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
AND CONSTRUCTION
OF THE SLOVAK REPUBLIC

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

FINAL REPORT

on the safety investigation of an air accident

of a helicopter type **Robinson R44 Raven I**

registration mark **OM-TTM**

Reg. No: SKA2018005

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.

Abbreviations and acronyms:

FDR/CVR	Flight Data Recorder/Cockpit Voice Recorder
FIC	Flight Information Centre
ft	Feet (unit of length)
KIAS	Knots-Indicated Air Speed
kV	kilovolt
PPL(H)	Private Pilot License/Helicopter
TWR Prešov	Military non-radar air traffic controller Prešov
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules

A. INTRODUCTION

Helicopter type: Robinson R44 Raven I
Registration mark: OM-TTM

Operator/owner:	TROLIGA BUS, spol. s.r.o.
Operation type:	general aviation/sports and recreational flying
Take-off site:	Veľký Šariš, Kanaš municipality, Prešov district
Flight phase:	take-off
Take-off site:	N 49°03'06.96“, E 21°13'53.22"
Impact site:	N 49°03'11.03", E 21°13'46.83"
Date and time of accident:	7 July 2018, 16 h 40 min.

Note: All time data in this Report is reported in UTC time.

B. INFORMATIVE SUMMARY

At 15:05 the pilot made an intermediate landing with a Robinson R44 Raven I helicopter, registration mark OM-TTM (hereinafter referred to as the "**R44**") in Veľký Šariš, Kanaš municipality, Prešov district (hereinafter referred to as the "**municipality**").

At 16:40 the pilot took off with the R44 in the municipality. During the departure at zero altitude the R44 hit 110 kV high-voltage overhead power lines (hereinafter referred to as "**HV lines**") which were perpendicular to the direction of the flight. The uncontrolled R44 fell 55 metres from the HV lines on a private field.

The R44 pilot suffered fatal injuries during the accident.

The R44 was destroyed during the accident.

The district Police directorate in Prešov reported the accident to the Aviation and Maritime Investigation Authority of the Ministry of Transport and Construction of SR.

A committee was set up to investigate the causes of the accident:

Ing. Igor Benek	Chairman of the Safety Investigation Committee
Róbert Grexa	Member of the Safety Investigation Committee

The Report has been issued by:

Aviation and Maritime Investigation Authority
of the Ministry of Transport and Construction of the Slovak Republic

C. MAIN PART OF THE REPORT

1. FACTUAL INFORMATION

1.1 History of the flight

On the above-mentioned date the pilot was performing VFR flights without a flight plan with the R44 for private purposes. At 14:59 the pilot reported a ´Chminianska Nová Ves´ position to the TWR Prešov unit, 12 km from the planned intermediate landing, asking for clearance to land on a 25x10 m grass working area (hereinafter referred to as the "**area**") within the boundaries of the municipality.

At 15:05 he landed on the area in the municipality.

At 16:38 the R44 pilot reported his take-off from the area in the municipality to the TWR Prešov unit, asking for a clearance to fly to his destination in Prešov, Košická 20 Street, where the R44 was hangared.

At 16:40 the pilot took off with the R44 in the municipality, heading 085°, and hovered 1 metre above the ground. After hovering above the ground and rotating to the right, the pilot moved with the R44, at an altitude above the rooftops of family houses and with a slow forward speed, heading 215°, in front of the house of his friends whom he had visited. In front of the house he turned left, heading 085°, and while the R44 was hovering, he said goodbye to his friends.

Then the pilot turned the R44 to the left in site. When turning, the pilot pushed the cyclic control stick and, while increasing the engine power, he departed with a descending flight, increasing the forward speed enormously with the heading 330°.

Ten seconds after departure, the R44 hit the HV lines which caused its destruction and subsequent fall. The R44 fell on a private field.

Time of day: Day
Flight rules: VFR

1.2 Injuries of persons

Injury	Crew	Passengers	Other persons
Fatal	1	-	-
Serious	-	-	-
Minor	-	-	-
None	-	-	

1.3 Damage to the R44

The R44 was destroyed during the accident.

