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

F I N A L R E P O R T

on the Expert Investigation of an Aviation Accident

Airplane type **WT9 Dynamic LSA/Club**

registration number **OM - DYF**

Ref. No.: SKA2016010

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.

Used abbreviations

AMSL	Above mean sea level
ARP	Aerodrome reference point
ATZ	Aerodrome traffic zone
CTAF	Common traffic advisory frequency
CRE	Class rating examiner
ELT	Emergency locator transmitter
FI(A)	Flight instructor (airplane)
FIC	Flight information centre
ft	Feet (dimensional units)
hPa	Hectopascal
LZPE	abbreviation in ICAO code for Prievidza airport
MEP(L)	Multi engine piston (land)
MHz	Megahertz
min	Minutes
OO PZ	District Police Department
RWY	Runway
sec	Seconds
SEP(L)	Single engine piston (land)
VDL	Correction of distant vision
VMC	Visual meteorological conditions

A. INTRODUCTION

Operator / Owner:	AEROSPOOL spol. s r.o.
Type of operation:	general aviation / test flight of intentional tail spins.
Type:	WT 9 Dynamic LSA/Club
Registration number:	OM - DYF

Take-off:	LZPE
Flight phase:	manoeuvring
Location of accident:	3.9 km SSW from ARP LZPE N 48°44´08.0´´ E 018°33´46.4´´
Date and time of accident:	27.10.2016, 09:51 hod

Note: All times in this report are UTC.

B. INFORMATIVE SUMMARY

On 27 October 2016 during a test flight of intentional tail spins for the purpose of verifying the fulfilment of the CS - LSA certification specification, a pilot with a WT9 Dynamic LSA / Club type airplane, registration number OM-DYF (hereinafter referred to as WT9), after a standard tail spin after one turn and the performance of a standard negotiation, continued in the tail spin. The airplane did not even react to the pilot's next attempt to perform a standard way of negotiation. During the airplane take-off, he probably went into a flat tail spin and even the subsequent pilot's interventions, including the use of a spin-recovery parachute which did not open, were not successful and the rotation was not stopped. The pilot left the airplane by jumping with a back-type rescue parachute and he landed uninjured. The airplane hit a field in the cadastral area of the village of Koš-Laskár. The airplane fall did not cause anyone any injuries. The airplane was destroyed during this air event.

The air crash was announced by witnesses to FIC Bratislava, CTAF LZPE, as well as to the emergency call line 112 and to OO PZ Prievidza.

The following expert investigation commission was set up to investigate the causes of the occurrence of the event in question:

Lic. Jaroslava Mičeková	– Chairman of the Investigation Committee
Ing. Ján Chudý	– Member of the Investigation Committee

The report was issued by:
Aviation and Maritime Investigation Authority
Ministry of Transport and Construction of the Slovak Republic.

C. MAIN PART OF THE REPORT

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

1. FACTUAL INFORMATION

1.1 History of the flight

Critical flight

According to the annex to the test flight program, the test flight on 27 October 2016 included a test of intentional tail spins with a 1 turn or 3-sec tail spin (whichever is longer) of the airplane at the maximum weight and rear center of gravity. After the starting of the engine of the WT9 airplane in front of the AEROSPOOL spol. s r.o. hangar, the pilot received from the CTAF operator at the LZPE airport, meteorological information and traffic information in ATZ LZPE. At 09:13, he performed a take-off from RWY22L airport LZPE. He ascended along with the accompanying WT10 OM-DYX into a restricted test flight area to the south of the LZPE airport. On the basis of the submitted flight plan, the pilot received permission from FIC Bratislava to ascend to the altitude of 10,000 ft AMSL in the restricted area of ATZ LZPE.

Upon reaching the permitted altitude of 10,000 ft AMSL according to the flight data log and data on the protocol card of the test flight, at 09:29, the pilot began to perform a right tail spin in different flight configurations (flaps 0°, 15°, 24°, and 35°). According to the pilot's assessment, all right tail spins were negotiable according to the established methodology and fulfilled the requirements of CS-LSA for tail spins.

