

*The original of the Final Report was issued in the Slovak language.
In case of inconsistency original version in Slovak language is applicable.*



MINISTRY OF TRANSPORT, CONSTRUCTION
AND REGIONAL DEVELOPMENT
OF THE SLOVAK REPUBLIC



AVIATION AND MARITIME INVESTIGATION AUTHORITY
Námestie slobody 6, P.O.BOX 100
810 05 Bratislava 15

FINAL REPORT

on investigation of accident
of helicopter type **AGUSTA A 109K2**
Registration No **OM-ATB**

Reg. No: **SKA2015004**

The investigation of occurrence has been conducted pursuant to Art. 18 of the Act No. 143/1998 on Civil Aviation (Civil Aviation Act) and on Amendment of Certain Acts and in accordance with the Regulation (EU) No. 996/2010 of the European Parliament and of the Council on investigation and prevention of civil aviation accidents and incidents, governing the investigation of civil aviation accidents and incidents.

The final report is issued in accordance with the Regulation L 13 that is the application of the provisions of ANNEX 13 Aircraft Accident and Incident Investigation to the Convention on International Civil Aviation.

The exclusive aim of investigation is to establish causes of accident, incident and to prevent their occurrence, but not to refer to any fault or liability of persons.

This final report, its individual parts or other documents related to the investigation of occurrence in question have an informative character and can only be used as recommendation for the implementation of measures to prevent occurrence of other accidents and incidents with similar causes.

A. INTRODUCTION

Operator / Owner: AIR-TRANSPORT EUROPE spol. s.r.o., health care provider (hereinafter "ATE")
Type of operation: Helicopter Emergency Medical Service
Type of helicopter: Agusta A 109K2



Registration No: OM-ATB
Take-off site: Airport Poprad – Tatry / LZTT
Flight phase: route / approach to the place of technical intervention
Place of accident: Under Kláštorňá roklina gorge – Hornád canyon - Slovenský Raj
Date and time of accident: 17.07.2015, 16:12

Note: All time data in this report are stated in the UTC time.

B. INFORMATIVE SUMMARY

On 17.07.2015, at 15:52, the pilot with helicopter type Agusta A 109K2, Registration No OM-ATB (hereinafter "helicopter") took off from the airport LZTT at the request of the Mountain Rescue Service transmitted through the Regional Operations Centre in Košice.

In the final approach phase on the place of technical intervention the main rotor blades came into contact with electric power lines, which caused their destruction and the helicopter crash. The helicopter crashed in the gorge of the Hornád canyon.

The helicopter crew members suffered fatal injuries in the accident. The helicopter was completely destroyed.

The following commission was appointed for investigation of the accident:

Ing. Igor BENEK	chairman of the investigation commission
Ing. Juraj GYENES	member of the investigation commission
PaedDr. Ján MIKUŠ	member of the investigation commission

The report is issued by:

Aviation and Maritime Investigation Authority
of the Ministry of Transport, Construction and Regional Development
of the Slovak Republic.

C. MAIN PART OF REPORT

1. FACTUAL INFORMATION
2. ANALYSES
3. CONCLUSIONS
4. SAFETY RECOMMENDATIONS

1. FACTUAL INFORMATION

1.1 History of the flight

On 17.07.2015 the pilot conducted a helicopter rescue flight according to procedures described in the ATE Operating Manual from the airport LZTT at request of the Mountain Rescue Service – Operations Centre Slovenský raj – Čingov. The helicopter crew consisted of the pilot, a doctor and a rescuer.

At 15:52 the pilot took off with helicopter and headed to the reported place of intervention, situated in the proximity of the orientation point “Tobogan“ in Kláštorňá roklina gorge in Hornád canyon, in the area of Slovenský Raj.

Following the telephone call and according to the methodology of rescue interventions during flight, the pilot made a transit landing at 16:07 (N 48°56'31.3'' E 20°29'04.7'') in the Čingov operating area to take on board a member of the mountain rescue service as a crew member/rescuer and expert on local conditions in the area of intervention.

After the take-off from the Čingov operating area, the helicopter with a four-member crew headed through the Hornád canyon to a place where an injured tourist was reported.

