NATIONAL BUREAU
OF AIR ACCIDENTS INVESTIGATION

OCCURRENCE CLASS:	FATAL ACCIDENT
AIRCRAFT OPERATOR:	Private Person
AIRCRAFT TYPE:	WT10 Advantic
REGISTRATION:	UR-PAMA
OCCURRENCE LOCATION:	Outskirts of Sheparivtsi Village, Kolomyia District, Ivano-Frankivsk Region
STATE OF OCCURRENCE:	UKRAINE
DATE OF OCCURRENCE:	July 28, 2021.

The report is published with the sole purpose to prevent air accidents in the Future/

NOTE: This report is a translation of the Ukrainian original investigation report. The text in Ukrainian shall prevail in the interpretation of the report.

APPROVED BY
Acting Director
of the National Bureau of
Air Accidents Investigation

(signed) Igor MISHARIN
July 18, 2023

Final Report

on Investigation into Fatal Accident with WT10 Advantic UR-PAMA Aircraft Manufactured by AEROSPOOL Ltd (Slovakia), Operated by Private Person, Which Took Place on July 28, 2021, at Outskirts of Sheparivtsi Village, Kolomyia District, Ivano-Frankivsk Region, During Recreational Flight.

Kyiv 2023

The investigation into the accident of the WT10-Advantic aircraft was conducted by investigated team appointed by order of the National Bureau of Air Accidents Investigations (NBAAI) No. 48 dated 28.07.2021.

The investigation team arrived at the accident site and began the field stage of the technical investigation on 29th of July 2021 at 16:00 Kyiv time.

The sole objective of the investigation is to prevent air accidents and incidents in the future, but not to establish guilt or liability.

Any administrative, official, prosecutorial, or judicial investigation aimed at establishing guilt or liability should be conducted separately from the technical investigation into air accidents, serious incidents, incidents, emergencies, and damage to aircraft on the ground (Article 119(4) of the Air Code of Ukraine.)

The investigation was opened on 28th of July 2021.

The investigation was closed on 18th of July 2023.

Table of Contents

List of Abbreviations:

AAIB - the UK Air Accidents Investigation Branch

NTSB - National Transportation Safety Board (USA)

RW - Runway

SAAU - State Aviation Administration of Ukraine – the civil aviation authority of Ukraine

CMU - Cabinet of Ministers of Ukraine

FOM - Aircraft Flight Operations Manual

NBAAI - National Bureau of Air Accidents Investigation of Ukraine

UkSATSE – Ukrainian State Air Traffic Services Enterprise

ATC - Air Traffic Control

JCM ATMS - Joint Civil-Military Air Traffic Management System

PIC - Pilot-in-Command

FLTC - Fuel and Lubricants Testing Center

VMC - Visual Meteorological Conditions

ACU - Air Code of Ukraine

UTC - Universal Time Coordinated

MH - Magnetic Heading

MD SESU – Main Directorate of the State Emergency Service of Ukraine

SFRU - State Fire and Rescue Unit

CPS - Civil Protection Service

EMS - Emergency Medical Service

SAR - Search and Rescue Operations

TW - Taxiway

AMM - Aircraft Maintenance Manual

POH - Pilots Operating Handbook

Synopsis

On 28th of July 2021, at 13:30 (local time), in the visual meteorological conditions (VMC), during a recreational flight around the city of Kolomyia, WT10 Advantic, a light single-engine amateur-built aircraft suddenly began to lose altitude and collided with the foundation of a private two-story building. As a result of the accident, the aircraft was destroyed, causing fuel to leak from the tanks onto the hot engine, a fire broke out, and the aircraft almost completely burned down. The pilot – the aircraft owner (a citizen of Ukraine) and three passengers died. The fire engulfed a two-story building, which sustained significant fire damage.

Note: *hereinafter, the Kyiv Time is used (UTC +3).*

The fatal accident of the WT10 Advantic aircraft was reported to the NBAAI by the Lviv UkSATSE department on 28th July 28, 2021, at 10:51 UTC.

On 28th of July 2021 NBAAI notified State Aviation Administration of Ukraine (SAAU) about the accident.

According to item 4.1. of Annex 13 ICAO, NBAAI notified the following countries:

- Slovak Republic (Aviation and Maritime Investigation Authority (AMIA) as a State of Manufacture of the aircraft) on 28th of July 28, 2021. On the 29th of July NBAAI received the information about willingness of AMIA to provide assistance without appointing of any representative or expert.

- Austria (Federal Safety Investigation Authority (SIA) as a State of Manufacture of the engine) on July 28, 2021. On the 29th of July NBAAI received the information about willingness of SIA to provide assistance without appointing of any representative or expert.

- USA (National Transportation Safety Board (NTSB) as two deceased passengers - US citizens) on July 28, 2021. On the 28th of July NBAAI received the information about NTSB appointment of accredited representative.

- United Kingdom (Air Accidents Investigation Branch (AAIB) as one deceased passenger – UK citizen) on July 30, 2021. On the 18th of August NBAAI received the information about AAIB appointment of accredited representative.

The Final Report is to be forwarded to the following recipients:

- NBAAI (original);

- SAAU (copy);

- AMIA Slovakia (copy);

- SIA Austria (copy);

- NTSB USA (copy);

- AAIB UK (copy).

Factual Information

Flight History

On July 28, 2021, the PIC submitted a flight request to the Ukraerocenter for 3 flights to the Hoverla mountain area and flights around Kolomyia.
The first flight was performed to Mount Hoverla, which lasted from 10.00 to 10.45. The total flight time was 45 minutes.

