AVIATION INVESTIGATION REPORT
A01O0200

COLLISION WITH OBJECT - WIRESTRIKE

AEROSTAR BALLOON RX-7 C-GFLH

GLOUCESTER, ONTARIO

14 JULY 2001

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Summary

After an advertising/sightseeing flight, an Aerostar RX-7 balloon, serial number RX7-3337, with a pilot and two passengers on board, landed in a field immediately north of Leitrim Road in Gloucester, Ontario. An electrical power line was located on the south side of the road. Once on the ground, the pilot established the balloon in equilibrium, and two ground crew "walked" the balloon closer to the road. The pilot then began deflation procedures, with one ground crew member holding onto the basket and the second ground crew member attempting to grip the crown lines. At this time, a strong gust of wind from the north lifted the balloon off the ground, with one ground crew member still hanging on, and the balloon began drifting toward the power lines. The ground crew member let go of the basket and fell to the ground from a height of 10 to 15 feet. The pilot lit the burners in an attempt to climb over the wires; however, before sufficient altitude could be gained, the balloon drifted into the wires and became entangled. A massive electrical arc occurred, the basket burst into flames and, shortly thereafter, the balloon descended to the ground. The basket lift cables burned away from the envelope, allowing the envelope to drift farther to the south where it came to rest on a horizontal antennae. The pilot and one passenger sustained serious burn injuries, and the second passenger died of electrocution. The ground crew member sustained minor injuries when she fell to the ground. The accident occurred at approximately 2009 eastern daylight time in day visual meteorological conditions.

Ce rapport est également disponible en français.

Other Factual Information

The pilot checked the weather three times before departure. A terminal weather forecast for the Ottawa / Macdonald-Cartier International Airport, Ontario, was issued on 14 July 2001 at 1631 eastern daylight time[1] and was valid from 1700 on July 14 to 1400 on July 15. The forecast was as follows: winds from 280° true at 10 knots; visibility greater than 6 statute miles (sm); a broken cloud layer at 3000 feet above ground level (agl); and, temporarily from 1700 to 2000, visibility 6 sm in light rain showers. A weather observation taken at Macdonald-Cartier International Airport at 2000 was as follows: a broken cloud layer at 4500 feet agl; a second broken cloud layer at 9000 feet agl; visibility 20 sm; winds from 320° true at 10 knots gusting to 15 knots; and temperature 20°C. Rain showers were noted within 5 sm. Remarks in the observation indicated towering cumulus cloud embedded in the cloud layers, with rain showers to the north-northeast. The weather observation station is approximately 3 km west-northwest of the accident site. Residents of the area just east of the accident site reported that rain and gusty winds developed at approximately the same time as the electrical power failed (time of the accident).

The balloon departed Jacques-Cartier Park in Hull, Quebec, on an advertising/sightseeing flight over the Jeux de la Francophonie (Francophone Games). At departure, the winds, as measured by the ground crew, were from the north-northwest at approximately 3 knots. During most of the flight, the weather was favourable, but toward the end of the flight the pilot was monitoring some unfavourable weather conditions east of his flight path. When the sky began to darken, he decided to land as quickly as possible. He reported that the winds on landing were approximately 4 to 6 knots (7 mph) and had been relatively constant throughout the flight.

The field chosen for the landing was bounded on the south (downwind side) by the road and power lines. The field contained some small rocks and a tower. Divots in the soil and information gathered from an eyewitness confirmed that the touchdown was bumpy but that the basket did not tip over. The first divot was approximately 700 feet (line of flight) northwest of the power line. The balloon came to rest approximately 600 feet (line of flight) from the power line.

The pilot established the balloon in equilibrium, and the ground crew "walked" the balloon closer to the road. Walking a balloon is a common practice to make recovery easier. The second landing site, where deflation was to take place, was approximately 240 feet (line of flight) upwind of the power lines. The burners were shut off, the main valves on the fuel supply tanks closed, and the fuel lines were emptied of propane. The pilot had begun to deflate the envelope by opening the spring top when the balloon was lifted by a gust of wind. The pilot opened the main valves on the fuel tanks and lit the burners in an unsuccessful attempt to climb over the wires.