1.4 Other damage

On 7 July 2018 the R44 hit the HV lines and tore them. By tearing the HV lines No. 6754/6755 Prešov I – Prešov III – Bardejov he caused damage to Východoslovenská distribučná, a.s. Mlynská 31, 042 91 Košice.

1.5 Personnel information

Pilot:
citizen of the Slovak Republic, aged 63;
holder of a valid PPL(H) issued by the Transport Authority of the Slovak Republic on 25 November 2014;

holder of a valid restricted radio telephone operator certificate of the aeronautical mobile service II issued by the Telecommunication Authority of the Slovak Republic on 16 August 2012.

Medical certificate class 2 - medical check undertaken on 31 August 2017.

Qualifications:

R44 with marked validity until 31 March 2019

Flight experience:

Total flight hours:	200 h 00 min as of 31 August 2017
Total flight hours with this type of aircraft:	200 h 00 min as of 31 August 2017
Number of flight hours in the last 90 days:	unknown
Number of flight hours with this type in the last 30 days:	unknown

1.6 Information about the R44

The R44 is a single-engine helicopter with a two-bladed main rotor and a two-bladed tail rotor. The undercarriage is equipped with landing skids. It has a closed cabin with two rows of seats for the pilot and three passengers or for two pilots and two passengers.

Type:	R44 Raven I
Registration mark:	OM-TTM
Serial number:	1633
Year of manufacture:	2006
Manufacturer:	Robinson Helicopter Company/USA
Engine:	O-540-F1B5

Total flight hours flown: unknown

Airworthiness Certificate No. 1130/01 issued by the Transport Authority of the Slovak Republic on 7 March 2013.

Airworthiness Verification Certificate issued by UTair Europe, s.r.o., CAME-I on 11 April 2018 with marked validity until 9 February 2019.
As of the airworthiness verification day, the helicopter had flown 1084 hours.

The maximum take-off mass of the helicopter - 1134 kg - was not exceeded during the take-off.

1.7 Meteorological information

On 7 July 2018 a high-pressure system was reaching our territory behind a cold front, bringing cold and dry air. It was semi-cloudy to cloudy and without precipitation (the cloud cover was 5/8ths to 6/8ths) at 16:40 in Veľký Šariš, Kanaš municipality.

Low-level clouds were formed by Stratocumulus Cumulogenitus with the cloud base at 1,500 to 2,000 metres. Medium-level clouds were formed by Altocumulus Cumulogenitus and Lenticularis and high-level clouds by Cirrus Fibratus and Cirrostratus.

The air temperature reached 21.5 °C, the relative humidity was 55% and horizontal visibility was approximately 30 km. A North-westerly wind was blowing in the area with a speed of 2-4 m/s.

Between 16:00 and 17:00 the weather conditions were stable in the area of the municipality, without any major changes in temperature, wind direction or speed.

On 7 July 2018 at 16:40 the sun was 16.9° above an idealized horizon in the area of the municipality and the azimuth of the sun's position was 285.2°. The elevation of the sun overreached the local horizon (with regard to the surroundings) in the direction of the azimuth by 12.6°. The astronomical sunset was at 18:41. According to measurements of the surrounding stations, no sunshine was recorded above the area in question at that time.

The meteorological conditions had no impact on the occurrence of the air incident.

1.8 Aids to navigation

The R44 was equipped for VFR flights.
Garmin GNC 250 XL navigation equipment was on board the R44.
A portable GPS Bendix King Skymap IIIC was found on the crash site. The Safety Investigation Committee did not check whether flight data was recorded on the above-stated equipment since they had sufficient information about the flight from the video records of eyewitnesses.

1.9 Communications

The R44 was equipped with radio-communication equipment enabling two-way contact at every moment of the flight with such radio stations and on such frequencies as laid down in the airspace's requirements.

During the flight the pilot was not in contact with FIC Bratislava which provides the aeronautical information service for VFR flights. VFR flights are not required to maintain constant two-way contact in uncontrolled airspace.