During the flight, the aircraft was carrying the PIC and 3 passengers (citizens of Ukraine.)

The second flight was also performed to Mount Hoverla. The flight lasted from 11.04 to 11.50. The total flight time was 46 minutes. During the flight, there were the PIC and 3 passengers (citizens of Ukraine) at the aircraft.

The third flight was performed around the Kolomyia. The flight lasted 10 minutes, from 11.53 a.m. to 12.03 a.m. During the flight, there were the PIC and 3 passengers (citizens of Ukraine) at the aircraft.

At 12.06, the fourth flight was made to Mount Hoverla. Landing was performed with the MH=119° at 12.44. The total flight time was 38 minutes.
There were the PIC and 3 passengers (citizens of Ukraine) at the aircraft. During flight the PIC asked (by mobile phone) the flight director to prepared 20 liters of fuel. After landing, the aircraft taxied to the hangar for refueling. The technician refueled 20 liters of fuel.

At 12.50, the pilot started the engine and taxied to the runway with MH=299°.

At 12.52, the pilot performed the fifth takeoff and flight around Kolomyia.

There were the PIC and 3 passengers (foreigners) at the aircraft. The weather conditions at the runway made it possible to land the aircraft in the opposite direction, since there was no wind - “calm”. Therefore, the PIC decided to land with MH=119° at 13.00. The aircraft stopped at the intersection of the runway and taxiway for unloading and loading of passengers. The total flight time was 8 minutes. From the airfield surveillance cameras, it was found that the unloading and loading of the passengers took place exactly at the place of landing on the runway. During whole boarding process the engine was not shutting down and the propeller was spinning. After boarding the PIC taxied closer to the end of the runway, turned around 180° and the sixth takeoff was performed with MH=299° at 13.03, the flight was around Kolomyia. The aircraft was carrying the PIC and 3 foreign passengers. Landing was performed with MH=119° at 13.11. The total flight time was 8 minutes. The aircraft stopped and turned to MH=299° at the intersection of the runway and taxiway for unloading and loading of passengers. The engine was not shutting down and after new boarding the PIC taxied closer to the end of the runway, turned around 180° and the seventh takeoff was performed with MH=299° at 13.14, and take flight above Prut River around Kolomiya city. The aircraft was carrying the PIC and 3 foreign passengers. Landing was performed with MH=119° at 13.22. The total flight time was 8 minutes. The aircraft stopped and turned to MH=299° at the intersection of the runway and taxiway for unloading and loading of passengers. The engine was not shutting down and after new boarding the PIC taxied closer to the end of the runway, turned around 180° and the eight takeoff was performed with MH=299° at 13.24. After 1-2 minutes, the PIC call the flight director and informs him

about the performing of the first turn (in Russian: “On the first turn”). Lately the left turn with access to the Prut River and fly along the city of Kolomiya was planned.

The aircraft was carrying the PIC and 3 foreign passengers, one of them was a British citizen, two of them were US citizens.

When the pilot did not establish contact at the estimated time and did not appear in sight on the runway, the flight supervisor began to worry and call the aircraft using his call signs: " MA! (Mike Alpha), MA! (Mike Alpha)" at 13.38, three more times at 13.39, and 4 more times at 13.40. There was no response. The flight supervisor went out onto the runway to get a better view of the landing approach zone. But the aircraft has not appeared in sight.

Subsequently, the flight supervisor received a call about the fatal accident with the WT10 Advantic aircraft from witnesses and responded to the accident site.

The area, where the fatal accident took place, is flat with an altitude of +296 m (972 ft.)

Coordinates of the ground impact site: - 48°33'05.5"N 24°59'00.7"E

1.2. Injuries.

Injuries	Crew	Pax	Other persons
Fatal	1	3	0
Serious	0	0	0
Minor/None	0	0	0

1.3. Aircraft Damage.

As a result of the ground impact, the aircraft was completely destroyed and burned down.

1.4. Other Damage.

On its way, the aircraft cut off electrical wires and de-energized the network between the houses of local residents, damaged the walls of two auxiliary houses and a metal fence, and damaged 3 fruit trees. The fire, which arose as a result of the ground impact, engulfed a significant part of the two-story house under the wall of which the aircraft fell. Firefighters managed to extinguish the flames and save another part of the house.

1.5. Personnel Information.

Position: PIC of WT10 Advantic

Date of birth: July 13, 1961

Education: - Chernihiv Higher Military Aviation School of Pilots, 1984, qualification: pilot engineer;

- Flight Academy of the National Aviation University, Kropyvnytskyi, 2017, specialization: "Flight Operation of Aircraft".

Total flight time: 3156 hours and 16 minutes.

On military aircraft: 2100 hours.

On WT10 Advantic (total) 1056 hours and 16 minutes.

(the pilot was accounting the flight time personally)

For the last 90 days: 25 hours 12 minutes.

For the last 7 days: 8 hours 15 minutes.

For the last 24 hours: 5 hours 45 minutes.

For the last 48 hours, the PIC's flight time made 8 hours 15 minutes.

(On July 26, 2021, the flight time was 2 hours 30 minutes) - the rest was more than 12 hours.

(On July 27, 2021, the flight time was 5 hours 45 minutes) - the rest was more than 12 hours.

Flight Crew Member Certificate UA.FCL. No.008500, issued by the State Aviation Administration of Ukraine (hereinafter - SAAU) on January 01, 2020.

