

FINAL REPORT

**Investigation on the accident
to RV-7 registration LN-DSF
at Špičník, 7 km S Modrava
on 23 August 2014**

Prague
April 2015

This investigation has been carried out in accordance with EU Regulation No 996/2010. The sole objective of the safety investigation is the prevention of future accidents and incidents without apportioning blame or liability.

The report has been translated and published by the Air Accidents Investigation Institute to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in Czech is the work of reference.

Used abbreviations:

AII	Air Accidents Investigation Institute
AGL	Above ground level
AMSL	Above mean sea level
ARM	Position of the ELT main switch for normal operation
ATS	Air traffic services
BASE	Cloud base
BKN	Broken
BNC	Bayonet Neill Concelman connector
CAA	Civil Aviation Authority
°C	Degrees Celsius
CEST	Central European Summer Time
CU	Cumulus
CHMI	Czech Hydrometeorological Institute
E	East
EDMF	Airfield Fürstzell (Germany)
EDCY	Airfield Welzow (Germany)
ELEV	Elevation (Based on WGS84 system)
ELT	Emergency locator transmitter
ENE	East-north-east
ESTF	Airport Fjällbacka (Sweden)
EUR	European region
ELEV	Elevation
FAA	Federal Aviation Administration USA
FEW	Few
FIC	Flight information centre
FIR	Flight information region
FISo	Dispatcher FIC
ft	Feet (dimensional unit - 0,3048 m)
HR	Hour(s)
hPa	Hectopascal
kg	Kilogram(s)
km	Kilometre(s)
kt	Knot(s)
l	Litres
LYR	Layer
m	Metres
MHz	Megahertz
min	Minutes (unit if measurement of time)
MIFM	Military Institute of Forensic Medicine
mm	Milimetres
N	North (cardinal direction)
NE	North-east
NW	North-west
NIL	None
PIC	Pilot in command
PPL(A)	Private pilot licence (aeroplane)
RESHRA	Indicator for recent phenomena – recent shower rain

RWY	Runway
QNH	Altimeter sub-scale setting to obtain elevation when on the ground
s	Second
S	South
SAR	Search and Rescue
SC	Stratocumulus
SCT	Scattered
SE	South-east
SEP land	Single-engine piston - land
SHRA	Indicator for recent phenomena shower rain
TMG	Touring motor glider
TOP	Cloud top
TSN	Time since new
UTC	Co-ordinated Universal Time
VFR	Visual flight rules
VRB	Variable

A) Introduction

Operator: Private owner
Aircraft type: Van's Aircraft, RV-7
Registration: LN-DSF
Location of accident: Špičnick mountain, 7 km S Modrava
Date and Time: 23 August 2014, 16:18 (All times are UTC)

B) Synopsis

On 24 August 2014, the AAll was notified of an accident of the RV-7 aircraft, which occurred during a VFR flight from EDMF, on the route partially in the Prague FIR, with planned landing at EDCY.

On 23 August 2014, the ATS unit in the Federal Republic of Germany lost radar information about the flight near the state border, approx. 7 km south of Modrava. The Münster RCC commenced a search. During the search the Münster RCC turned to the Prague RCC with a request to check radar records and the flight route over the territory of the Czech Republic. The search result was negative; therefore, the Prague RCC started searching on the territory of the Czech Republic. The wrecked aircraft was found by the SAR helicopter crew on the following day. The aircraft collided with tree trunks near the summit of the Špičnick mountain. The aircraft was destroyed by the collision. The pilot, showing no signs of life, was found in the wreckage. No other persons were injured.

The AAll Commission arrived at the location of the air accident on 24 August 2014 to commence investigating its causes.