Critical left tail spin

By a left tail spin, the pilot ascended to the permitted altitude of 10,000 ft AMSL which he had levelled to a 030° rate and announced that he was ready to perform the test. The commander of the accompanying airplane confirmed that the space was free. At 09:43:33, the pilot reduced the speed to idle running and was continuously reducing the flight speed to the input speed to perform the left tail spin by smoothly lowering the control lever with a 1 kt/sec speed drop. At 09:49:42, at the altitude of 9,940 ft AMSL, at a speed of 44 kt, he performed a standard entering into a left tail spin. He pulled the control lever to the utmost deflection of the altitude rudder, and at the same time, he used the maximum deflection of the directional rudder to the left. After 1 turn in the left tail spin, the pilot made a negotiation according to the methodology. The airplane was at the altitude of 9,860 ft AMSL when the pilot used the maximum deflection of the directional rudder to the right at 09:49:46. With a 2 second time-delay, he pushed the control lever to the maximum deflection of the altitude rudder. After this intervention, the airplane continued in its left tail spin without attempting to stop the rotation at a steady speed of 48 kt and with an average vertical drop speed of 5,600 ft / min. At 09:49:54, the engine was stopped as well as the propeller. Therefore, at 9:49:58, the pilot returned the directional rudder back to the "left tail spin" position and then, with a time-delay of 1 second, he pulled the control lever to the maximum deflection of the altitude rudder. Immediately, together with the reaching of the full deflection of the altitude rudder in a “pulled” position at the altitude of 8,500 ft AMSL, the pilot repeated the standard intervention with full deflection of the directional rudder to the right. Subsequently, he suppressed the control lever to full deflection. According to the pilot, even after the second intervention for negotiating, the airplane continued the tail spin. After 5 sec, he again put the rudders into "left tail spin” position. At 09:50:08, the pilot repeated the procedure of negotiation. The airplane continued to rotate and in this situation, the pilot decided to negotiate with the usage of the flaps. After

4 seconds, he pushed the flap into 15° position and then he closed them. After unsuccessful negotiation, he put the rudders into the “left tail spin” position at the altitude of 7,140 ft AMSL. At 9:50:16, the pilot repeated the procedure of negotiation, but the airplane continued the tail spin. He left the rudder in the "counter-tail spin" position for an additional 10 seconds up to the altitude of 6,100 ft AMSL. Together with the reaching of the full deflection of the altitude rudder in a “pulled” position at the altitude of 6,000 ft AMSL, the pilot repeated the standard intervention with a full-deflection of the directional rudder to the right. Subsequently, he suppressed the control lever to full deflection. After 1 second, he slightly reduced the suppression of the altitude rudder while reducing the deflection of the directional rudder to the right. He then used the full rudders in the "counter-tail spin" position with a slight use of the right wings. After 2 seconds, in order to perform negotiation, he slightly used the wings with full rudders in the "counter-tail spin" position. At 09:50:33, he aligned the wing into neutral position and to negotiate the tail spin, he used the full suppression of the altitude rudder while using the full deflection of the directional rudder to the left. After an additional 2 seconds of rotation, he aligned the directional rudder into the neutral position during full suppression of the altitude rudder. At the altitude of 5,180 ft AMSL, the pilot repeated the negotiating procedure, but the airplane continued in the tail spin. He left the rudders in the "counter-tail spin" position for an additional 6 seconds up to the altitude of 4 660 ft AMSL, when the pilot, after unsuccessful attempts to stop the rotation, activated the spin-recovery parachute for the first time by pulling the driver's handle. As the pilot did not notice any significant change in the position of the airplane nor the stopping of the rotation, he activated the spin-recovery parachute for the second time after 5 seconds by pulling the driver's handle. At 09:50:51, he slightly reduced the suppression of the altitude rudder during the full deflection of the directional rudder to the right. Subsequently, he used the full rudders in the "counter-tail spin" position with a slight use of the right wings. 6 seconds after repeated interference in order to negotiate the left tail spin, the pilot pulled the driver's handle in order to discard the spin-recovery parachute at the altitude of 3,300 ft AMSL At 09:50:58, he reduced the suppression of the altitude rudder into the “neutral” position during the full deflection of the directional rudder to the right. He then used the full rudders in the "counter-tail spin" position. At 09:51:02, the pilot held the lever with his right hand and then he suppressed the lever to full deflection, and decided to leave the airplane using a back-type rescue parachute. At the altitude of 2,440 ft AMSL, he pulled the driver's handle to discard the cockpit cover, which was then detached from the still rotating airplane. As soon as the pilot left the cockpit, he opened the back-type rescue parachute and landed at 09:51:47 on a field about 35 meters from the WT9 airplane.

Witnesses observation

A witness who performed the function of the CTAF operator at LZPE airport, registered the information at approximately 9:50 from the accompanying WT10 OM-DYX for the pilot of the WT9 airplane to open the stabilization spin-recovery parachute. It was followed by a recommendation for the activation of the ballistic rescue system of the WT9 airplane. After another 4 minutes, he received information from the WT10 OM-DYX airplane deck that the pilot jumped out of the WT9 airplane and landed with a rescue parachute on the ground. On the basis of the above mentioned information, he called the pilot's mobile phone, who answered him and confirmed that he was OK.

The witness who was performing the function of pilot-in-command of the accompanying WT10 OM-DYX airplane, saw the pilot perform the tail spin tests in a restricted test flight area. In the last attempt/configuration of the WT9 airplane, he remained in a steady tail spin position. He saw him descending to a small height which he could not guess. Then the airplane got lost under the wing of the accompanying airplane which was piloted by the witness. Then he saw him on the ground with a parachute next to him. He performed a security flyby over the place of his fall, where he saw the pilot standing beside the wreck and waving his hands. He subsequently informed the department of FIC Bratislava, the CTAF operator at the LZPE airport about the extraordinary event and he also navigated the members of ground security who were heading toward the WT9 pilot.

