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Report C 1998:20e

**Accident involving hot-air balloons
PH-IHO and SE-ZGH on
8 August 1997 in the airspace
near Årsta Holmar, in Stockholm, AB county,
Sweden**

L-59/97

(This is a translation from the Swedish original report. If there is any difference caused by the translation the Swedish version is valid.)

1998-06-16

L-59/97

Swedish Civil Aviation
Administration

601 79 NORRKÖPING

Report C 1998:20e

The Swedish Board of Accident Investigation (Statens haverikommission, SHK) has investigated an accident which occurred on 8 August 1997 near Årsta Holmar, AB county, Sweden, involving two hot-air balloons with registration PH-IHO and SE-ZGH.

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717) the Board submits herewith a report of the investigation.

S-E Sigfridsson

Monica J Wismar

Henrik Elinder

Jan Mansfeld

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Report finalised 1998-06-16

<i>Aircraft: registration and type</i>	A. PH-IHO , Cameron N-133 B. SE-ZGH , LBL 240A
<i>Owner</i>	A. Rene Elgersma, Melkweg 62, 3225 VE Hellevoetsluis, Holland B. Ballongflyg Hit & Dit AB Hammarbyvägen 37, 120 32 Stockholm/Upp & Ner AB, address as above.
<i>Time of accident</i>	1997-08-08, at 20:06 hrs in daylight. <i>Note:</i> All times in the report are given in Swedish Daylight Saving Time (SDST) = UTC + 2 hours
<i>Place</i>	In the airspace near Årsta Holmar, AB County, (pos 5818N 1803E, approximately 350 metres above sea level)
<i>Type of flight</i>	A. Private B. Utility Aviation
<i>Weather</i>	Wind 160 degrees/6 kts, visibility more than 10 km, no clouds below 5 000 ft, temp./dewpoint +23/+14 degrees C, QNH 1023 hPa
<i>Numbers on board: crew</i>	A. 1 B. 1
<i>passengers</i>	A. 3 B. 10
<i>Personal injury</i>	A. Slightly injured B. None
<i>Damage to aircraft</i>	A. Substantial B. None
<i>Other damage</i>	Tree damage
<i>Commander's age and licence</i>	A. 36 yrs, Balloonist's Licence, Dutch B. 54 yrs, Balloonist's Licence
<i>Commander's total flying hours</i>	A. Approximately 250 hours, of which 200 on the type B. Approximately 690 hours, of which an unknown hours on the type
<i>Commander's flying hours and number of landings previous 90 days</i>	A. Approximately 90 hours/45 landings, all on the type B. Approximately 18 hours/ 6 landings of which 2 hours/ 1 landing on the type

The Board of Accident Investigation (SHK) was notified on 8 August 1997 that an accident involving two hot-air balloons with registrations PH-IHO and SE-ZGH had occurred on the same day at 20:06 hrs in the airspace near Årsta Holmar, AB county, Sweden.

The accident has been investigated by SHK represented by Sven-Erik Sigfridsson, Chairman, Monica J Wismar, Chief Investigator Flight Operations, Henrik Elinder, Chief Technical Investigator (aviation), and Jan Mansfeld, Chief Investigator (rescue services).

The Board has been assisted by Ingmar Lilja as operational expert.

The investigation has been followed by the Swedish Civil Aviation Administration represented by Carl Olsson.

The purpose of the investigations performed by SHK is solely to prevent accidents and incidents in the future.

SUMMARY

On 8 August 1997 a number of hot-air balloons were to take off from Enskedefältet, south of Stockholm city, on passenger flights. The wind from about 100 metres was southerly-to-westerly up to an altitude of approx. 1 500 metres.

The pilot of the Dutch hot-air balloon PH-IHO took off some minutes after the Swedish balloon SE-ZGH, just after 19:55 hrs. He ascended to 1 200 ft with the same direction of flight as the other balloons in the vicinity. He soon drifted away from the others and ascended to follow them. When he reached approx. 1 400 ft he heard voices and saw a shadow over his balloon. Then a scraping was experienced from his balloon shroud, which split. They sank rapidly. To reduce the rate of descent the passengers jettisoned two gas cylinders of LPG at the same time as the pilot started the burner. They crash landed among some trees in the northern part of Årsta holmar. Deceleration took place when the shroud was caught in the treetops and the basket struck the ground right-side-up. Those on board left the basket unaided and the pilot announced via his comm. radio that they were out of danger.