Ratings:

- SEP (land), single-engine, piston (land), inspection date: August 22, 2020, valid until August 31, 2022;

- SEP (land) FI(A), single-engine, piston (land), flight instructor (aircraft), inspection date: August 22, 2020, valid until August 31, 2023.

Medical Certificate No. 94555.

Date of issue: November 27, 2020.

Valid until: November 27, 2021.

1.6. Aircraft Data.

Aircraft of amateur-built construction:	WT10 Advantic
Serial No.:	AD-006/2016
Nationality and registration marks:	UR-PAMA
Owner:	Private person
Operator:	Private person
Manufacturer:	AEROSPOOL Ltd (Slovakia)

Date of manufacture and start of operation:	June 16, 2016.
Certificate of Aircraft Registration:	No. RP 4367/1, issued by the SAAU on November 21, 2017.
Permit to Fly:	No. 1851 issued by the SAAU on December 17, 2020.
Term of Validity	December 16, 2021.
Operating time since new:	803 hours.

Maintenance Program

Maintenance program for the WT10 Advantic aircraft of amateur-built construction, nationality and registration marks UR-PAMA No. AD-006/2016/2017 edition 2 dated November 19, 2019, Revision 2, was approved by the SAAU on November 21, 2019. The maintenance program includes the engine and propeller maintenance works.

The aircraft and engine maintenance were as follows:

On June 14, 2017, 101 hours of operation, the base 100-hour maintenance of the aircraft and engine was performed in accordance with the WT10 Advantic Aircraft Maintenance Program at Chaika Aerodrome. License No. UA.66.1941;

On September 29, 2018, 201 hours of operation, the base 100-hour aircraft maintenance and 200-hour engine maintenance according to the WT10 Advantic Aircraft Maintenance Program at the Chaika Aerodrome. License No. UA.66.1941;

On June 30, 2019, 300 hours of operation, the base 100-hour maintenance was performed in accordance with the WT10 Advantic Aircraft Maintenance Program at Buzova Aerodrome. License No. UA.66.1941;

On October 29, 2019, 400 hours of operation, the base 100-hour aircraft maintenance and 200-hour engine maintenance in accordance with the WT10 Advantic Aircraft Maintenance Program at Buzova Aerodrome. License No. UA.66.1941;

On June 05, 2020, 504 hours of operation, the base 100-hour maintenance of the aircraft and engine in accordance with the WT10 Advantic Aircraft Maintenance Program at Buzova Aerodrome, license No. UA.66.2347;

On August 06, 2020, 601 hours of operation, the base 100-hour aircraft maintenance and 200-hour engine maintenance in accordance with the WT10 Advantic Aircraft Maintenance Program at Kolomyia Landing Site. License No. UA.66.2347;

On November 04, 2020, 698 hours of operation, the base 100-hour maintenance of the aircraft and engine in accordance with the WT10 Advantic Aircraft Maintenance Program at Byshiv Aerodrome. License No. UA.66.2347;

On May 16, 2021, at 803 hours of operation, the last maintenance of the WT10 Advantic aircraft, the base 100-hour aircraft maintenance and 200-hour engine

maintenance were performed at Byshiv Aerodrome. License No. UA.66.2347.

Engine and Propeller.

Engine:

Type: Rotax	914 UL3.
Manufacturer:	BRP- Powertrain GmbH & Co. KG, (Austria)
Manufactured:	May 05, 2015
Serial No.:	7683992
Operating time since new:	803 hours
Last maintenance:	May 16, 2021

Propeller:

Drawing No.	MTV-34-1-A/ 175-200
Serial No.	160082
Manufactured:	February 02, 2016
Manufacturer:	MT-Propeller, Entwicklung GmbH (Germany)
Operating time since new:	803 hours
Installed on the engine:	September 30, 2017

Fuel:

Recommended fuel:	A-95 gasoline.
Fuel used:	A-92 gasoline.

Aircraft Defects and Failures: None

Weight Specification:

Empty aircraft weight:	432.8 kg
Maximum take-off weight:	850 kg
Maximum landing weight:	850 kg

Center-of-Gravity (CG) position range: 0.300 ÷ 0.640 m - from the leading edge of the mean aerodynamic chord.

1.7 Meteorological Information.

The actual weather at the Kolomyia weather station from 06.00 to 12.00 UTC on July 28, 2021, was as follows:

For 06.00 UTC, Kolomyia:

Total cloud amount: 3 tenths, high cumulus. Visibility 20 km. Surface wind is calm (quiet.) Air temperature +22.6°C, dew point temperature +18.5°C. Pressure reduced to sea level: 1014.8 GPa. Barometric trend (- 0.4) hPa.

For 09.00 UTC, Kolomyia:

Total cloud amount: 3 tenths, cirrus cover. Visibility 20 km. Surface wind direction 100°, speed 1 m/s. Air temperature +30.0° C, dew point temperature +18.0° C. Pressure reduced to sea level 1013.3 hPa. Barometric trend (-0.6) hPa.

For 12.00 UTC, Kolomyia:

Total cloud amount: 6 tenths, cumulonimbus rain, cloud base 600 m. Visibility 20 km. Surface wind direction 060° speed 2 m/s. Air temperature +32.8°C, dew point temperature +17.6°C. Pressure reduced to sea level - 1011.5 hPa. Barometric trend (-1.4) hPa.

During the flight, no dangerous weather phenomena for aviation were observed.