In the final approach phase in the intervention area at 16:11 the crew members devoted themselves exclusively to the preparation for technical intervention, as confirmed by the account of the eye witness, who identified the open door of the helicopter and the preparation for airdropping of the rescuer.

The crew started the manoeuvre of approach to the patient with the aim to airdrop the rescuer. In this phase of flight, at 16:12, with the helicopter slightly banking to the right (course of flight 261° - 272°, flight speed 77 km/h, altitude of 647 m), the main rotor blades came into contact with electric power lines.

The contact caused rupture of two electric power lines, their winding on the rotor head (in a length of 2 m), gradual disintegration of rotor blades and further increase of massive destruction forces. The loss of surface of the main rotor blades caused the drop of its efficiency, which was not sufficient for the flight speed of 77 km/h, and the helicopter crashed into the gorge on the right side of the river Hornád.

In the helicopter cabin there was no tool for rope cutting in case that the helicopter comes into contact with rope during flight in low altitude.

The helicopter crew members suffered fatal injuries incompatible with life and the helicopter was destroyed in the accident.

Daytime: day

Flight rules: VFR

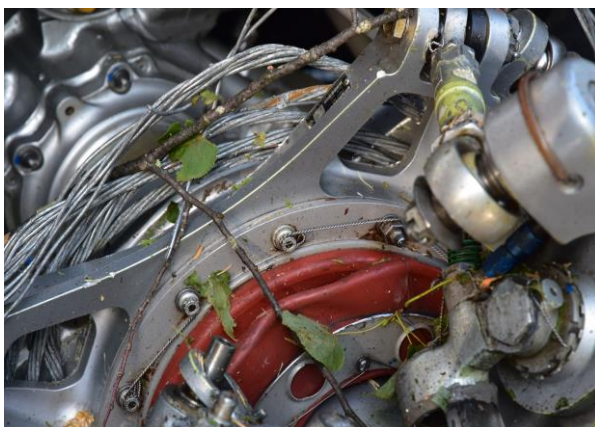
1.2 Injuries to persons

Injury	Crew	Passengers	Other persons
Fatal	4	-	-
Serious	-	-	-
Minor	-	-	-
None	-	-	-

1.3 Damage to aircraft

The helicopter was destroyed in the accident:

- fully destroyed rotor, broken helicopter body, massive damage to the cabin.



1.4 Other damage

No circumstances with potential claims for compensation of other damage toward a third party were notified to the Aviation and Maritime Investigation Authority.

1.5 Personnel information

Pilot:

A national of the Slovak Republic, aged of 44 years, Holder of the helicopter pilot licence issued on 14.05.2014 by the Transport Authority of SR, Civil Aviation Division.

Medical certificate of 1st class with marked validity until 12.12.2015.

Qualifications

Helicopter (typ Agusta A 109K2) - with marked validity until 31.05.2016

Flying experience:

Total flight hours	1823 hours 05 minutes 5154 flights
of which in 2015	75 hours 18 minutes 249 flights

Crew members of HEMS (Helicopter Emergency Medical Service):

Doctor - a national of the Slovak Republic, aged of 45 years

Rescuer - a national of the Slovak Republic, aged of 34 years

Mountain Rescue Service member - a national of the Slovak Republic, aged of 36 years.

1.6 Aircraft information

Type:	Agusta A 109K2	
Registration No:	OM-ATB	
Serial No:	10009	
Manufacturer:	Agusta S.p.A	
Total operating hours:	4 088 hours	
Right-hand engine:	Arriel 1K1	S/N 16011 TSN 3960
Left-hand engine:	Arriel 1K1	S/N 16056 TSN 3989

The certificate of airworthiness No 0717, issued by the Transport Authority of SR, date of issue: 29.04.2008; certificate of airworthiness verification issued on 10.04.2015 with marked validity until 25.04.2016.

Total operating hours since manufacture: 4824 hours 12 minutes 21245 flights.

Third-party insurance: CATLIN Insurance Company Limited 20 Gracechurch Street GB-London EC3V 0BG, valid from 17.02.2015 to 16.02.2016.