Balloon SE-ZGH took off at 19:55 hrs and rose to 1 200 ft. The pilot tried unsuccessfully to make contact with Bromma air traffic control. Meanwhile he ascended to an altitude between 1 400 ft and 1 600 ft. While he was occupied on the radio a passenger told him there was a balloon under them and that they were going to collide. The pilot fired the burners but was unable to avoid the collision. He continued his flight to reach an area on which to land. After just over an hour they landed at Edsberg, north-east of Stockholm.

The accident was reported to the rescue services at 20:09 hrs. The first vehicle reached the shorefront at Sockerbruksgränd in the Tanto area after four minutes, to note that the balloon fliers were on the islet and that they were in no immediate danger. They were fetched ashore by a police launch and driven to the hospital (Södersjukhuset) for examination.

The accident was caused by both pilots' lack of attention.

Recommendations

The Civil Aviation Administration is recommended

- to consider requirements for a commercial pilot certificate for balloons in commercial use, and
- to consider demands for the use of life jackets when the greater part of a flight is to take place over water.

1 FACTUAL INFORMATION

1.1 History of the flight

During the evening of 8 August 1997 a number of hot-air balloon units with pilots, passengers and chase vehicles were gathered at Enskedefältet, south of Stockholm city, to prepare for passenger flights. The wind at a height of approximately 100 metres was southerly shifting to west at a height of approximately 1 500 metres. The flights were to take place overhead Årsta, the inner-city area of Stockholm and onwards towards Edsviken.

Shortly after 19:55 hrs, the Dutch hot-air balloon PH-IHO, with the pilot and three passengers on board, took off. This was a few minutes after the Swedish SE-ZGH balloon's launch. The Dutch pilot has stated that after take off they ascended to 1200 feet with the same flightpath as the other balloons in the vicinity. After a short while he drifted away from the others and subsequently ascended further to enable himself to follow them. When he reached approximately 1 400 feet and levelled off, he heard voices and discerned a shadow above his balloon. Thereafter something scraped the balloon shroud which then ruptured. They then began to descend at a substantial rate of approximately 1 000 ft/min. To diminish the rate of descent the passengers threw two of the liquefied petroleum gas (LPG) cylinders overboard as the pilot simultaneously started the gas burner. They crash landed among the trees on the northern part of Årsta Holmar. Deceleration occurred when the balloon shroud entangled itself in the treetops and the balloon baskets impacted right-side-up. The individuals on board were able to leave the basket unassisted and the pilot radioed to Air Traffic Control that they were out of danger.

The pilot of balloon SE-ZGH has stated that he listened to the weather information broadcast from Stockholm/Bromma airport on his communications radio prior to take off, which was at 19:55 hrs. After take off he ascended to 1 200 feet. When he attained this height he attempted to contact the air traffic controller in Bromma tower via his comm-radio without success. He could however, via the radio, hear that other balloonists did indeed have contact with the tower. During this time he had ascended to a height of 1 400 to 1 600 feet. While he was preoccupied on the radio, one of his passengers informed him that there was another balloon beneath them and that they were going to collide. The pilot started his burner but was failed to in avoid the collision. He observed that the shroud of the underlying balloon had ruptured and that the entire unit was now plunging towards the water. He continued the flight in order to reach a landing area. After a little more than one hour they landed near Edsberg north-east of Stockholm.

The rescue services received the accident alarm at 20:09 hrs. The first vehicle arrived on the shorefront near Sockerbruksgränd in the Tanto area within four minutes and ascertained that the balloon-flyers were on the islet and that they were not in immediate danger. They were picked up and brought to the mainland by police boat and driven thereafter to hospital (Södersjukhuset) for examination.

The accident occurred at position 5818N 1803E; approximately 350 metres over the sea.

1.2 Personal injuries

	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>	<i>Total</i>
Fatal	-	-	-	-
Seriously injured	-	-	-	-
Slightly injured	1	3	-	4
No injuries	1	10	-	11
Total	2	13	-	15

1.3 Damage to the aircraft

A. Substantial, B. None.

1.4 Other damage

Damage to trees.