1.8 Navigation Aids.

The aircraft is equipped with:

- Magnetic compass;
- Flight Instruments Air Speed Indicator;
- Flight Instruments Altimeter;
- EFIS – Sky View;
- Transponder.

All navigation means were destroyed because of the crash and fire.

1.9 Means of Communication.

The Kolomyia Landing Site is equipped with a VHF radio station operating at a frequency of 131.250 MHz (call sign - "Kolomyia") and intended for radio communication between the flight supervisor and Pilot-In-Command (PIC). During flights, the PIC was keeping the radio communication with the flight supervisor.

The PIC conducted the information exchange with units of the Joint Civil-Military Air Traffic Management System (JCM ATMS) using a cell phone. During flights

from the Kolomyia Landing Site, the senior coordinating authority for the airspace use is the Lviv Air Traffic Management Center.

The radio station and mobile phones of the KPS and passengers were completely burned because of crash.

1.10. Landing Site Data

Kolomyia Landing Site has a Certificate of Operation Authorization No. ZPM 08-217 UKMK, issued by the SASU on June 06, 2019, valid at the time of the accident. Instruction on Flight Operation (Airspace Use) in Area of "Kolomyia" Permanent Landing Site, as amended, was approved on July 10, 2012, by the Head of the SASU. The Landing Site is located 2.9 km north of the center of Kolomyia.

Landing Site reference point coordinates:	48° 33′ 03″ N 025° 02′ 32″ E.
Landing Site elevation	296 m (972 ft)
Magnetic dip	(+5ºE)
Runway threshold elevation:	
- For landing MH=119º	294 m
- For landing MH=299º	293 m

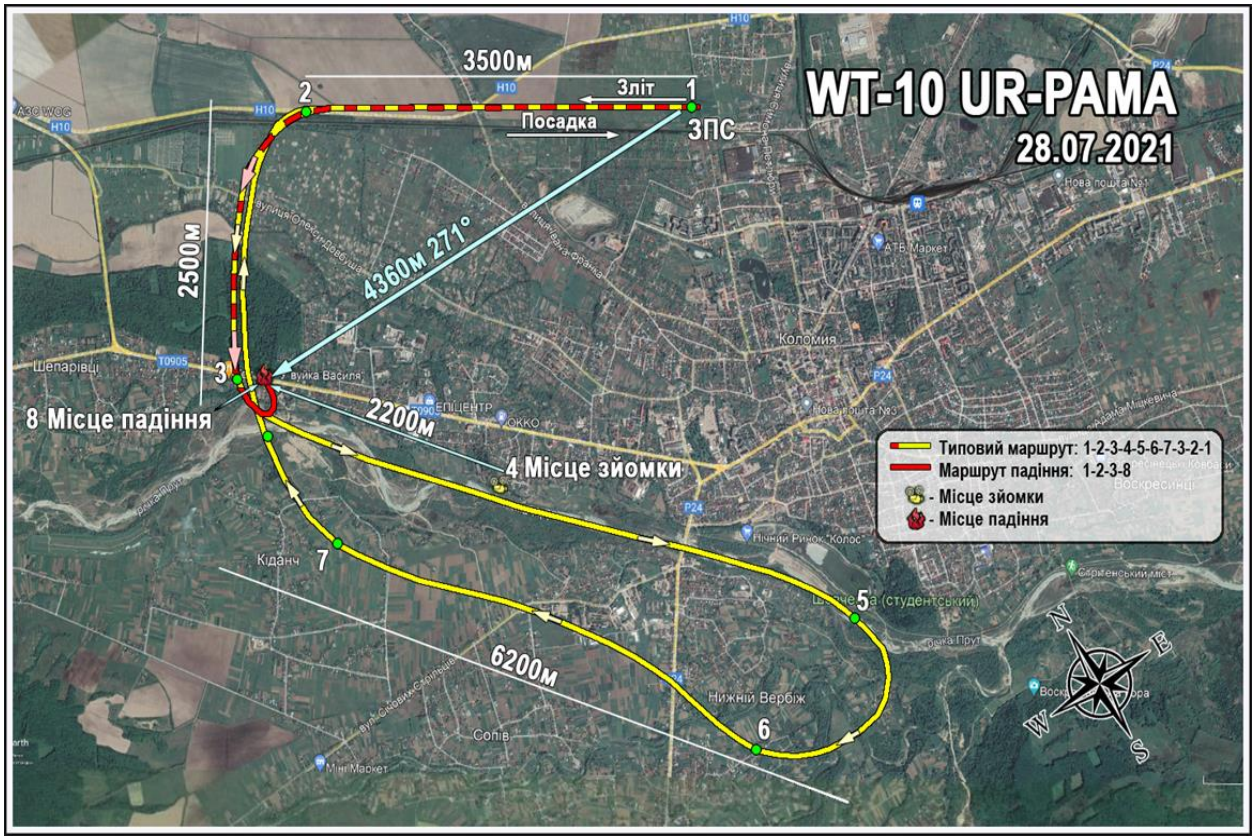
The Landing Site contains the main paved runway of 485m × 26m (air-strip of 585m × 66m) with take-off and landing MH=119° and 299°. The pavement is asphalt. Free 50 m zones are from both ends of the paved runway; the airstrip graded areas of 20m are on both sides of the paved runway. Aircraft aprons and paved runway are connected by unpaved Taxiway-1 and Taxiway-2, the bearing capacity of which is 3 kg/cm^2.