The record of technical and flight parameters obtained from the flight recorder indicates that the technical condition of the helicopter before accident and during flight was not the cause of the accident. Both engines were properly running until the moment of the accident.

1.7 Meteorological situation

On 17.07.2015 in the afternoon our territory was situated between an area of higher pressure above the Alps region and an area of low pressure above the northern Belorussia with prevailing western to north-western air circulation. The Popradská and Hornádska kotlina valleys had warm summer weather conditions with fast development of heap clouds generating local storms, which moved in the steering north-west flow to the south-east and then decayed. With coming sunset, the cloud formation ceased and the storm activity diminished in the south-east direction of the ridge of Slovenské Rudohorie mountains.

At the time of accident, the area of Slovenský raj, the Hornád canyon under the Kláštorňá gorge had a half-covered sky, with a degree of cloud cover 3 to 4/8, of which 2 to 3/8 by low-level clouds "Cu mediocris" (cloud height approx. 1500 m above the ground), 1/8 by middle-level clouds "Ac" and 2/8 by high-level clouds "Ci". No precipitations occurred in the area. The horizontal visibility was 25 to 30 km, air temperature was about 23°C. Gentle west wind

with speed up to 4 m/s and gusts up to 6 m/s was blowing at a height of 10 m above the ground. The data on air temperature and wind are related to a fictitious mountain ridge at an altitude of 700 m in the affected area. Data on wind direction and wind speed in free atmosphere, based on aerological outputs in Gánovce, confirm the temperature and wind data referred to above.

The position of the Sun at the time of accident in the area of Slovenský raj, Hornád canyon under the Kláštorňá gorge, coordinates 48°57'10.69"S and 20°25'12.72"V, was determined as follows: Sun azimuth 280.8°, Sun height 18.9°. The Sun disappeared below the horizon at 18:32. The investigators took into account the total sky coverage by clouds and their distribution in the area of Popradská and Hornádska kotlina valleys, in particular the structure of low heap clouds, data from nearby meteorological stations, as well as the position of the Sun in the sky at the critical time. The Sun shone in the affected location at the time of accident.

Meteorological data were obtained by measurements of classic climatologic, precipitation-gauge a automatic meteorological stations of the observation network of the Slovak Hydrometeorological Institute (SHMI) installed in the Popradská and Hornádska kotlina valleys and in the Slovenské Rudohorie mountains. In addition, measurements of SHMI distance systems, i.e. satellite and radar measurements, as well as radio probe and radiation measurements from the station Gánovce pri Poprade were used.

1.8 Aids to navigation

N/A.

1.9 Communications

The helicopter was equipped by radio communication equipment allowing two-way radio communication with all air stations and rescue service stations at every moment of the flight.