Daytime: day
Flight rules: VFR

1.2 Injuries to persons

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

1.3 Damage to aicraft

After falling at the edge of an agricultural plot, the airplane was destroyed.


OM-DYF

1.4 **Other damage**

The Aviation and Maritime Investigation Authority has not been notified of any circumstances with potential claims for other compensation to third parties.

1.5 **Personnel information**

Pilot:

Citizen of the Czech Republic, age 66, holder of a CPL (A) commercial pilot license, issued by the Czech Republic Civil Aviation Authority on 10.05.1999.

Valid 1st class medical certificate, with VDL limitation, with a marked validity until 22.05.2017.

Valid universal licence of radio-operator of air navigation service.

Qualifications

SEP(L)	with marked validity until 30.04.2018
MEP(L)	with marked validity until 30.04.2017
FIA(A)	with marked validity until 28.02.2017
CRE	with marked validity until 31.12.2016
NIGHT	with marked unlimited validity
AEROBATICS	with marked unlimited validity
TOWING-S/BAN	with marked unlimited validity

The pilot had long-term experience as a pilot and instructor of airplanes, including aerobatics on propeller airplanes. In his present practice, he performed intentional tail spins on airplanes, mostly the Zlín Z 50M, Z 142, Z 526 and Super Decathlon.

Flight experience

The total flight time on airplanes, according to the records made by the pilot in the documentation dated 27.10.2016 before the critical flight, was as follows:

- altogether on all types 6,560 hours
- altogether during last 90 days 50 hours
- altogether during last 30 days 12 hours
- out of which altogether 12 hours on a WT9 airplane

1.6 Aircraft information

General information

The WT9 airplane is a single-engine composite low-wing aircraft, with a solid main chassis and a nasal wheel. It has conventional control with a mechanical transmission of forces to the airplanes's control surfaces, mechanically controlled flaps, and electrically operated transverse and longitudinal balancing.

Test flights of intentional tail spins were performed on the manufacturer's airplane, with a pilot seat for the use of a back-type rescue parachute, and emergency cockpit discarding. The airplane was also equipped with a rescue ballistic system and a PP-2 spin-recovery parachute. Verification of the functionality of the spin-recovery parachute and a verification of the emergency performance of the cockpit cover was the subject of a separate ground test conducted on 12.08.2016.

On 27.10.2016, the airplane obtained a release to service No.: 055/M/2016 after the replacement of the altitude rudders according to the working order WO 2016 1012-1 R0 and the mounting of the PP-2 spin-recovery parachute without limitation.

During the critical test flight, the airplane was at maximum take-off weight and a weight of 90 kg was added to its rear center of gravity, with regard to the centre of gravity in the cockpit at the seat of the co-pilot (75 kg) and (15 kg) on the right side of the luggage compartment.

Type:	WT9 Dynamic LSA/Club
Registration number:	OM – DYF
Serial number:	DY-507/2014 LSA
Manufacturer:	AEROSPOOL, spol. s r.o. Prievidza

Flight License No. 1189/04, issued by the Transport Authority of the Slovak Republic, valid until 19.05.2017.

Legal Insurance: Allianz – Slovak insurance company No.411 022 078/End 1, valid until 14.03.2017.

Airplane Station Authorization, No. 1410791059, valid until 31.12.2023.

Maintenance and release certificate No. 033 / M / 2016 SK.MF.001 valid until 04.05.2017.

Total number of hours flown as of 27.10.2016: 158 h 54 min / 338 flights.

Drive unit

Engine– type:	ROTAX 912 ULS 2
Manufacturer:	Bombardier Rotax GmbH
Serial number:	6,786,065
Total number of hours flown	20 h 49 min
Propeller - type:	SR3000N
Manufacturer:	WOODCOMP Ales Kremen
Serial number:	35046
Total number of hours flown	20 h 49 min

Airplane operation

The airplane was operated on the basis of the Flight permit (No 1189/04) issued in accordance with Regulation (EC) 216/2008, Article 5, par. 4, letter a) for the purpose of developing and demonstrating compliance with the regulations or certification specifications in accordance with the approved flight conditions under No. 60047529, issue No. 3.

The airplane was filled on LZPE, date 27.10.2016 with the gasoline type BA 95 to a total amount of 85 litres in both tanks. The pre-flight inspection was performed by an authorized maintenance technician in the morning and after the landing of the first flight.

1.7 Meteorological information

Synoptic situation

According to the report of the Air Meteorological Service of the Slovak Hydrometeorological Institute, the high-pressure above H1031 hPa with its centre above Poland was moving eastwards and it was gradually weakening.