1.5 The crew

A. The pilot was 36 years old at the time and had a valid Balloon Pilot's Licence.

Flying hours

<i>previous</i>	<i>24 hrs</i>	<i>90 days</i>	<i>Total</i>
All types	-	90	approximately 250
This type	-	90	approximately 200

Number of landings this type previous 90 days: 45.

B. The pilot was 54 years old at the time and had a valid Balloon Pilot's Licence.

Flying hours

<i>previous</i>	<i>24 hrs</i>	<i>90 days</i>	<i>Total</i>
All types		18	approximately 690
This type		2	unknown ¹

Number of landings previous 90 days: 1.

1.6 The aircraft**1.6.1 General**

Owner: A. Rene Elgersma, Melkweg 62

¹ The pilot's logbook containing his flying hours was stolen the same day as the occurrence.

3225 VE Hellevoetsluis, Holland
 B. Ballongflyg Hit & Dit AB,
 Hammarbyvägen 37,120 32 Stockholm/
 Upp & Ner AB, address as above.

Type: A. Cameron N-133
 B. LBL 240A

Serial number: A. 4080
 B. 199

Year of manufacture: A. 1997
 B. 1995

Both hot-air balloons had valid Certificates of Airworthiness.

1.7 Meteorological information

The weather reported at Bromma airport at 19:50 hrs and 20:20 hrs was as follows:

19:50: Wind 160 degrees/07 knots, visibility >10 km, no clouds below 5 000 ft, temp./dew point +24/+14 degrees C, QNH 1023 hPa.

20:20: Wind 160 degrees/06 knots, visibility > 10 km, no clouds below 5 000 ft, temp./dew point +23/+14 degrees C, QNH 1023 hPa.

Wind profile measured at Stockholm/Arlanda airport:

Altitude (metres/feet) Direction (degrees) Meters/second

528/1731	221	11.1
463/1518	213	10.9
443/1452	212	11.1
408/1338	209	10.6
381/1249	207	10.4
343/1125	206	10.4
315/1032	204	9.8
284/931	202	9.7
253/829	200	9.1
224/734	201	9.1
198/649	199	8.6
166/544	202	8.6
114/373	195	7.3

Near the Southern Stockholm coast (Södertörn) the wind was reported at 110-120 degrees/<5 knots. Further along the coast from Stockholm and towards the north the surface wind was 150-170 degrees/5 knots. The Swedish Meteorological Institute (SMHI) analysis of the winds at Årsta Holmar shows a direction of 120-140 degrees/5-7 metres per second (10-14 knots).

1.8 Navigational aids

Not applicable.

1.9 Radio communications

The radio frequency used to communicate with Bromma tower was 118.1 Mhz.

The pilot of balloon PH-IHO contacted Bromma tower at 19:59 hrs and received clearance to ascend to 1 200 feet.

At 20:06 hrs the pilot of balloon SE-ZGB reported to Bromma tower that a collision had taken place.

1.10 Airport data

Not applicable.

1.11 Flight and sound recorders

Was not installed. Not required.

1.12 Accident site and Aircraft wreckage

1.12.1 *Accident site*

The balloon crash landed on the northern portion of Årsta Holmar in an area covered by large deciduous trees. After ground contact the balloon basket was upright on the ground. The shroud and accompanying lines were hanging in the treetops. Tree limbs with a diameter of two decimetres were broken off.

1.12.2 *Aircraft wreckage*

The balloon basket was almost undamaged while the shroud was torn to pieces and had burn marks on the lower edge. Two LPG cylinders remained in the basket while two others were recovered in the water north of the islet. Life vests were onboard, packed in sealed plastic covers which were secured with cable ties. These had not been used.

1.13 Medical information

There is no indication that the mental and physical condition of the crew had been impaired prior to the flight.

1.14 Fire

When the balloon shroud was punctured during the collision it was partially depleted of warm air and subsequently portions of it came close to the burner flames and caught fire. No fire broke out at the crash site.