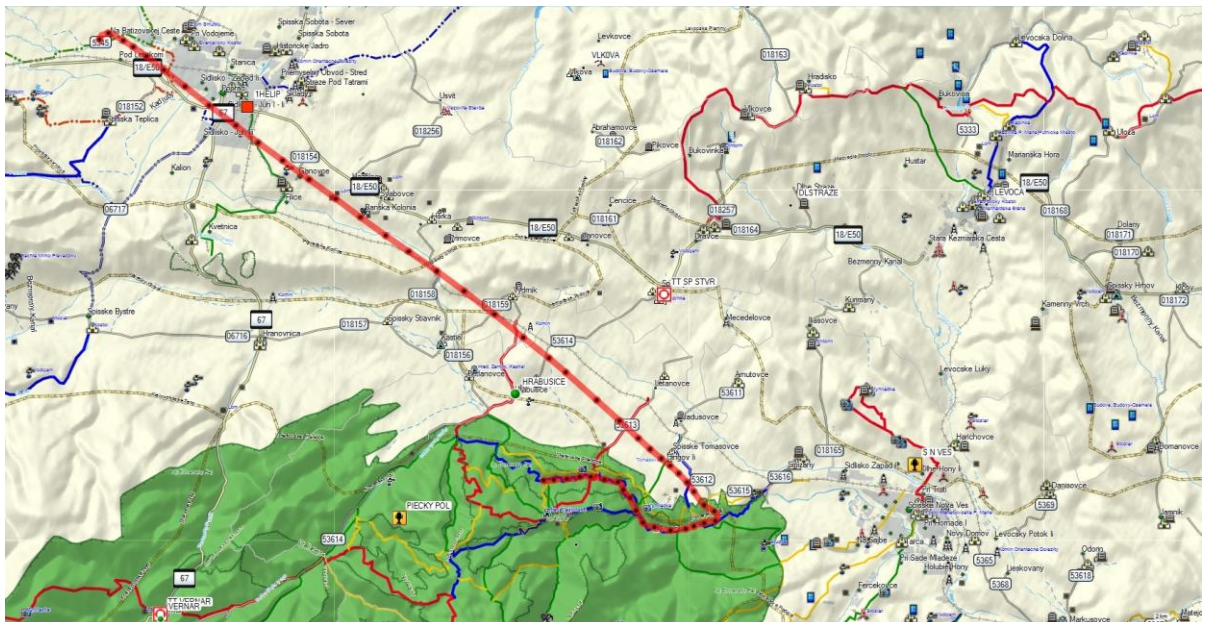
1.10 Aerodrome information

N/A.

1.11 Flight recorders

Data from the device GARMIN GPSmap 296 S.No.10711731 were used for evaluation of the flight.

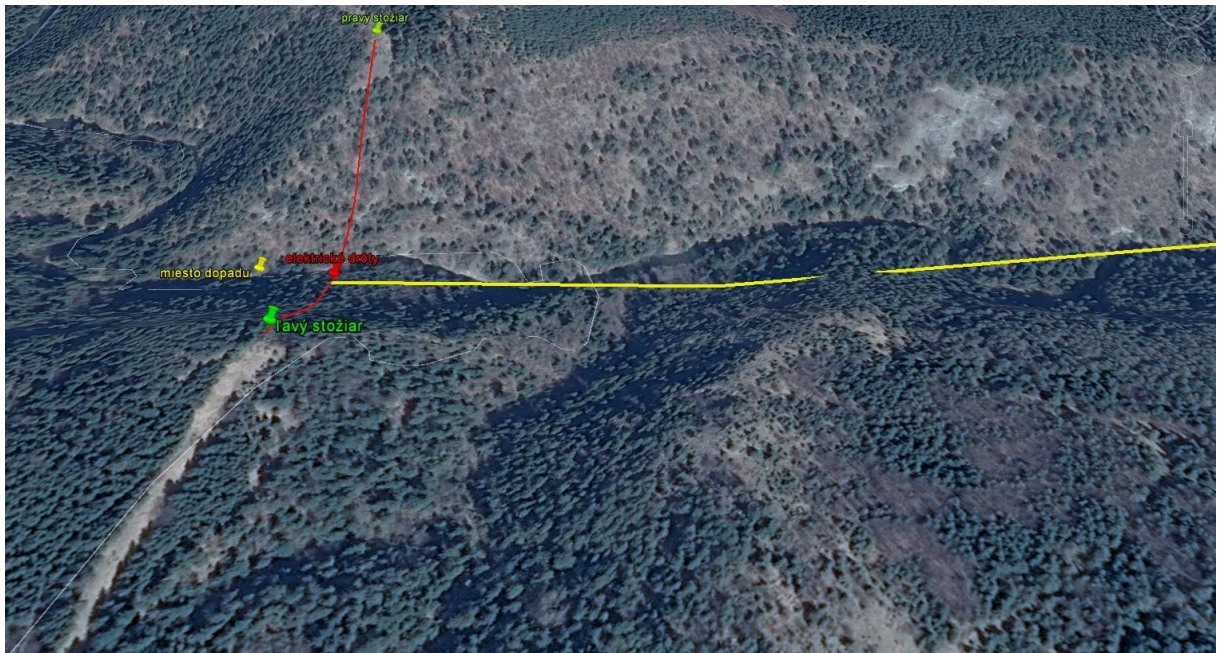
Data from the device Health and Usage Monitoring System (hereinafter "HUMS") were used for evaluation of basic parameters of the power unit.

