fabric, the nomex, and nylon panels exhibited fire damage. The crown ring was found with all 24 retaining cords still attached. Continuity of the crown, vent and rotating vent lines from the basket to the top of the envelope could not be confirmed due to fire damage. However continuity was confirmed from the crown to approximately 6 feet above the top portion of the nomex panel.

The MINI-T type basket which was composed of stainless steel tubing, padding, plywood, woven wicker, and rope handles for passengers to hold onto while kneeling. It was certificated for a maximum gross weight of 3,190 pounds. A fuel cylinder compartment was located on the left side of the basket, as viewed from the downside or aft side of the basket. The fuel compartment contained two 20 gallon Lindstand Balloons LTD tanks which were recognized to be stainless steel fuel cylinders, and a 10 gallon aluminum fuel cylinder located between the stainless steel cylinders, the serial number on the left tank was not a serial number listed on the equipment list supplied by the manufacturer but was on the equipment list on the similar balloon owned by the operator. The right tank's serial number was one that was on the equipment list. According to the operator of the balloon the aluminum cylinder was positioned on top of a "milk crate with a piece of plywood on it." The two stainless steel cylinders remained intact and exhibited thermal damage. The approximate top half of the aluminum cylinder had been melted due to the ensuing fire. A quarter-turn quick shut-off valve was attached to the top of each stainless steel cylinder, and a gate-type shut-off valve was installed on the aluminum cylinder. The valve on the forward fuel cylinder was found in the partially

closed position. The valve on the aft fuel cylinder was found in the full open position. The valve on the center aluminum cylinder was damaged by fire and its position was not able to be determined, however according to the operator of the balloon the accident pilot's habit was to leave that valve closed during flight.

The remains of the Lindstrand Sqieeze Trigger Main Valve double burner were co-located with the vaporization coils, piezo tube, jet ring, main burner valve, cross-over burner, pilot light regulator and pilot light valve. All components exhibited fire damage.

MEDICAL AND PATHOLOGICAL INFORMATION

The Chester County Coroner performed an autopsy on the pilot on September 9, 2008. The reported cause of death was smoke inhalation and thermal burns.

Toxicological testing was performed post mortem at the FAA’s Bioaeronautical Sciences Research Laboratory, Oklahoma City, Oklahoma. The test results revealed 28 percent carbon monoxide level and were also positive for Metoprolol. The pilot had not indicated the use of Metoprolol on his last application for airman medical certificate dated March 24, 2008.

TEST AND RESEARCH

Components from the fuel delivery system were submitted to the National Transportation Safety Board Materials Laboratory for analysis. The components included a tank valve, various hose fittings, and hoses. The tank valve was identified as a Rego brand 9101C1 tank valve and the composite material of the valve body was consistent with brass. The fitting material attached to the female end of the valve was also consistent with brass and the end of the fitting was fractured. Examination of the fracture surface found microvoid coalescence fracture features consistent with overstress. The other end of the fractured brass fitting was attached to a female-female fitting, and the material composite for this fitting was consistent with galvanized steel.

ADDITIONAL INFORMATION

According to passenger interviews, there was a safety briefing prior to the flight, however several of the passengers arrived to the safety briefing late and they were not informed of what was missed. Several passengers felt that the passenger compartment of the basket was "cramped." Prior to landing they were told to put their backs against the basket and to grab the ropes to support themselves. When the basket finally impacted the ground, the burners “came on” and the basket flipped over.

According to the operator of the balloon the aluminum tank is used primarily for the inflation of the balloon and remains within the fuel compartment of the basket. Since they rarely utilize all of the fuel from the tank during the filling of the balloon it allows a little extra fuel in case the pilot would need it. A review of one of the passenger's video of the time around the inflation of

the balloon revealed that the aluminum tank had what appeared to be a "cut out" in the top collar of the tank. This "cut out" is similar to those found on Raven/Aerostar 10 gallon Worthington tanks which were not an approved part for use on any Linstrand Balloons. A Service Bulletin (SB) 137 dated July 1, 2003 produced by Aerostar required that these tanks be removed from service.

In an email to the FAA, the mechanic that performed the last inspection on the balloon reported that the fuel tanks in which he inspected for the operator were Linstrand, Aerostar, and Worthington manufactured tanks. The mechanic further informed the FAA in a phone interview that if the balloon came in for inspection with the manifold to the center tank, the tank would not be part of the inspection.

Weight and Balance Information

The operator also informed the Safety Board investigator that they chose this balloon since there were "no issues with the number of passengers we can carry" when it comes to weight and balance. Therefore they do not do a weight and balance prior to any flights.

Operation Manual

The operator informed the Safety Board that the FAA does not require an operation manual for their flights; however they do share information about best practices or give guidance to their employees by having open communication and discussions about specific items. The operator further stated that they "never see the FAA." They also stated that the pilot of any of their flights makes the final decision on whether a flight will depart or not.