Reports of SYNOP meteorological station in Prievidza

PRIEVIDZA 270900Z VRB 2kt 10 km FEW 3000ft SC BKN 17700 ft AC 06°C 2°C QNH 1030
PRIEVIDZA 271000Z VRB 2kt 10 km FEW 3500ft CU BKN 13800 ft AC 08°C 2°C QNH 1031
PRIEVIDZA 271100Z VRB 2kt 10 km FEW 3500ft CU BKN 17700 ft AC 10°C 2°C QNH 1030

1.8 Aids to navigation

Not applicable

1.9 Communications

During the test flight, the pilot was in connection with the CTAF LZPE operator at a frequency of 122.600 MHz and with an accompanying airplane and ground security of test flights at a frequency of 133.300 MHz.

1.10 Aerodrome information

LZPE airport is an international public airport and it is located 2.5 km toward 245° from Prievidza railway station. The altitude RWY 04R / 22L, with a length of 940 m, is 853 ft / 260 m.

1.11 Flight recorders and other recording devices

Two DYNON SkyView screens (PFD, EMS), an accelerometer, fuel flow measurement, a digital dynamometer, an outdoor temperature sensor, light signalization of directional rudder deflection end position and longitudinal steering position indication and a GOPRO HERO4 camera were installed in the airplane cockpit. GOPRO HERO4 cameras with a 1x/sec recording rate were mounted on the left wing winglet and on the fuselage.

PFD DYNON SkyView provides information about - time, speed and flight height, vertical velocity, incline, tilting, turning, vertical load multiplies and other data.

EMS DYNON SkyView provides engine operating information - time, engine speed, fill pressure, oil pressure and temperature, cylinder head temperature and coolant temperature, exhaust temperature, fuel pressure and fuel consumption data, and other data.

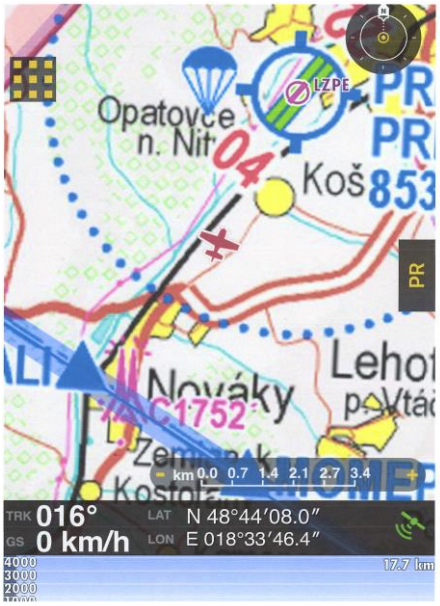
DYNON SkyView recorded values with a recording rate of 16x/sec.

The selected function parameters of the DYNON SkyView were used for the purpose of detecting the causes of the airplane crash.

1.12 **Wreckage and impact information**

General

The airplane hit land, in a field of the agricultural enterprise of AGRODAN s.r.o Koš, the cadastral area of the village of Koš-Laskár. The geographical coordinates of the final position of the airplane were 48° 44'08.0"N and 018° 33'46.4"E.



The place of the airplane crash

The airplane was located on the edge of an agricultural plot with a longitudinal axis of 315°, without the cockpit cover, which was undamaged in the hillside at a distance of 25 m from the airplane fuselage. The front part of the fuselage with the engine was deformed at the bottom by the impact on the ground. The engine covers were deformed and broken, the front chassis leg, the oil cooler along with the air rectifier to the cooler were broken as well as propeller blade No. 1, and propeller blade No. 2 was partially broken and the propeller cone was damaged. The main chassis's legs were pushed into the central wing and the laminate wheel covers were broken. The fuselage was broken twice in the crew compartment space along with the central wing, about 25 cm from the dashboard and at the place of the seat backs separating the luggage compartment from the cockpit. The left part of the central wing had a perforated leading edge and its bottom part was broken. The lower stabilizing surface was broken in the rear part of the fuselage. At the end of the fuselage, a device for glider lifts and a bracket for storing the spin-recovery parachuter was mounted. Both parts were damaged and broken. An unwrapped strap of a spin-recovery parachute that was not activated during the flight was connected to the towing device. After the towing device was broken on the ground, it fell out of the bracket spontaneously, being still in an unpacked state.

The stabilizer and the altitude rudder were significantly damaged, the right part of the rudders was broken in half. The left side of the rudder was broken in 1/2. The keel surface and the indicator were broken in half.

The left half of the wing was broken off from the central wing and had a broken left flap at the distance of 35 cm from the central wing. The left wing was broken at 1/3 of its length. The bottom wing covering was cut and the left winglet was broken. The leading edge was cut at a distance of 80 cm from the wing end. The outer “stall stripe” was unstuck from the leading edge and the leading edge was detached at the level of the left fuel tank shutter.
The right half of the wing had a detached leading edge at the outer “stall stripe”. The speed sensor was broken at the bottom part of the wing. The right winglet was broken and the right wing was broken at 1/3 of its length. The right flap was damaged at its bottom part in a compartment of the second hitch.