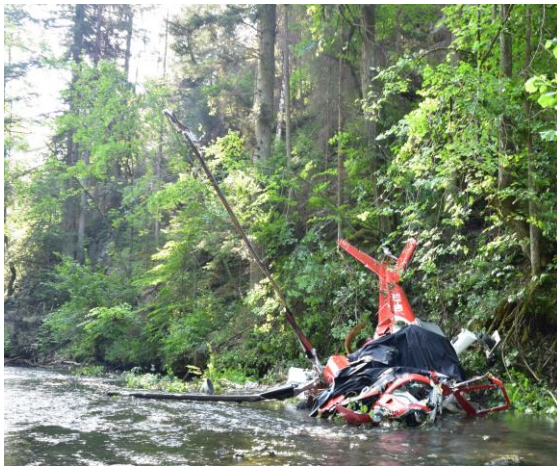
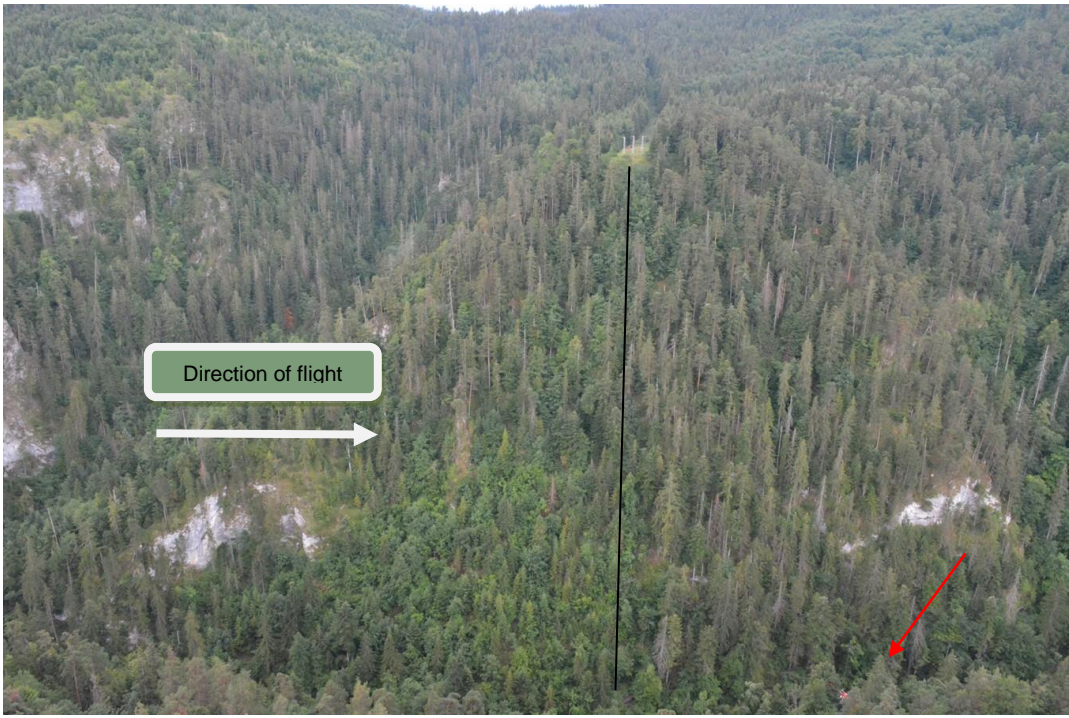


1.12 Wreckage and impact information

N 48°57'10.10" E 20°25'12.70"

The helicopter crashed into a narrow gorge, on the bank of a river, in hardly accessible area with thick forest stand. A portion of wrecks was dispersed in its proximity, in the river. Segments of rotor blades were found on a hardly accessible hillside of the gorge.





1.13 Medical and pathological information

Forensic examination was conducted – assessment of the pilot's death related to the calculation of impact velocity, evaluation of special biochemical examinations, pilot's health condition before the accident, detailed analysis of the mechanism of injuries caused by the ground impact of the helicopter.