1.10 Information about the area

The planned landing and take-off was performed on a selected area in the municipality

N 49°03'06.96“, E 21°13'53.22"

The landing and take-off site may be described as a 25x10 m area with a moderate incline, oriented in the direction 085°/265°, located near a family house with numerous obstacles in the surroundings. After landing, the R44 sat with its front part against the slope.

There was no equipment to indicate the wind direction or speed in the area.

1.11 Flight recorders and other recording devices

The R44 was not equipped with FDR/CVR.

1.12 Wreckage and impact information

Coordinates of the crash site:
N 49°03'11.03", E 21°13'46.83"

The R44 fell on an uninhabited area covered with bush in the vicinity of a family house (22 metres).

The HV lines were 55 metres far from the wreckage site.

The fuselage was quite distorted and its front part was completely destroyed. Traces of earth were found on the wreckage of the fuselage, including the cylinder head of the main rotor and blades, so after the R44 hit the ground, it turned over on the front and the right side and the rotation was stopped by the skids.

The tail boom was separated and was found intact, 10 metres from the fuselage.

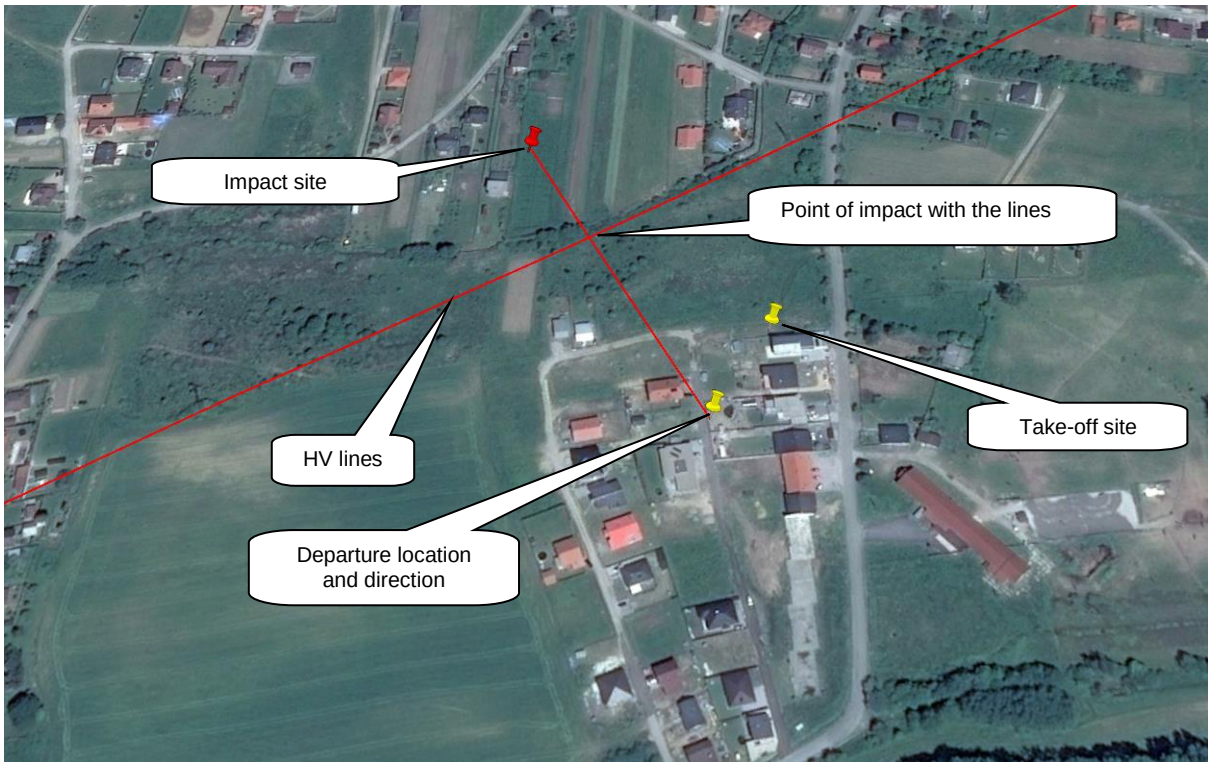
The control panel was thrown out of the fuselage and was found 2 metres from the fuselage; the cyclic control stick was damaged. The foot pedals of the pilot were torn off; the foot pedals in front of the seat of the other pilot were damaged.