Available take-off run distance	485m (RW 12/30)
Available take-off distance	535m (RW 12/30)
Available aborted take-off distance	485m (RW 12/30).

1.11 Flight Recorders.

The aircraft is not equipped with a flight data recorder and cockpit voice recorder. Current laws and regulations do not provide for the presence of any recorder at this aircraft type.

Calculation of Aircraft Flight Trajectory and Route Layout.



Inscriptions:

Місце падіння = Ground Impact Location; Місце зйомки = Filming Location.

Посадка = Landing; Зліт = Take-Off; ЗПС = Runway.

In Yellow: Typical Route: 1-2-3-4-5-6-7-3-2-1.

In Red: Fatal Accident Flight Route: 1-2-3-8.

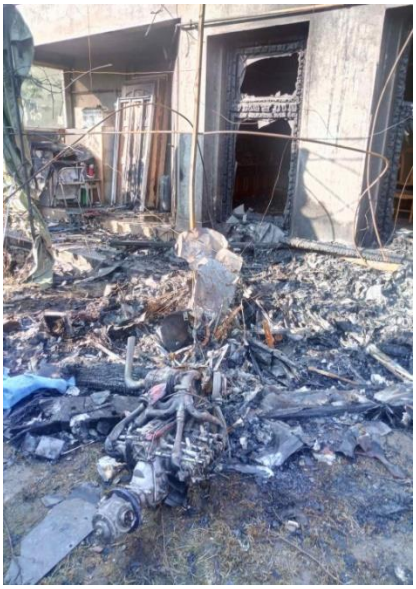
During flights, the PIC used RW 30/12.

The take-off was performed with the magnetic heading MH=299°, and landing with MH=119°. The flight route went through waypoint 1 (take-off point), waypoint 2 (first turn), waypoint 3 (turn over the Prut River) with the subsequent flight over the river bed to waypoint 5. The number 4 on the route indicates the location of eyewitnesses, who filmed the last minutes of the flight. After waypoint 5, the aircraft performed a right turn through waypoints 6, 7, 3, 2 and 1 back to the Landing Site for landing and passengers unloading. The last flight was performed from point "1" through point "2" to point "3" with MH=210°. With this heading, the PIC performed an advanced (and possibly higher) aerobatics maneuver. During this maneuver, a partial engine failure with a drop in its power probably occurred. Therefore, instead of continuing to fly along the Prut River bed in the direction of point "5", the PIC is turning the aircraft toward the Runway with MH=30°. The aircraft began to lose altitude sharply, collided with ground obstacles, and impacted the ground at the location marked with the number 8. The last flight in the diagram is marked in red.

The flight trajectory is built on eyewitness records who that day were at the point "4" of the Prut River and saw the sixth and seventh flights over the river, but technical problems with the mobile phone did not allow them to be filmed. The witness prepared to film the eighth flight and began filming it from a distance, however the aircraft crashed so the smoke at the crash site was clearly visible. The duration of the flight with foreigners was about 8 minutes. Flight speed was from 160 km/h to 210 km/h. Given the distances, NBAAI reproduce the approximate flight path, since there is no other possibility. The PIC regularly flew on the same route to around the city of Kolomyia.

1.12 Wreckage and Impact Information.

The aircraft impacted the ground on a private yard under the wall of a two-story stone house on the Prut River side. As a result of the fatal accident, the wires of the power line were broken, the power supply to the surrounding houses was cut off, fruit trees were broken and damaged, the roofs and walls of two outbuildings, the wall of a residential building and the metal fence of a private territory were damaged. The wreckage of the aircraft was scattered on the ground in an area of about 600m^2. During the ground impact, a fire broke out, as a result of which the aircraft completely burned down. Only the engine and some metal parts of the aircraft remained.



1.13 Medical and Post-Mortem Information.

A forensic medical examination of the PIC's body was conducted by the Kolomyia District Department of the Ivano-Frankivsk Regional Bureau of Forensic Medicine.

Given that the three passengers were not citizens of Ukraine, no further examination

of their bodies was carried out, since the head of the group decided to take them with him and later send them to the United States of America and Great Britain.

The volume, nature and morphology of the PIC's injuries, as well as the results of laboratory tests, give grounds to consider that they were all caused by action of blunt hard objects and open flames immediately before his death. PIC died as a result of combined trauma to his body, with multiple skeletal fractures, damage to internal organs and thermal burns.

The presence of carboxyhemoglobin in the blood at a concentration of **7%** is a sign of lifetime exposure to the fire (short period of time.)

During the forensic toxicological examination, alcohols and their isomers **were not found** in the blood and urine, which gives grounds to consider that the PIC was not in a state of intoxication at the time of death.

1.14. Fire in Flight.

There was no evidence of a fire during the flight. This was confirmed by witnesses, who saw the aircraft in the sky before its ground impact, as well as by a video shot by a bystander on the Prut River. The fire was caused by the aircraft collision with the ground, its destruction, fuel leakage from the tanks, and fuel spilling onto the hot engine. The flames engulfed the aircraft and then spread to the building. All four people on the aircraft suffered fatal injuries. The people in the building escaped on their own.

1.15 Survival Factors.

On July 28, 2021, at 13.36, an eyewitness reported to the 7th State SAR Unit of the Kolomyia District Department of the Main Directorate of the State Emergency Service of Ukraine in Ivano-Frankivsk Region. The accident site was identified by the street and house numbers, as well as by smoke and fire. The emergency stage "DETRESFA" was declared.