After the arrival of a member of the expert investigation commission at the place of the airplane crash, it was necessary to deactivate the ELT device, which was automatically activated and it was transmitting an emergency signal when the airplane hit the ground.

Cockpit

The cockpit cover was adjusted to be discarded in an emergency situation. It was found undamaged, in the hillside, at a distance of 25 m from the fuselage of the airplane.

The top cover of the dashboard was broken. The cockpit included switches necessary to perform a flight in the off position. The main switch under the cap was in the ON position. The magnet switches were in the OFF position. The key inserted in the starter cabinet was in the OFF position. The fuel cock was in the OFF position. The engine control lever was in the "Idle" position, the propeller control with a switch was in the "Constant Speed" position and the choke was in the "OFF" position. The ventilation and heating controls were open in the position of 1 cm. The spin-recovery parachute activation control was activated as well as the control of the spin-recovery parachute discarding. The activation control of the cockpit cover discarding was activated. The ballistic rescue system control was not activated. For security reasons, it was secured and deactivated against accidental activation by a technician of the company Aerospool s.r.o after arriving at the place of the airplane crash. Analogue devices on the dashboard were retained and readable. The speedometer indicated a velocity of 0 kt. The altimeter set to QNH 1031 hPa indicated 200 ft AMSL. A readable compass rate of 315° was displayed at the magnetic compass. The variometer indicated a vertical speed of 500 ft/min descending. The fuel pressure indicator was indicating a value of 0 bar. The flight clock was indicating 158 h 55 min.

Steering

Steering elements were connected to the rudders and they were compact and functional. The control lever and pedals in the cockpit were not blocked.

Drive unit

After the crash, the engine was connected with the propeller. The engine was attached to the engine seating. All controlling elements were connected to performing elements, they were compact and functional. The piping of the fuel, oil and cooling system in the engine compartment was compact, no leakage of operating fluids was noted.

The engine together with the propeller was disassembled at the site and sent to the ROTAX workplace and subjected to a detailed inspection. The state of the mechanical and electrical parts of the engine was verified, the state and all measured values corresponded to the technical requirements. The inspection did not identify any faults or deficiencies that could cause the engine stoppage in the critical left tail spin. Motor gasoline BA 95 was used to drive the engine. The amount of oil in the tank was at operating value.

After the air crash, the engine was subjected to a standard functional test on the testing device and a record of the operation parameters was made. During the test, the engine reached the required values and its operation was steady, it responded fluently to speed changes.

Recording devices

The GOPRO HERO4 camera mounted on the left wing winglet was found in a hillside at the distance of 5 m from the airplane fuselage, and the GOPRO HERO4 camera mounted on the cockpit cover was found in a hillside at the distance of 25 m from the fuselage of the airplane together with the cover.

1.13 **Medical and pathological information**

The pilot evaluated his health status prior to the airplane crash as good, corresponding to the health classification. He attended the last medical inspection on 11.10.2016 and the inspection was performed by the appointed doctor CZ/AME/161-R with a result “Capable for class 1” with a VDL limitation. Members of OO PZ Nováky performed an indicative breath test with the AlcoQuant 6020 plus device and the result was negative.

1.14 Fire

The airplane did not burn.

1.15 Survival aspects

The pilot landed uninjured on a back-type rescue parachute at a distance of approx. 35 m from the airplane.

1.16 Tests and research

Since the spin-recovery parachute did not open after being activated by the pilot during the critical left tail spin, the Aerospool s r.o. manufacturer performed a series of tests on 02.11.2016 in order to discover possible causes explaining why the spin-recovery parachute did not open.

Description of the device

The PP-2 type spin-recovery parachute was placed in a casing and attached to the rear part of the airplane fuselage under the directional rudder (fig. 1) The parachute was attached to the airplane by a towing device, allowing its discarding after opening and stabilizing the tail spin. The parachute is released by an extraction parachute. The pressed extraction parachute including the main parachute was secured in a casing with 4 straps. The release system is controlled by the pilot using a steel cable that secures the straps in the closed position. After activation, the steel cable is released from the straps securing cone and it unlocks 4 straps (fig. 2).

A tin-plated copper cable was used for securing the steel cable with a diameter of 0.2 mm of the 44A0111 type and a seal.

The cable was secured in the way shown in fig. 3.