Flight Manual

According to the balloon manufacturer's flight manual Section 1.1.1 "the balloon must not be flown if it has been modified without the approval of the national airworthiness authority in the state of registration."

According to the balloon manufacturer's flight manual Section 2, Normal Procedures, Pre Take-off Checks states in part "Passengers completely briefed and in the basket." The section further went on to state "Immediately before touchdown, turn off the pilot lights and if possible close the liquid valves and vent the fuel lines."

The flight manual also stated that, "the passengers should be briefed on the identification of the controls and their purpose, how and when to enter and exit the basket, position during flight, what to hold on, etc."

According to the flight manual Section 3 Emergency Procedures, Ground Fire, the pilot should "evacuate all other personnel to a safe area, turn off the source of propane at the cylinder valve, if possible, and operate the fire extinguisher. If the fire is not put out in 20 seconds,

abandon the balloon because there is a strong risk of explosion. If the balloon is inflated, the deflation system should be operated prior to evacuating the basket to prevent subsequent take-off."

Section 3 of the flight manual also provides guidance for heavy landings and defines them "in which impact forces are largely vertical…the position adopted should be with knees slightly bent…it is important to face away from the direction of travel and to hold onto the internal rope handles firmly. This will resist any pitching forwards motion that may also be present in any landing situation."

Balloon Flying Handbook

According to the Balloon Flying Handbook (FAA-H-8083-11), "prior to inflation is the most appropriate time to give passengers their first briefing for behavior during the flight and landing. The pilot should inform them that during the landing they should stand in the basket where he indicates (based on wind conditions), facing the direction of flight, with feet and knees together, knees slightly bent, holding tightly to the sides of the basket and that they are not to exit the basket until instructed to do so."

Additionally, it advised that "just prior to landing that the pilot in command should explain correct posture and procedure to the passengers, and to prepare the passengers for the possibility of a hard impact and to have them, stand in the appropriate area of the basket. It further states that some passenger, believing the flight is over as soon as the basket makes contact with the ground, start to get out. All passengers should stay in the basket until individually told by the pilot to exit."

Pilot Information

Certificate:	Commercial	**Age:**	67,Male
Airplane Rating(s):	Single-engine land	**Seat Occupied:**	
Other Aircraft Rating(s):	Balloon	**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	No
Instructor Rating(s):		**Toxicology Performed:**	Yes
Medical Certification:	Class 2 With waivers/limitations	**Last FAA Medical Exam:**	March 24, 2008
Occupational Pilot:	Yes	**Last Flight Review or Equivalent:**	
Flight Time:	(Estimated) 1143 hours (Total, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	Lindstrand Balloons	**Registration:**	N844LB
Model/Series:	150A	**Aircraft Category:**	Balloon
Year of Manufacture:		**Amateur Built:**	
Airworthiness Certificate:	Normal	**Serial Number:**	
Landing Gear Type:	None	**Seats:**	
Date/Type of Last Inspection:	March 28, 2008 Annual	**Certified Max Gross Wt.:**	
Time Since Last Inspection:	38 Hrs	**Engines:**	
Airframe Total Time:	262 Hrs at time of accident	**Engine Manufacturer:**	
ELT:	Not installed	**Engine Model/Series:**	
Registered Owner:	Air Venture Balloon Rides, Inc.	**Rated Power:**	
Operator:	Air Venture Balloon Rides, Inc.	**Operating Certificate(s) Held:**	None

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual (VMC)	**Condition of Light:**	Day
Observation Facility, Elevation:	LOM,302 ft msl	**Distance from Accident Site:**	15 Nautical Miles
Observation Time:	18:40 Local	**Direction from Accident Site:**	89°
Lowest Cloud Condition:	Clear	**Visibility**	10 miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	6 knots /	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	250°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30 inches Hg	**Temperature/Dew Point:**	22°C / 18°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Chester Springs, PA (NONE)	**Type of Flight Plan Filed:**	None
Destination:	Phoenixville, PA (NONE)	**Type of Clearance:**	
Departure Time:	18:08 Local	**Type of Airspace:**	

Wreckage and Impact Information

Crew Injuries:	1 Fatal	**Aircraft Damage:**	Substantial
Passenger Injuries:	4 Serious, 3 Minor	**Aircraft Fire:**	On-ground
Ground Injuries:	N/A	**Aircraft Explosion:**	On-ground
Total Injuries:	1 Fatal, 4 Serious, 3 Minor	**Latitude, Longitude:**	40.128887,-75.595001

Administrative Information

Investigator In Charge (IIC):	Etcher, Shawn
Additional Participating Persons:	Robert W Fus; Philadelphia FSDO; Philadelphia, PA Phillip Thompson; Lindstrand Balloon USA; Galena, IL
Original Publish Date:	March 23, 2010
Last Revision Date:	
Investigation Class:	Class
Note:	The NTSB traveled to the scene of this accident.
Investigation Docket:	https://data.ntsb.gov/Docket?ProjectID=68886