The cover of the main rotor shaft was distorted and cut after the impact with the HV lines; the cyclic control rods were damaged. The cylinder head of the main rotor was damaged, both blades were broken at their roots and damaged along their entire length.

The tail rotor was not damaged.

The engine bay was distorted.

As a result of the impact, the pilot´s body was thrown out and was found to the right of the wreckage of the R44´s fuselage. The seat belt was found intact and was probably not used. The pilot was not wearing a helmet.



1.13 Medical and pathological information

From the point of view of forensic medicine, it was a case of violent death caused by the pilot´s injury which resulted directly from the R44's accident.

At the time of the accident the pilot was not under the influence of alcohol, common medicaments, narcotic substances or drugs which could have affected the pilot´s attention during the flight.

Neither external or internal examinations or additional laboratory expert tests of the biological material collected during the autopsy indicated any acute or chronic diseases which could have adversely affected the pilot's attention or actions at the time of the accident or which could have caused his death.

All identified injuries were caused by the incident and they occurred when the R44 hit the field.

1.14 Fire

None.

1.15 Survival aspects

It was not necessary to perform any investigation or rescue with SAR equipment.

1.16 Tests and research

N/A

1.17 Organizational and management information

- R44 operation - General performance

The pilot-in-command may operate the helicopter only if the performance is appropriate and corresponds to relevant flight rules and to all other limitations related to the flight, the airspace or the aerodromes or the places of operation used, while it shall take into consideration the graphical accuracy of all maps used.

Operation in the third performance class is such that, in the event of an engine failure at any time during the flight, a **forced landing** may be required in the case of multi-engine helicopters but in the case of single-engine helicopters it is always required.

The pilot-in-command cannot operate the helicopter above densely populated areas of towns or settlements or above crowds of people in open spaces if it is not possible to land without posing a major threat to any persons or property on the ground in the case of an engine failure. A densely populated area is any area in a city, town or village which is mainly used for housing, business activities or recreational purposes.

- Minimum altitudes

With the exception of take-offs and landings or any cases authorized by the Transport Authority of the Slovak Republic, flights above densely populated areas or above crowds of people in open spaces need to be performed at such altitudes which will enable landing without posing a threat to the persons or property on the ground in the case of any danger.

With the exception of take-offs and landings or any cases authorized by the Transport Authority of the Slovak Republic, VFR flights cannot be performed:
a) above densely built-up areas or above crowds of people in open spaces or above habitats of animals sensitive to noise - national parks - at altitudes lower than 300 metres (1,000 ft) above the highest obstacle within 600 metres from the aircraft;
b) anywhere else at altitudes lower than 150 metres above the ground or water.

- Flight manual

According to the R44 Pilot´s Operating Handbook, Section 4 Normal procedures, Take-off procedure, take-off needs to be performed in accordance with the profile shown in the safety chart contained in Section 5, pp 5-6. It results from the above-stated diagram that take-offs should be performed by hovering at a height of no more than 10 ft (3.048 m), gradually increasing the performance and flying forward, while at the speed of 45 KIAS (83.3 km/h) the helicopter could achieve the maximum height of 25 ft (7.62 m). If there is sufficient open space for a take-off, the above-stated procedure guarantees that, in the event of any failure of a crucial engine at any point of the take-off flight path, the helicopter is able to perform a forced landing. Since the helicopter was taking off from an area which was approximately 25 metres long and delimited by obstacles that were up to 10 metres high, the pilot could not perform the above-stated procedure.

1.18 Additional information

At the crash site the Safety Investigation Committee did not find the following documents which have to be on board during the flight:
a) certificate of registration of the aircraft in the aircraft register;
b) airworthiness certificate of the aircraft;
c) logbook or any similar document;
d) permission to put into operation and to operate communication and radio navigation equipment, if on board;
e) document proving insurance of the liability for any damage caused by operation of the aircraft;
f) the pilot´s personal documents.

1.19 Useful or effective investigation techniques

Common investigation methods were applied.