The pilot was issued a balloon pilot licence in May 1993. According to his logbook, he was trained on the Aerostar RX-8 balloon and was checked out on the Aerostar RX-7 balloon. His total flying experience was approximately 500 hours, of which most was on the accident balloon type. He received a Category 3 medical examination on 17 August 2000 and had no history of health problems. He was wearing his glasses at the time of the accident, in compliance with a licence restriction that glasses must be worn.
The balloon documentation indicated that it had been maintained in accordance with regulations. The balloon had accumulated approximately 91 hours in service since new.

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[1] All times are eastern daylight time (Coordinated Universal Time minus four hours).

Examination of the remains of the balloon system did not reveal any anomalies that might have contributed to the accident. When the envelope spring top was examined at the accident site, only one spring, number 11B, was found in its associated spring pocket. The spring top is a deflation panel controlled by an activation line attached to and accessible from the basket. When all 14 springs are in their respective pockets and the vent panel is closed, the spring top is considered closed. The pilot indicated that he had released only two of the springs before the balloon unexpectedly lifted into the air. It was not determined how all the springs but one got into the open position, but they might have opened when the envelope separated from the basket.

The burners were connected to a standard fuel supply and tested. The only anomaly identified during the burner testing concerned the return action of one blast valve trigger. This anomaly was determined to be interference with a melted guide pin in the trigger handle, a result of the fire. The fuel supply line from the horizontal tank to its associated burner was found torn free of the burner fuel inlet fitting. This failure occurred during the impact sequence with the power lines since there was no observed or reported fire or fuel leak before the impact. Responding emergency personnel reported that the post-impact fire was generally blue with some yellow flames. The blue flame indicated that propane was burning; the yellow flame was produced by the burning rattan of the basket. The fuel tank main valves were found open.

The envelope consisted of 12 gores (panels) that are attached to vertical and horizontal load straps that transfer the weight of the basket to the envelope. The gores are made from a coated rip-stop nylon material. The lower portions of the occurrence envelope gores were melted away in the area of the envelope throat. The skirt, manufactured from rip-stop nylon and lined with a fire-resistant nomex material, had become brittle from the heat and fractured into small pieces. It was found distributed about the accident site. The horizontal load strap, to which the basket lift cables were attached, had burned and/or melted and detached from the envelope. Review of Type Certificate Data Sheet No. A15CE, which lists the requirements for certification of the Aerostar RX-7 balloon, revealed that there are no flammability standards for the materials from which the balloon is constructed.

A weight calculation was completed to determine the gross weight at launch. This calculation indicated that the balloon was approximately 230 pounds under its maximum gross weight of 1480 pounds at take-off from Jacques-Cartier Park. A second weight calculation was completed to determine the approximate weight of the balloon when it was lifted into the air by a wind gust. This calculation, which included the weight of the ground crew member, found that the balloon was approximately 190 pounds under gross weight when the accident happened.

The power line consisted of 45-foot poles with three electrical power conductors mounted on insulators attached to each pole. One conductor was mounted on the top of the pole; the remaining two were mounted on each side of the pole, 3½ feet below the top conductor. When the basket became entangled in the wires, the lift of the envelope pulled the road-side lower conductor into the top-mounted conductor, causing a phase-to-phase electrical arc. The phase-to-phase voltage on this power line is 27 680 volts, and the phase-to-ground voltage is 16 000 volts. A recording system at the electrical power station revealed that the balloon struck the power lines at 2009:39.

The Aerostar RX-7 hot air balloon flight manual contains numerous precautions to observe when operating near power wires, including the following:[2]

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[2] Aerostar International Inc., *Hot Air Balloon Flight Manual: Aerostar (Raven) Model RX-7 Hot Air Balloon*.

> Ensure there are no power lines in the landing area!!
> Allow at least 100 feet horizontal separation from power lines or other hazardous obstacles downwind of the balloon for each mph of wind speed.
> Preferably, make all landings downwind of such obstacles after crossing them at a safe altitude. If winds are gusty, thermic, or otherwise unstable, be especially cautious.
>
> This guideline will vary with experience levels, loading, and gust conditions for each instance. The pilot-in-command is responsible to exercise judgement for the safe conduct of the flight.

Measurements taken at the accident site indicated that the balloon came to rest approximately 240 feet from the power lines. The winds at the time of the landing were estimated to be 4 to 6 knots (7 mph) blowing from the north-northwest. To comply with the balloon flight manual, the balloon should have landed and remained at least 700 feet upwind of the power lines. The first landing, before the balloon was walked closer to the road, was approximately 600 feet from the power lines.