The following vehicles **departed t**o the site:

- at 13.36, 2 fire tanker trucks of the 7th State Fire and Rescue Unit of the city of Kolomyia (12 people, 2 units of equipment);

- at 13.44, 1 special light rescue vehicle of the 7th State Fire and Rescue Unit of the city of Kolomyia (5 people, 1 unit of equipment);

- at 14.03, 1 special light rescue vehicle of the 11th State Fire and Rescue Unit of the city of Nadvirna (5 people, 1 unit of equipment);

- at 13.37, the Mobile Operational Group of the Kolomyia District Department of the Main Directorate of the State Emergency Service of Ukraine in the region (4 people, 1 unit of equipment);

- at 13.40, the Operational Coordination Center of the Main Directorate of the State Emergency Service of Ukraine in the region (4 people, 1 unit of equipment);

- at 13.48, the Mobile Operational Group of the Main Directorate of the State Emergency Service of Ukraine in the region (5 persons, 1 unit of equipment);

- at 13.50, the Head of the Main Directorate of the State Emergency Service of Ukraine in Ivano-Frankivsk Region, Colonel of the Civil Protection Service.

In addition, emergency crews of the Gas Facilities Operation Department, Electricity Network Repair Service, police officers, ambulance service were involved, deputy mayors of Kolomyia city, the leadership of Ivano-Frankivsk Regional State Administration were involved.

The following search and rescue forces and equipment arrived at the accident site:

- at 13.49, 2 fire tanker trucks of the 7th State Fire and Rescue Unit of the city of Kolomyia (12 people, 2 units of equipment);

- at 13.56, 1 special light rescue vehicle of the 7th State Fire and Rescue Unit of the city of Kolomyia (5 people, 1 unit of equipment);

- at 14.40, 1 special light rescue vehicle of the 11th State Fire and Rescue Unit of the city of Nadvirna (5 people, 1 unit of equipment);

- at 13.50, the Mobile Operational Group of the Kolomyia District Department of the Main Directorate of the State Emergency Service of Ukraine in the region (4 people, 1 unit of equipment);

- at 14.24, the Operational Coordination Center of the Main Directorate of the State Emergency Service of Ukraine in the region (4 people, 1 unit of equipment);

- at 14.35, the Mobile Operational Group of the Main Directorate of the State Emergency Service of Ukraine in the region (5 persons, 1 unit of equipment);

- at 14.42, the Head of the Main Directorate of the State Emergency Service of Ukraine in Ivano-Frankivsk Region, Colonel of the Civil Protection Service;

- at 13.55 (UTC) – fire containment;

- at 14.47 (UTC) – fire overhaul.

- The death toll – 4 people.

There were involved:

- Fire trucks – 2 units;
- Special emergency rescue vehicles – 2 units;
- ASh-5 headquarters car – 1 unit;
- Mobile Operational Group vehicles – 3 units;
- Number of SES personnel – 36 people.

1.16. Tests and Research

The Accredited Testing Center "Fuel and Lubricants Testing Center" LLC ("F&L TC" LLC) (Accreditation Certificate meeting the requirements of DSTU ISO/IEC

17025:2017 was issued by NAAU under No. 20138, valid until November 19, 2022) conducted the fuel and lubricant testing.

Fuel and Lubricants Provided for Tests:

1. A 3-liter fuel sample in two glass jars of 1.5 liters each.

2. A sample of synthetic oil of Aeroshell, Piston Engine Oil, Sport Plus 4 for Rotax engines (4-stroke piston engines) in a 1-liter plastic canister.

3. Oil filter from the Rotax 914 UL3(F3) engine of the Aerospool WT10 Advantic UR-PAMA aircraft.

The samples were registered with "F&L TC" LLC on September 23, 2021.

Due to the fact that the gasoline in jars differs in color, each jar was registered under an individual number: **No. 4890** (darker shade of yellow) and **No. 4891** (lighter shade of yellow).

The sample of synthetic oil of Aeroshell, Pistone Engine Oil, Sport Plus 4 was registered under **No. 4892**.

Oil filter from the Rotax 914 UL3(F3) engine of the Aerospool WT10 Advantic UR-PAMA aircraft was registered under **No. 4892a**. The filter has damage in the form of mechanical deformation of the outer surface. As agreed with the investigation authority, the remaining engine oil in the amount of about **2 cm^3** was drained from the filter and used for the examination.

Taking into account that the gasoline samples were taken from one container with a capacity of 200 liters (metal barrel), a combined sample of 1 liter was made and examined; the remnants of samples **No. 4890 and No. 4891** were retained as arbitration samples.

Conclusions of Tests:

1. By detonation resistance, the combined sample of gasoline (**No. 4890, 4891**) **failed to meet** the requirements of the Technical Regulation on Requirements for Motor Gasoline, Diesel, Marine and Boiler Fuels, approved by the Resolution of the Cabinet of Ministers of Ukraine No. 927 of August 01, 2013, as regards A95 gasoline. The combined sample of gasoline (**No. 4890, 4891**) meets the requirements for A-92-Euro-5 gasoline according to the tested parameters.

2. No foreign impurities were found in gasoline samples **No. 4890, 4891** in the scope of the testing conducted. The darker color of the first sample taken may indicate the beginning of oxidation and settling of gasoline in a metal barrel with a volume of 200 liters.