From the forensic aspect, the pilot died of violent death due to accident causes, injuries to several vital organs and fractures of several bones of the skull, torso and extremities.

The examination of biological materials did not detect the presence of ethylalcohol, standardly used painkillers, tranquillizers and sleeping drugs (analgesics, ataractics, barbiturates and benzodiazepines), or other psychoactive substances, narcotics and drugs, which could influence the thinking and behaviour of the pilot at the time of accident, or contribute to his death.

Neither the external and internal inspection of a corpse, nor supplementary laboratory examinations of biological materials detected acute or chronic pathological changes, which could negatively influence attention and behaviour of the pilot at the time of accident or contribute to his death.

1.14 Fire

No fire broke out.

1.15 Survival aspects

The witness of the accident, professional fireman, who found himself approximately 200 m from the place of accident, checked the vital functions of victims immediately after the crash of helicopter, but stated that none of the crew members showed any signs of life.

Due to the hardly accessible area, high daily temperature and coming sunset the mortal remains of the victims were recovered from the wrecks and transported away by a helicopter in the morning of 18 July 2015.

1.16 Tests and research

N/A.

1.17 Organizational and management information

ATE operates the helicopter emergency medical service (HEMS) in seven operating centres throughout Slovakia. They have long-year experiences from provision of air rescue services. The crews of the operating centre POPRAD-KRIŠTOF 03 mostly perform interventions in difficult conditions of High, West and Belianske Tatra mountains as well as in the region of Slovenský raj. The attendant personnel of the station ATE HEMS consists of a pilot, a doctor and a rescuer. The difficult terrain of this region requires the frequent use of special equipment such as cable and suspension winch.

The flight operation was performed in accordance with aeronautical regulations valid in the territory of the Slovak Republic and with local rules.

The flight was conducted in accordance with working procedures and methodology of intervention during emergency flights (HEMS flight), approved by the Transport Authority of SR - Aircraft Operation Department.

On the basis of assessment of distress call circumstances or circumstances identified during intervention, the attendant doctor may, following consultation with the attendant pilot and with regard to the need of safe and expedient implementation of intervention, complete the rescue team by further specialists (mountain rescuer, dog robber, etc.). The specialists attended required training according to the curricula of ATE. The deployment of persons who attended (repeated) training is the responsibility of the respective rescue unit.

1.18 Additional information

The operator ensured the performance of a helicopter flight on the same route to the place of accident for the purpose of simulation of the flight before the accident and reconnaissance (visibility of power line pylons and conductor from the perspective of the pilot in the cabin) in order to collect information on possible conditions during the critical flight and to analyze potential perceptions of the helicopter crew members.

The arrival at the place of accident was performed on a straight course to the Sun, like on the day of accident. Although the pilot was exactly informed about the location of existing power line pylons and conductors he had to interrupt the arrival at the close proximity of the place of accident, because he was unable to identify the obstacle. Subsequently, he conducted air suspension and with help of the operator identified the pylons without problems; however, the position of conductors toward the ground and the Sun could not be identified.



The pilot also conducted approach/arrival from the opposite direction, i.e. from east to west, like on the day of accident, but this time with the sun shining from behind his back. He identified the power line pylons and conductor without problems.



The Transport Authority of SR in accordance with Article 29 of the Civil Aviation Act in conjunction with provisions of Title 6 of Regulation L14/I orders marking of obstacles inside protective zones of aerodromes and aeronautical ground facilities.

The Transport Authority of SR in accordance with Article 30 of the Civil Aviation Act in conjunction with provisions of Title 6 of Regulation L14/I orders the marking of obstacles outside protective zones of aerodromes and aeronautical ground facilities. The types of obstacles and their marking are provided for by Title 6 of Regulation L14/I.

The owner of building or the operator of aerodrome or aeronautical ground facilities is responsible for installation and maintenance of the prescribed aeronautical obstacle marking.

According to valid legislation the Transport Authority of SR may order the aeronautical obstacle marking of VHT power lines 110 kV and more (Article 30 (1)(c) of the Civil Aviation Act).

This obligation currently does not apply to low tension lines.