1.15 Survival aspects

The pilot of balloon PH-IHO contracted back pain from the impact and was X-rayed in hospital. No serious injuries were found. The passengers were in a state of shock. Some experienced cervical pain and some sustained minor burns. No injuries were reported in balloon SE-ZGH.

There was no Emergency Locator Transmitter (ELT) on board. Not required.

1.16 Special tests and investigations

The communications radio (Brand/DittelfSG5) was investigated at a special laboratory. There it was ascertained that the transmitter had a functional range of only 10-50 metres.

1.17 The company's organisation and management

The hot-air balloon of Swedish registration was operated by a company which regularly undertakes passenger flights in Stockholm. In the company's operational manual (DHB) it is prescribed that the pilot shall have performed at least 3 flights during the previous 90 days, one of which on the current balloon type. He shall furthermore have passed periodic flight training (PFT) with the Chief of Flight Operations (CFO) or an inspector/instructor.

The Swedish pilot who normally flies the company's stationary gas balloon (anchored with a cable) was scheduled for extra duty to fly hot-air balloons during the week of the Stockholm Water Festival. This was the first flight of that period. Since the pilot had owned his own hot-air balloon company and had been a well-known balloonist for several years, the CFO made an exception and did not perform a check flight prior to the mission. The CFO has stated that he asked the commander how many flights he had performed during the previous 90 days. The answer he received was that he (the pilot) had made six flights and had also flown large balloons. The CFO has subsequently inquired at other balloon companies and has ascertained that the pilot in question made at least three flights in the 90 days previous to the accident, one of which was in the LBL 260.

1.18 Other information

1.18.1 *Witness statements*

Several people saw the collision between the two balloons. Some had the impression that the Swedish registered balloon sank while others stated that the Dutch ascended into the Swedish. The pilot of the Dutch balloon stated to the police immediately after the accident that he collided with the Swedish balloon while ascending.

During the flight one of the passengers aboard the Swedish balloon was filming with his video camera. The board (SHK) has viewed this video and can ascertain from it that the Swedish pilot was preoccupied with his flight comm-radio. One of the passengers brought to the pilot's attention that there was another balloon beneath them just prior to the collision. The balloon shroud split from the pressure and flames could be seen issuing from the burner of the lower balloon.

1.18.2 *Right-of-way rules*

For balloon flying the traffic rules, where applicable, are found in Bestämmelser för Civil Luftfart Trafikregler (BCL-T). (Rules for Civil Aviation.)

In BCL-T paragraph 3.2 "*Remark. To avoid collision it is of the greatest importance that careful lookout is practised on board aircraft during flight,*

irrespective of whether VFR or IFR flight is performed and irrespective of what classification of airspace the flight is performed within, also during maneuvering on the ground or water.”

Further in paragraph 3.2.1.1 “Aircraft may not be operated so close to another aircraft that a risk of collision may arise.” In paragraph 3.2.2 Right-of-way requirements: “Aircraft that are not required to give way to other aircraft shall maintain course and speed. The aircraft commander is however always required to take such measures as best serve to avoid a collision.” As to who is required to give way it is stated that “motor-driven aircraft that are heavier-than-air shall give way to airships, gliders and balloons.” On the other hand there are no mutual rules between balloons. In paragraph 3.2.2.4 Overtaking “An overtaking aircraft shall, irrespective of climbing, descending or in cruise, give way by altering its course to the right of the overtaken aircraft.” On the other hand, course changes with balloons take place by altering height.

In world-wide competitions with many balloons in the same area there are conventional or recognised rules. The pilot may not ascend if he is not absolutely certain that there is no balloon above. Recommended climb rate in the vicinity of other balloons is 300 feet/minute (approximately 1,5m/second). When two balloons are approaching each other the pilot of the higher balloon shall also give way and if necessary ascend to avoid a collision.

1.18.3 *Authority and requirements during flight with hot-air balloons*

In Sweden approximately 80% of all hot-air balloon flying is of commercial nature. In the Stockholm area about 10 000 passengers are transported each year. According to the Civil Aviation Regulations (BCL) with regard to flights with hot-air balloons, no distinction is made between private flying and commercial flying with respect to different certificate requirements or operational rules, as is the case with other flight activity with other aircraft types in commercial aviation. In BCL-D 2.8 paragraph 7.2 there is a note that reads “BCL-D 4.2 contains specific supplementary requirements for duty as aircraft commander in commercial air traffic with a hot-air-balloon.” The above mentioned chapter/paragraph contains no such supplementary requirements. This means that a newly-trained balloon pilot may fly with up to 24 passengers in a hot-air balloon after a total of 16 hours of flying, thereof a minimum of 14 hours with an instructor onboard, as is the requirement for basic training.