Fig. 1

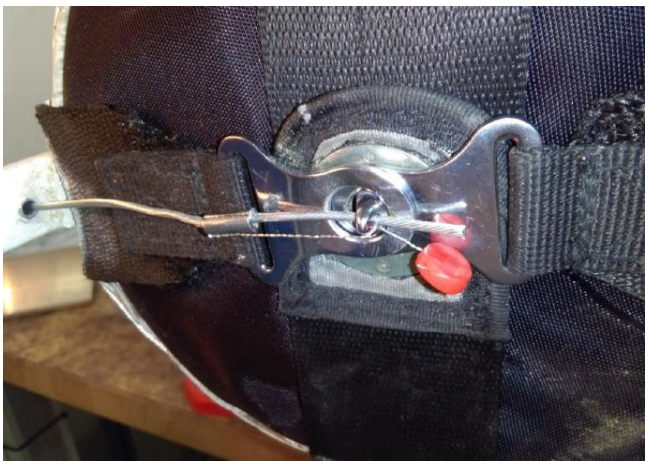


Fig. 2

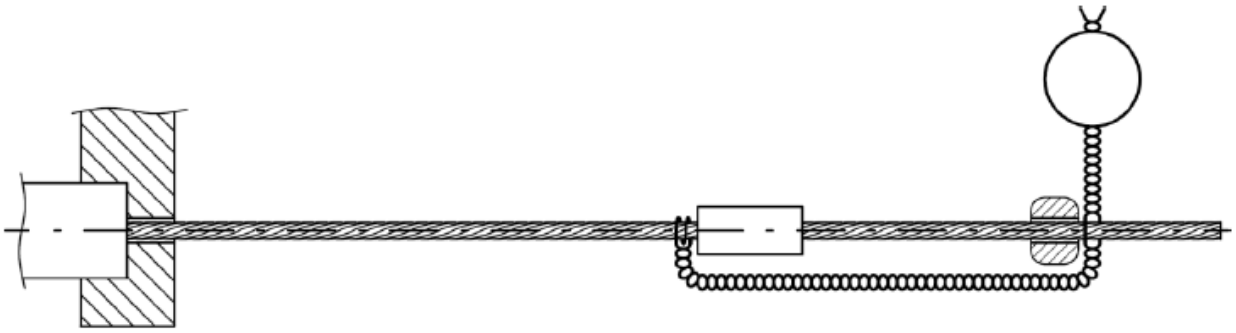


Fig. 3

The test procedure

A total of 5 attempts were made during the test with a different way of securing the steel cable. In attempts 1-4, the spin-recovery parachute was opened after activation.

In attempt No. 5, the securing cable was inserted into the opening of the securing cone for straps with an overlap of 25 mm and its other end was secured by the seal according to fig. 4.

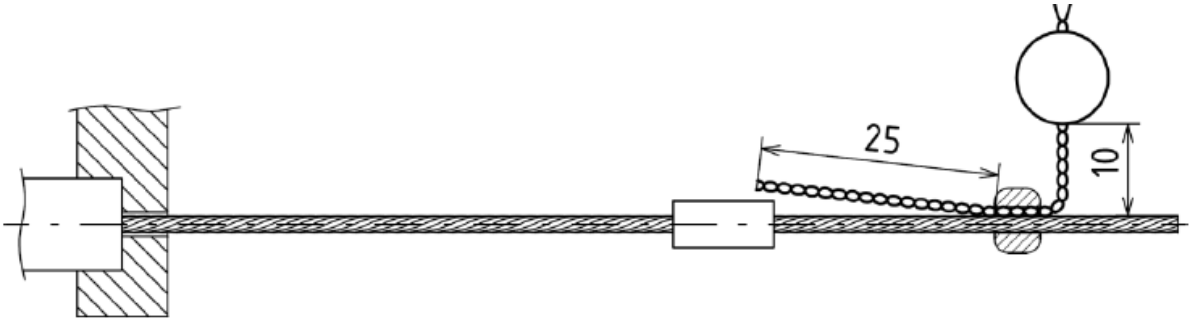


Fig. 4

In this attempt, unlike in previous experiments, the cable was slowly pulled out of the cone and the spring of the extraction parachute was held by hand for slow release. After the sliding of the last two buckles of the securing straps out of the cone, these, together with the securing cable, blocked the opening of the straps and the parachute did not open (fig. 5).

Fig. 5

Test conclusion

According to test result No. 5, it was proven that in certain conditions, the securing cable and the seal can *cause* the blocking of the securing straps and therefore the spin-recovery parachute would not open even after being activated by the pilot.

1.17 Organizational and management information

The owner and operator of the WT9 airplane is the manufacturer, the holder of the APOA designing authorization No. EASA.AP356, certification of a production organisation approval No. SK.21G.0002, certification of approval of an organization performing maintenance No. SK.MF.001 and certification of approval of an organization managing the observance of airworthiness No. SK.MG.015. He performs test flights of prototypes and experimentally adjusted airplanes, serial test flights and operational test flights of WT9 Dynamic airplanes.

Test flights are provided by the manufacturer's aviation and ground staff, prototype test flights and experimentally adjusted airplane test flights are performed by the manufacturer's pilots and, in specific cases, by contracted pilots. The crews of the test flights follow the LZPE Airport Operational Manual. The program and methodology of the test flight are prepared by Aerospool Prievidza s.r.o.