3. According to the document of the Pilots Operating Handbook, the engine of the model "Rotax" 914 UL3 (F3) should use a gasoline with a minimum octane number by the research method **(RON) of 95 units**. The Rotax 914 UL3 (F3) engine is turbocharged, and, given the high degree of air compression by the turbine, it can be assumed that at operation on A-92 gasoline in certain modes (full load), detonation

combustion of the fuel-air mixture in the engine cylinders may occur. The consequences of prolonged detonation for the engine can be very severe: overheating, burn-throughs and destruction of parts of the cylinder-piston group and valves of the gas distribution mechanism, destroyed piston rings and stuck piston rings, increased wear of parts of the crank mechanism, etc.

The results of the study of the fresh oil show that sample **No. 4892** is a high-index SAE-40 oil with a high alkaline number and content of active elements, especially zinc. These indicators indicate high performance of the oil.

The results of testing the oil drained from the filter **(No. 4892a)** indicate that the oil was exposed to an action (probably thermal one), as a result of which the concentration of light elements (phosphorus, sulfur) decreased, and the concentration of heavy elements (calcium, zinc) increased significantly. At the same time, the ratio between the content of active elements indicates that the same oil as fresh oil was used in the engine.

The high content of wear products in the oil from the filter, especially iron, taking into account the place of oil sampling and possible thermal effects on the filter (much higher than the calibration limit of the device – 300 mg/kg and with the permissible limit for oils before replacement < 100 mg/kg), give grounds to recommend the study of the timeliness of engine oil replacement and diagnostics of engine parts by disassembly.

1.17 Information on Organizations and Administrative Activities Related to Accident.

The WT10 Advantic aircraft, serial number: AD-006/2016, nationality and registration marks: UR-PAMA, was manufactured in Slovakia.

The SAAU issued the following documents:

Conclusion No. 13.1.4-887-2016 of August 29, 2016 on Operation Feasibility and Conditions of Amateur-Built Construction (Aircraft) WT10 Advantic, No. AD-006/2016;

Appendix to the Conclusion No. 13.1.4-887-2016 of August 29, 2016, on Operation Feasibility and Conditions of Amateur-Built Construction (Aircraft) WT10 Advantic, No. AD-006/2016;

- Notice of Nationality and Registration Marks Assignment to Aircraft, No. RN 3928;

- Certificate of Granting of ICAO 24-Bit Aircraft Address, No. RA 1202;

- Civil Aircraft Radio Station License, No. 7463;

- Certificate of Aircraft Registration, No. RP 4367/1;

- Permit to Fly, No. 1851;

- Flight Conditions for the Permit to Fly are specified in the Approval Form No. 12.1.4-127-2017, edition 1, of December 14, 2017.

The aircraft was maintained in accordance with the MAINTENANCE PROGRAM by the technical staff authorized to perform these operations (licenses UA.66.1941 and UA.66.2347). The responsibility for aircraft maintenance shall be borne by the owner of the aircraft.

Aircraft preparation and flight operations were performed under the direction of the aircraft owner (PIC.)

1.18. Additional Information

The aircraft is equipped with the Magnum 901 Rescue System, which is designed for a maximum weight of 950 kg at a maximum flight speed of 320 km/h. The minimum altitude for its use should be 200 m above the ground. When used at a lower altitude, oscillation and swaying of the aircraft may occur, which will not have time to stabilize, leading to a rough landing, destruction of the aircraft structure, injuries and even death of the pilot and passengers.

1.19. New Methods Used in Investigation

None.

2. Analysis.

The WT 10 Advantic UR-PAMA aircraft had no onboard data recorders, so the following materials were used to analyze the circumstances of the accident:

- statements of witnesses related to the accident;
- eyewitness's video footage recorded from the bank of the Prut River in the direction of the ground impact site;
- Aircraft Maintenance Manual, Pilots Operating Handbook of the aircraft;
- aircraft pilot data;
- aircraft registration documents and permit to fly;
- aircraft maintenance documents;
- aircraft mass specification and center-of-gravity position;
- meteorological documentation;
- results of inspection of the ground impact site;
- results of the aircraft wreckage examination;
- conclusions of the forensic medical examination of the pilot's body;
- analysis and conclusions of the aircraft fuel and oil testing;
- analysis of video information from ground surveillance cameras installed at the Kolomyia Landing Site.

2.1 Meteorological Conditions Analysis.

It has been established that the meteorological conditions in the flight area were fully consistent with the VMC and could not have significantly affected the occurrence and development of the emergency situation (section 1.7). However, the following should be taken into account: the flights started at 10 am at an air temperature of 23℃ with a gradual increase in temperature up to 33℃ and a drop in pressure. Therefore, at the time of the eighth flight, the meteorological conditions were significantly different from the initial ones. This could have adversely affected the operation of the aircraft's engine, which was fueled by A-92 gasoline, and reduced its power.

2.2 Engine Failure Probability Analysis.

Based on the statements of the witnesses, who observed the aircraft flight and heard the engine roar, as well as on the data obtained by the specialists of the Kyiv Scientific Research Institute of Forensic Expertise during the engine disassembly and detailed study of all its components, the Investigation Team Members concluded that the engine was in good working order at the time of the accident and was operating before the collision. This is also evidenced by the propeller blades, which have characteristic fractures due to rotation.

2.3 Poor Quality Fuel and Lubricants.

Section 1.16 analyzed the fuel and lubricants used at the WT10 Advantic. The gasoline samples did not meet the requirements of the Aircraft Maintenance Manual and Pilots Operating Handbook, and are classified as unbalanced (unconditioned) motor gasoline.