The Transport Authority of SR assesses the construction of power lines with tension of 22kV or higher leading over valleys, near motorways, first-class roads etc. on an individual basis, taking into account potential frequent flights of the emergency service, but it only **RECOMMENDS** aeronautical obstacle marking, instead of ordering it.

In this case the fulfilment of this condition is always at the discretion of the owner of the building.

1.19 Useful or effective investigation techniques

Standard investigation methods were used.

2. ANALYSIS

With probability bordering on certainty it can be assumed that at the time of arrival, before the technical intervention itself, the whole crew of helicopter was intensively searched for and locating the place of intervention. It is proved by the speed and height of flight obtained from the flight recorder and by the open door, as confirmed by the account of the witness.

All crew members were developing maximum effort to locate the injured person and the place of intervention, which was hidden in a narrow valley and forest stand of the winding river Hornád.

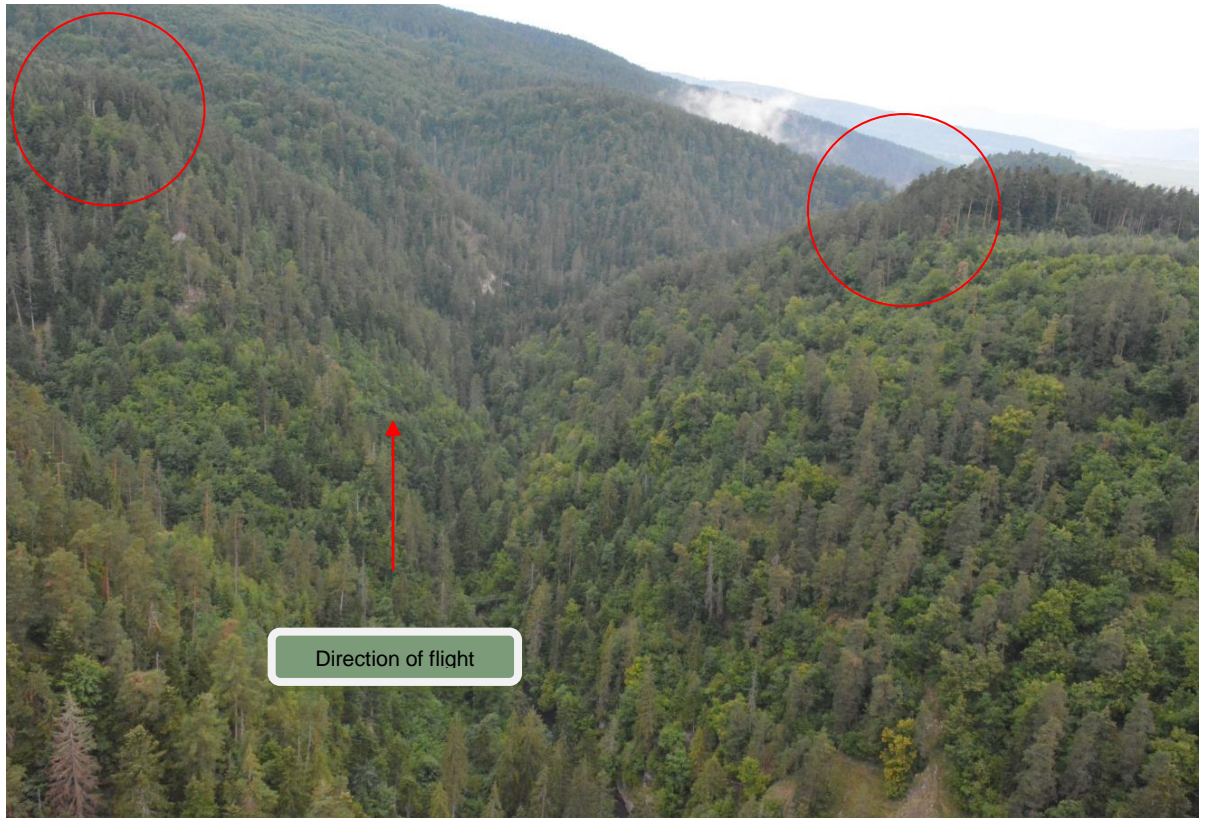
In a search for the place of intervention, where the injured tourist found himself, and going on reconnaissance in difficult flight conditions, and probably due to the time constraint at the rescue of patient, the pilot flew against the sun disappearing below the horizon, which limited his ability to identify power lines on pylons hidden in forest stand, due to the low height of flight.