1.18 Additional information

Assignment of the test flight

Regarding the assignment of the test flight of intentional tail spins, the manufacturer required the performance of single-turn or 3 second-tail spins (whichever is longer) in various configurations, in order to verify the properties during a tail spin. The pilot was supposed to perform right tail spins at first and then left tail spins. He was supposed to perform the tail spins in accordance with the established methodology.

The methodology of negotiating was stated in the assignment as follows:

After performing a single turn or a 3 sec one (whichever is longer), with the wings in the neutral position, press the counter-directional rudder to maximum deflection and, after completing the directional rudder impact, push the altitude rudder as required,

simultaneously slide the flaps (if extended) and with the POM in the idle position. After stopping the rotation, adjust the directional rudder and by the fluent levelling of the altitude rudder, negotiate a nose-dive.

Record in the protocol the properties in the tail spin, record the size of the turn, the maximum negotiating speed, and the altitude of negotiating (the beginning and the end). Track the multiple during the tail spin negotiation on the g-meter, in the case of the danger of exceeding the 4g multiple, reduce the draw speed.

Evaluation of the intentional tail spins

The manufacturer performed an analysis of test flights within the program of intentional tail spins test flights. The analysis of each test within the program has been incorporated into the protocol. To determine the typical course of intentional tail spins, the average values of the monitored tail spin parameters were determined using a recording device. Tail spin tests with the normal use of steering were performed at all points (corners) of weight and center of gravity (rear and front center of gravity position). All right tail spins met the requirements of CS-LSA regulation for tail spin negotiation.

WT9 Dynamic LSA/Club airplane, in the FG912T configuration type does not have a tendency to negotiate left tail spins.

Emergency procedures

Emergency procedures in case of the unsuccessful attempt for intentional tail spin negotiation have been stated in the methodology for tail spin performance. The airplane was equipped with the following emergency rescue means:

Spin-recovery parachute type PP-2 – use in the case of unsuccessful attempts for tail spin negotiation in a normal or abnormal way, after being opened, it was supposed to perform a turning moment opposite the direction of the tail spin and simultaneously increase the longitudinal incline in the tail spin, with a gradual transition into a spiral and nose-dive. The originally non-negotiable tail spin is supposed to be negotiable after the activation of the parachute after approx. 2 turns. After stopping the rotation and restoring the steering, the parachute must be discarded as well as before the normal landing of the airplane.

The MAGNUM.601 type ballistic rescue system should be used in the case of unsuccessful attempts for tail spin negotiation in a normal or abnormal way and unsuccessful activation of the spin-recovery parachute. A critical height of 4000 ft AGL (1260 m) has been set for its activation.

Back-type rescue parachute for the pilot type ATL-88/90 for the emergency escaping of the airplane. In case of unsuccessful attempts for tail spin negotiation and the unsuccessful usage of the spin-recovery parachute or ballistic secure system, a critical height of 3500 ft AGL (1100 m) has been set for airplane escaping. A minimum height of 330 ft AGL (100 m) has been set for the usage of the ATL-88/90 type rescue parachute for emergency airplane escaping.

1.19 **Useful or effective investigation techniques**

Conventional methods of investigation were used.

2. ANALYSIS

2.1 General

The investigation revealed that the pilot was qualified in accordance with the regulations. The airplane was qualified for the test flight in order to verify the performance of the tail spins according to the test flight program, in accordance with the manufacturer's internal regulations. No evidence of a breakdown before the air event during the wreck and drive unit inspection was found.

The purpose of the flight was the test with an assignment to repeat the program after its interruption caused by the issue with the left tail spin negotiation at the maximum weight, the airplane rear center of gravity in the configuration of the 15° flap and 1 turn, while the airplane did not respond to the standard way of negotiating.

The manufacturer has decided to start developmental tests of unintentional tail spins with the original methodology and a new pilot who has completed the differential training and ground preparation for the tests.

During the analysis of information, the commission did not aim to evaluate the tail spin qualities of the airplane. It focused on how the airplane behaved in the tail spin and the way it was negotiated. The presence of on-board video and video from the left wing played a significant role in the provision of the accurate description of the airplane behaviour in the tail spin. It enabled evaluating the resulting auto-rotary motion, angular velocities and especially the steepness and positions oscillation.

Longitudinal incline of the airplane in left tail spin

The measured value of the longitudinal incline demonstrates that during the negotiation of the tail spin, the airplane probably changed its position into a flat tail spin (*a flat tail spin is a tail spin with an angle of longitudinal inclination lower than 45°. A more difficult negotiation is characteristic for the flat tail spin; a normal tail spin is a tail spin during which the airplane is in a position corresponding to normal flight with an angle of longitudinal inclination greater than 45°).*

The commission used a record of the measuring equipment to analyse the steering interventions during the tail spins which were the subject of the test flights. However, the measurement equipment had limitations resulting from the functional parameters of the recorder used. It did not record positional angles nor some parameters important for

the analysis of airplane behaviour during an auto-rotary movement. It also did not record wing deflections. The commission has analysed flight information about transverse and longitudinal incline during the tail spin which were recorded by the DYNON SkyView (PFD) device, to determine how the airplane behaved in the tail spin and in its negotiation, but these data were not clear.