2. ANALYSIS

Pilot activity

The pilot landed in a densely built-up zone of the municipality on an area surrounded by numerous obstacles, including family houses. From the tactical point of view, such area was not suitable for landing and take-off with the R44 with regard to the nature of the terrain and to the obstacles in the surroundings of the selected place since it was a single-engine R44 of the third performance class where, in the event of any technical problems during the flight, people and property on the land may have been in jeopardy. Any potential change in wind direction and intensity could also have significantly affected the landing and the take-off.

It is very likely, almost certain, that in the take-off and departure phase the pilot was influenced by the presence of his friends to whom he wanted to say goodbye, which, ultimately, caused him to not pay enough attention to obstacles in the surroundings, including the HV lines in the area which were hard to see, and, as a result, he did not start to climb in time above the surrounding obstacles to avoid the HV lines.

The pilot selected an inappropriate take-off path - perpendicularly to the HV lines - and an inappropriate form of overflying the obstacles (HV lines should be overflown above the mast). He departed with a descending flight with enormous acceleration of the helicopter against a setting sun which restricted his view from the cabin to the front and up. When the pilot was at the level of the HV lines, they were difficult to see due to a wooded slope behind them in contrast to a bright sky caused by the setting sun (the effect of the setting sun from behind the clouds was strong).

The R44 hit a HV line with the shaft of the main rotor and then another HV line with the cabin. The impact disabled the controls, damaged the main rotor blades and broke the pilot´s cabin.
The R44 continued falling uncontrolled and fell 55 metres from the HV lines. After it hit the ground it turned over and the tail boom tore off. The rest of the fuselage turned over after the impact and ended up on the undercarriage skids.

If the R44 had departed along the HV lines in the direction towards Prešov with smooth gradual acceleration and climbed at the same time, the pilot would have avoided the biggest obstacle in the direction of the flight.

3. CONCLUSIONS / Causes of the air accident

3.1 Findings

- the pilot had valid qualifications to perform flights in the particular R44 category;
- at the time of the accident the pilot was not under the influence of alcohol, common medicaments, narcotic substances or drugs which could have affected the pilot´s attention during the flight;
- the pilot´s health condition had no impact on the occurrence of the air accident;
- during the flight, the pilot was not wearing a seat belt;
- the pilot did not ask the Transport Authority of the Slovak Republic for assessment to operate the R44 in the third performance class in municipalities;
- the pilot operated the R44 in the third performance class above a densely populated area and municipality, while its performance was not appropriate and did not correspond to relevant flight rules or any other restrictions applicable to the flight;
- the pilot performed the flight above densely built-up areas at an altitude and in a space which did not enable him to land without posing a threat to any persons or property on the ground in the event of any danger. He performed the landing and the take-off under conditions which did not enable him to reach an acceptable level of safety;
- the Safety Investigation Committee was not able to obtain the pilot´s total flight hours with the R44; as a result, it could not determine his flight experience with the R44;
- the pilot did not comply with the obligatory standards and recommendations of international civil aviation organizations for landing and take-off with the R44;
- it is obvious from eyewitness reports and from camera records made by the eyewitness at the accident site that the R44 had sufficient performance to perform the take-off from the area in question and its technical condition did not cause the accident;
- the R44 had valid documentation and did not demonstrate any malfunction before the air accident;
- the Safety Investigation Committee was not able to obtain the total flight hours of the R44;
- the R44 complied with the airworthiness conditions;
- the technical condition of the R44 had no impact on the occurrence of the air accident;
- the R44 was destroyed during the accident;
- the meteorological conditions had no impact on the occurrence of the accident.

3.2 Causes of the air accident

The main and immediate cause of the accident was the fact that, while hovering above the ground, the R44 hit HV lines which were perpendicular to the direction of the flight.

The pilot´s decision to perform a non-standard procedure during his departure from the area without climbing to a safe altitude above the surrounding obstacles in a hilly terrain, overlooking the HV lines.

4. SAFETY RECOMMENDATIONS

The Final Report on safety investigation of the air accident does not contain any recommendations.

In Bratislava, on 23/10/2018