The examination of the propeller fragments mod. MTV-34-1, serial No. 160082, which were provided to the experts, has found that they have signs that, taken together, indicate that the aircraft propeller was rotating at the time of the destruction.

2.4 Aircraft Control Failures.

The Investigation Team has no evidence indicating that there were any failures in the aircraft control.

2.5 Causes Related to Human Factor in Aircraft Equipment Operation or Piloting Technique Error During Flight Execution.

The PIC was personally piloting the aircraft on the day of the fatal accident. He had successfully completed seven previous flights with tourists. The PIC performed various maneuver cycles in his flights, delighting the passengers. Kolomyia landscapes, the Prut River, canyons, Mount Hoverla – all this makes up a very interesting photo and video material. The owners of these photos and videos post them on public networks. Watching these videos, the investigation concluded that the pilot allowed himself to perform maneuvers of advanced aerobatics such as

"barrel rolls" – rotation around the longitudinal axis, turns with a banking angle of 80°-90°, a sharp climb and then a rapid descent, and so on. Eyewitnesses, who were close to the fatal accident site, confirmed such maneuvers before the accident. The pilot may not have had a sufficient altitude when performing an advanced aerobatic maneuver. This could have been caused by seemingly minor deviations from the standards, such as an increase in air temperature along with a drop in pressure in the landing site area (paragraph 2.1), or a mismatch of the gasoline with the recommended brand (paragraph 1.16.)

The PIC was in satisfactory health, as evidenced by the valid medical certificate and forensic medical report (1.13.) The PIC was in control of the aircraft right up to the point of the ground impact.

According to Conclusion No. 13.1.4-887-2016 on the possibility and operating conditions of the WT10 Advantic amateur-built aircraft, No. AD-006/2016, in the cockpit of an aircraft, in a most visible place, there must be an information available in red paint or in the form of a plate with the inscription: “Aircraft of amateur design is not intended for commercial flight activities. Performing complex and aerobatics is prohibited.”

3. Conclusions:

1. The aircraft was well maintained and in good condition. Maintenance was performed regularly by certified specialists. On the day of the fatal accident, the aircraft had already completed 7 flights without any critical technical remarks.

2. The aircraft weight and Center-of-Gravity position were within the operational limits.

3. The aircraft had an Airworthiness Certificate in accordance with the current regulations.

4. The owner of the aircraft has a Contract No. 02.07-000208/02 of Liability insurance for damage caused to third parties in accordance with the requirements of paragraph 5 of part 1 of article 118 of the Air Code of Ukraine.

5. The aircraft pilot had an extensive experience in flying this aircraft and was prepared to take actions in abnormal situations. He had a valid Medical Certificate and had undergone scheduled flight checks.

6. The Aircraft Maintenance Manual and Pilots Operating Handbook prohibit to perform flights at this aircraft with banking angles of more than 60°, maneuvers of advanced ("barrel roll") and higher aerobatics. The PIC allowed himself to perform such.

7. The travel agent organized sightseeing flights, which indicates the presence of a commercial element in these flights, but the owner of the aircraft agreed to perform these flights contrary to the "Permit to perform flights" No. 1851, provided by the State Aviation Administration of Ukraine, and the “Flight Conditions”, specified in the approval form No. 12.1.4-127-2017 edition 1 dated 14.12.2017, valid until 16.12.2021.

8. According to paragraph 1.1. of WT10 Advantic UR-PAMA Amateur Design Aircraft Operational Conclusions, WT10 Advantic Amateur Design Aircraft, No. AD-006/2016, must be used exclusively for non-commercial flying activities.

9. The aircraft was not allowed to perform a commercial transportation of baggage, cargo, mail and passengers and perform aviation work for pay, hire or charter and conduct training.

10. The fuel did not meet the specifications for the operation of the WT10 Advantic UR-PAMA aircraft.

3.1. Fatal Accident Causes

The probable cause of the fatal accident was the performance of advanced aerobatics maneuvers prohibited by the Flight Operation Manual, exceeding the limits of permitted banking angles and overloads at low altitude, and the use of an inappropriate brand of gasoline, which in the aggregate led to a loss of the aircraft controllability.

3.2. Contributing Factors:

Deterioration of the meteorological flight conditions (air temperature increase from 22.6°C up to 32.8°C with a simultaneous pressure drop from 1014.8 hPa down to 1011.5 hPa);

Probable PIC's fatigue, since the flight that ended in the fatal accident was the 8th flight for the pilot on the day of the accident without a rest break. The flight time for that day made 3 hours 25 minutes.

The pilot and passengers were not fixed by shoulder fasting belts, but only by waist belts (according to witness information).

4. Safety Recommendations.

4.1. To the Senior Aviation Officer of the Kolomyia Landing Site:

4.1.1 Use only certified fuel and lubricants made by well-known companies, request and keep copies of quality certificates on fuel and lubricants used at Kolomyia Landing Site.

4.1.2 Amend the Instruction on Flight Operation at Kolomyia Landing Site, taking into account the expiration of the referenced regulations.

4.2. To the State Aviation Administration of Ukraine:

4.2.1. Organize an inspection of the relevant amateur-design aircraft of the available information, made in red paint or in the form of a plate in Ukrainian and English, with the inscription: "Amateur-design aircraft is not intended for commercial flight activities. Performing complex and aerobatics is **PROHIBITED**".

4.2.2. Research the feasibility of posting similar information on other general aviation aircraft.

Factor: Human.

Category: Loss of Controllability in Flight (**LOC-I**), at Low Altitude (**LALT**).