At the time of arrival a large part of the valley was in a shadow, which rendered the exact location of the place, where the patient found himself, very difficult.

During this maximum concentration oriented to the search for the injured person, the pilot overlooked the power lines blending with the ground, which was unrecognizable due to their installation on low pylons and conductors overhanging low over the valley. Under the light conditions and given the course and height of flight the power lines were difficult to notice.

The process of destruction and the character of damage to preserved fragments indicate the primary contact of electric power lines with peripheral arches of main rotor blades. On this basis it can be concluded that in the final approach phase the flight was conducted at the level of the power lines from the view of rotor blades and with the helicopter slightly banking to the right, which is proved by the fact that the first conductor remained intact and that rotor blades collided with the following conductors.

It can also be assumed that one of potential causes of the contact with power lines was the pilot's limited view in certain directions during the flight due to the structure of cabin and dashboard. If the pilot does not notice an obstacle before some point of time, in the following phase of flight this obstacle is practically unidentifiable.



3. CONCLUSIONS / CAUSE OF ACCIDENT

3.1 Findings

- The pilot and the crew members had valid qualifications for making the critical flight according to submitted rescue flight documentation.
- In a search for the place of intervention the pilot made a flight against the sun disappearing below the horizon, which limited the possibility of identification of the power lines on pylons hidden in the forest stand at given height of flight.
- The helicopter was not equipped by a flight data recorder, therefore the analysis of the flight relies, as regards the flight parameters, on GPS a HUMS data.
- The helicopter had valid documentation and did not show any fault before the take-off and during the flight.
- The helicopter fulfilled the conditions of airworthiness before the critical flight.

3.2 Cause of accident

- The main and immediate cause of the accident was the collision of the helicopter with steel power lines hanging over the Hornád canyon, during a flight in low height;
- The approach and start of technical intervention were performed by the helicopter crew under meteorological conditions negatively affected by the sunset, which probably caused the overlooking of electric power lines by the pilot flying against the light.

3.3 Contributory factors

- Rescue flight in a difficult mountain terrain under specific conditions;
- Non-marked electric power lines from the view of the helicopter crew;
- Installation of electric power lines on low pylons blending with surrounding forest stand, which rendered its identification difficult.
- High probability of blinding by the sun disappearing below the horizon in opposition to the main task to find the place for airdrop of the rescuer in a dark valley without contrasts.
- Low discernibility of objects in a dark valley and resulting difficult identification of power line conductors.

4. SAFETY RECOMMENDATIONS

On the basis of investigation of the accident of:

Helicopter type **AGUSTA A 109K2**

Registration No **OM-ATB**

Date of accident: **17.07.2015**

We recommend to implement the following measures:

ATE

- To equip the rescue helicopter pilots by detailed maps of height obstacles, HT/VHT
- To verify at the manufacturer whether the helicopters may be equipped by a tool for rope cutting during flight in low altitude;
- To analyze the results of investigation of the accident with aviation and technical personnel, focusing on the specifics, limitations and risks of performance of activity in a mountain area, in given location and in given season of year;
- During regular training to highlight to the crew members the importance of reconnaissance of the area of intervention, putting stress on the terrain, obstacles and meteorological conditions;
- Adoption of own measures on the basis of results of investigation.

Directorate General of Civil Aviation and Water Transport of MTCRD SR

- To initiate / consider amendments of valid law in the Slovak Republic for buildings and non-building facilities situated outside the protective zones, which by their properties could menace the flight safety, by introducing the obligation to apply the aeronautical obstacle marking to VHT power lines (22 kV and more), in particular those leading over valleys or near motorways, roads for motor vehicles and first-class roads, which can cause unacceptable risks to aircraft.

Bratislava, 06.11.2015