To license a balloon company the Swedish Civil Aviation Administration demands that the company in its operational manual states the following minimal requirements for a pilot in the company performing commercial passenger flight:

- age 21,
- 100 hours as commander of a hot-air balloon,
- 2 years certificate holding,
- trained on the type/version,
- at least one full weight flight on the type/version without passengers,
- trained in firefighting and in taking care of acute ill and/or wounded persons,
- PFT with the CFO before the first flight and once a year thereafter,
- approval from the CFO for the actual mission,
- minimum three flights during the last 90 days, of which at least one on the type/version before paying passengers may be flown.

The Swedish Balloon Federation, together with the commercial balloon companies has agreed that none commercial flights over Stockholm should not be undertaken with pilot’s who have less than 50 hours of balloon experience.

SHK has reviewed the regulations applicable to hot-air-balloon flying in England. Commercial balloon activities are specifically regulated there through both operations

and certificate directives. All in all, higher requirements are made for training of commercial balloon pilots; e.g, a minimum of 75 hours before a certificate is issued, requirements on the number of take-offs within 90 days and also periodical flight training (PFT) once per year. Flights over densely-populated areas may take place only above 1 500 feet height and with a 700 metre lateral obstacle clearance. Special authorisation is required for landing in densely populated areas.

2 ANALYSIS

2.1 The accident

On the evening of the flight the weather conditions were good and more than 20 balloons were in the airspace above Stockholm. Several had approximately the same takeoff time and launch area. Therefore they were very close to one another after takeoff. When flying with many balloons, the risk of collision is great and this imposes high demands on the attentiveness of the pilot and upon his flight planning. The sluggishness that is apparent in manoeuvring a balloon through its ascending and turning calls for great vigilance by the pilot, who is obliged to ascertain that empty space exists above him if he intends to climb or have a chance to give way. According to testimony and to the videotape, SHK can ascertain that the Dutch balloon climbed and collided with the Swedish balloon; also that the Swedish pilot was preoccupied with his comm-radio and was not keeping sufficient lookout for other traffic. The collision shows that a lack of attention prevailed on the part of both pilot's.

Fortunate circumstances caused the balloon to end up among trees which retarded the impact. Had the unit ended up in the water or directly on the ground the personal injuries would have been more serious. SHK noted that the onboard life vests were difficult to use due to their packaging and the manner in which they were mounted. It would probably be better during overwater flights, that are often the case in the Stockholm area, that passengers wear their lifevests from the beginning. In the event of a collision or other rapid event causing the balloon to end up in the water, there is no time to free, unpack and don the vests.

2.2 Rules for balloonsflying

Considering that around 10 000 passengers per year in the Stockholm area alone, undertake balloon flights, SHK finds it remarkable that there is no set of rules to regulate the commercial part of this operation, such as exist for other aviation operations. The Swedish Balloon Federation has together with the commercial companies come to their own agreements; but technically a newly-trained balloon pilot has the right to fly a large balloon with for example 24 passengers over densely populated areas. SHK has illustrated the problem in earlier investigations (Report C 1996:18).

3 CONCLUSIONS

3.1 Findings

a) The pilots were qualified to perform the flight.

- b)* The hot-air balloons were airworthy.
- c)* The comm-radio in the Swedish hot-air balloon was only functional as a receiver.
- d)* The Dutch hot-air balloon ascended into the Swedish.
- e)* The commercial portion of hot-air balloon operations is not regulated in the Rules of Civil Aviation.

3.2 Causes of the incident

The accident was caused by both pilot's lack of attention.

4 RECOMMENDATIONS

The Civil Aviation Administration is recommended

- to consider requirements for a commercial pilot certificate for balloons in commercial use, and
- to consider demands for the use of life jackets when the greater part of a flight is to take place over water.