2.2 Analysis of the way of negotiating

The basis of the tail spin negotiation is that the pilot, through the deflection of the directional and altitude rudder, overcomes the inertial moments and the angle of inclination on both halves of the wing will be reduced under the critical level. The sequence of the directional rudder and the altitude rudder use is also important. After performing 1 turn or a 3-second turn (depends on what takes more time), the pilot was instructed in the test flight assignment to press the counter-directional rudder to the maximum deflection and after finishing the intervention of the directional rudder, to press the altitude rudder as required.

During the critical left tail spin, the camera recorded altogether 57 turns.

During the analysis of the methodology of standard tail spin negotiation, the commission has not discovered any differences with the prescribed methodology.

2.3 Airplane

No evidence about the airplane breakdown that could lead to the problems during tail spin negotiation was found during the technical inspection of the airplane. From the state of the drive unit, it was deduced that the engine did not work at the time of the airplane crash.

The Rotax 912 ULS 2 engine is not suitable for acrobatics (flight on the back, etc.). The commission believes that the engine break down in the developed acrobatics is the probable consequence of the failure of the fuel supply by pressure carburettors due to centrifugal forces and the change of position of the longitudinal axis of the airplane The spin-recovery parachute was not released out of its casing and it did not unroll.

The commission supports the test result (test No. 5) which proves, that in certain conditions, the securing cable and the seal can cause the blocking of securing straps and therefore the spin-recovery parachute would not open even after being activated by the pilot.

2.4 Flight conditions

The test flight was performed for VMC. The height altitude wind was within the limits which allowed the performance of the test program from the determined altitude.

The pilot was familiar with the restricted test flight area and its surroundings. He performed the tail spins in the restricted test flight area which is distant from densely populated areas of towns and settlements, as well as from people in the open air.

2.5 Pilot

According to valid regulations, the pilot was competent and had long-term experience as a pilot and instructor on airplanes, including aerobatics on propeller airplanes.
His was familiar with the program and results of the tests of intentional tail spins to verify compliance with the CS-LSA certification specification, including experience with the behaviour of the airplane when launching and negotiating the tail spins with single or multiple turns to the left or right, including the results of the analysis of the tail spin negotiation problem.

3. C O N C L U S I O N S / Cause of the Aviation Accident

3.1 Findings

Airplane

- had a valid flight license issued by the Transport Authority of the Slovak Republic;
- the used type of the recorder did not record positional angles or some parameters important for the analysis of airplane behaviour during a auto-rotary movement. It also did not record wing deflections;
- for the critical test flight, it was at the maximum take-off weight and a weight was added to its rear center of gravity;
- it was filled with the prescribed fuel and a pre-flight inspection was performed by an authorized maintenance technician;
- the pilot did not discover any break down of the airplane or its system, nor was there any evidence of an airplane failure before the air event;
- the auto-rotation of the airplane in the tail spin continued to the left until it hit the ground;
- the damage of the airplane corresponds to the impact on the field at the place of impact.

Pilot

- had the valid qualification for the required flight and long-term experience, including acrobatics;
- he had valid medical fitness for the given type of aviation activity;
- the pilot left the uncontrollable airplane using a rescue back parachute without injuries.

3.2 Cause of the aviation accident

- the WT9 airplane, in the FG912T configuration type, did not have a tendency to negotiate left tail spins.
- the definite cause of the ineffectiveness of the standard way of left tail spin negotiation after 1 turn could not be detected;
- the combination of several impacts on the characteristics of left tail spin negotiation at the maximum weight and a rear center of gravity was the probable cause;
    - the deflection of the directional rudder did not induce a sufficient moment to stop the rotation probably due to the lesser efficiency induced by the airplane position in the tail spin which corresponded to the flat tail spin;
    - the original unadjusted altitude rudders were used.

4. SAFETY RECOMMENDATIONS

The airplane manufacturer has taken the following measures during the investigation of the air event in question:

- On 02.11.2016, he issued the Binding Service Bulletin SBLSA-011-2016;
- On 02.11.2016, he issued the Binding Service Bulletin SBLSA-012-2016;
- On 16.11.2016, he issued the Binding Service Bulletin SBLSA-013-2016;
- he decided not to continue in the program of test flights of intentional tail spins of the WT9 Dynamic LSA/Club airplane, in the FG912T configuration type, but in the certification process demonstrating the fulfilment of requirements CS-LSA Subpart B 4.5.9.1 and B 4.5.9.3 applying the document EASA ELOS-BLSA.0221-01 from 22.12.2016.

Bratislava, 18.04.2017