The flight manual, section III, subsection 3.28, contains procedures to avoid dangerous obstacles:

> In the event of an extreme situation where there is an imminent threat of impact with dangerous obstacles which may cause serious or fatal injuries:
>
> 1. Effect rate-of-descent for immediate landing by venting or opening the deflation panel.

The flight manual, section I, subsection 1.5, Protection Equipment, requires that helmets for all occupants be on board the balloon and worn during specified circumstances:

> Helmets are required for all occupants on board and must be worn during emergency procedures as specified in Section 3 of this manual as well as any other time it is deemed necessary by the pilot-in-command. It is recommended that the minimum guideline for such utilization be:
>
> 1. Optional for take-offs and landings in winds of less than 10 mph.
> 2. Utilize for all take-offs and landings in winds of 10 mph or greater.
> 3. Utilize for low altitude flight including take-offs and landings when wind conditions are gusty or unstable.

> It is strongly recommended that helmets be worn for the above conditions as a minimum. The final determination on such utilization remains with the pilot-in-command and he must apply these guidelines based on experience and each individual situation as it arises. Passengers must be briefed on the proper use prior to flight.

None of the balloon's occupants was wearing a helmet, and no helmets were found in the wreckage of the balloon.

Information recorded by the on-board global positioning system during the last nine flights made by the occurrence balloon and the pilot was recovered. On at least five of these flights, the balloon was landed near or walked close to a road; it was not determined if power lines were along the roads.

Analysis

When the balloon initially landed, it was approximately 600 feet upwind of the power lines, somewhat short of the 700 feet recommended in the flight manual for the existing winds. The balloon was then brought into equilibrium and walked to a second landing site approximately 240 feet upwind of the power lines. Information gathered during the investigation revealed that, after landing, balloons are commonly walked to a position more favourable for recovery. This procedure must be completed with regard for obstacles, especially power lines. The existing weather conditions, particularly the winds, must also be considered. Information from previous flights recovered from the on-board global positioning system indicated that some of these flights were successfully landed near roadways or were walked closer to roadways after landing. Since it was standard practice for the pilot to land or position the balloon near a road, he likely did not adequately consider the risk posed by the proximity of power lines. The pilot's decision-making process and judgement were likely influenced by the routine nature of the procedure. Formalized pilot decision-making training is not available for balloon pilots, but a multimedia educational package on pilot decision-making is available from Transport Canada.

No anomalies were found with the balloon system that might have contributed to the accident. Immediately after the pilot began opening the spring top, an unexpected gust of wind lifted the balloon, with its occupants and one ground crew member, into the air and caused it to drift toward the power lines. The pilot immediately assessed the situation and concluded that the balloon would contact the wires unless he was able to climb over them. Rather than effect a rate-of-descent for immediate landing by venting or opening the deflation panel in accordance with the flight manual, he decided to light the burners and attempt to climb over the wires.

Findings as to Causes and Contributing Factors

1. Given the known weather conditions, the final landing area was too close to a power line to allow the pilot time to react safely to the gust.
2. The balloon struck electrical power lines, causing an electrical arc and fire that destroyed the balloon and resulted in serious and fatal injuries.

Findings as to Risk

1. When the pilot realized that the balloon was heading for the power lines, he tried to climb the balloon over the power lines rather than land immediately. This action was not in accordance with procedures in the flight manual.

2. There are no flammability standards for materials used in the construction of balloons.

3. The occupants were not wearing helmets during the accident flight, increasing the risk of injury.

Other Findings

1. Formal pilot decision-making training is not available for balloon pilots.

Safety Action

Although formal decision-making training is not available for balloon pilots, Transport Canada has made available to the aviation industry, via CD-ROM, a multimedia educational package on Pilot Decision-Making (TP13897). The goal of this package is to help pilots make better decisions by introducing them to the concepts, principals, and practices of good decision-making.

Transport Canada, Civil Aviation, publishes the *"Aviation Safety Ultralight & Balloon"* newsletter. This publication is in the process of redesign and should be released in the third quarter of 2002, entitled "*Recreational Aviation Safety*".

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board authorized the release of this report on 09 October 2002.