The cause of the accident was investigated by an AAll commission comprising:

Investigator in charge: Ing. Stanislav Suchý
Members: Ing. Lubomír Stříhávka
COL. MD. Miloš Sokol, PhD. - MIFM

The Final report was released by:

AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
199 01 PRAHA 99

On the 20 April 2015

C) The Final report includes the following main parts:

- 1) Factual information
- 2) Analysis
- 3) Conclusions
- 4) Safety recommendation
- 5) Appendices

1 Factual information

1.1 History of the flight

1.1.1 Circumstances Preceding the Event Flight

On 21 August 2014, the pilot conducted a VFR flight from ESTF to EDCY. At 14:17 on 22 August 2014, the pilot continued the VFR flight from EDCY to EDMF, where he landed approx. at 15:48. This flight was not performed over the territory of the Czech Republic as the pilot was flying along the borders of the Munich FIR and the Prague FIR. On 23 August 2014, the pilot planned to fly from EDMF to EDCY. The witness, who had been in contact with the pilot approx. since 09:00 and had taken him to the aerodrome on the same day in the afternoon, said that the pilot had not assessed the weather as bad at the time of departure approx. at 16:00 and that it had not been raining. No details of the pilot's preflight preparation are known. He had a tablet with him. Updated weather information in the Prague FIR, a significant weather map for low-level flights, a significant weather map for the EUR area, satellite images, radar echos and METARs of the aerodromes were available on the CHMI website.

During the time which the witness spent with the pilot, the same showed no signs of any worries, he was in good mood and was not complaining of anything. On 23 August 2014, the pilot drank no alcoholic beverages before the flight and, according to the witness' statement, he had no health complaints and took no medications.

1.1.2 Event Flight

Pursuant to the recorded radar data, information acquired from the airborne navigational system and the records of messages on the Munich FIC frequency, the pilot took off from EDMF at 16:06. The recorded data show that after the take-off the pilot continued approximately on the flight line directly to EDCY.

From 16:08 onwards, the situation display of ATS surveillance information indicated the SSR echo location of the LN-DSF aircraft with an assigned form.

At 16:10:54 the pilot established radio contact on the Munich FIC frequency. He was gradually ascending under the track angle of approx. 005 degrees.

At 16:11:05, the pilot transmitted a message notifying of his performance of the flight in accordance with the VFR regulations from EDMF to EDCY, he also reported the take-off time being 16:06, requested the flight plan activation and the information on operation on the planned track.

At 16:11:24, upon the request by the Munich FIC, the pilot reported the aircraft type RV-7, his flight position at 9 NM east of the Vilshofen aerodrome, and the SSR 7000 transponder settings. Munich FISo acknowledged the aircraft identification, the flight level at 4,000 ft, and the QNH at 1,015 hPa. The pilot of LN-DSF confirmed the data on QNH 1,015 hPa and at 16:12:02 repeated the request for the flight plan activation. Munich FISo confirmed the information again.

At 16:12:04 the aircraft reached the flight level of 4,000 ft and then continued in flight at this level at the ground speed of approx. 150–170 kt. He was heading to the east from the Elsenthal aerodrome from whose level the ground is rising gradually up to the peaks of the range between Grosser Rachel (4,767 ft AMSL) and Lusen (4,490 ft AMSL) where the border between the Munich FIR and the Prague FIR lies.

At 16:17:15, the information about the flight level of 4,400 ft and the ground speed of 160 kt appeared on the air traffic situation display. The aircraft continuously kept the track angle of approx. 007 degrees. According to the position of the relevant symbol, the LN-DSF aircraft was located just before the border of the Prague FIR at 16:17:40.

At 16:17:50, according to the recording of the air traffic situation display, the last information about the LN-DSF aircraft position was at the flight level 4,400 ft¹ with the ground speed of 160 kt. At 16:22:54, after the Munich FISO had ascertained that the LN-DSF position indication had not been updated, the Munich FISO attempted to establish communication with the pilot. No reply was received. The call was therefore repeated, but the LN-DSF aircraft pilot transmitted no more messages.

No witnesses from the vicinity and from the time of the loss of communication of radar information about the LN-DSF aircraft location were available.

The aircraft, as deduced from the traces and findings of the wreckage, collided in the area approx. 80 metres SE from the summit of the Špičník mountain (4,432 ft / 1,351 m) with the top parts of dry and dead tree trunks. After the impact, the trajectory of the motion continued above the northern slope of Špičník to the point of next collision with the tree trunks which caused the destruction of the aircraft. The diagram of the track in the location of collision of the aircraft is shown in Figure 1.

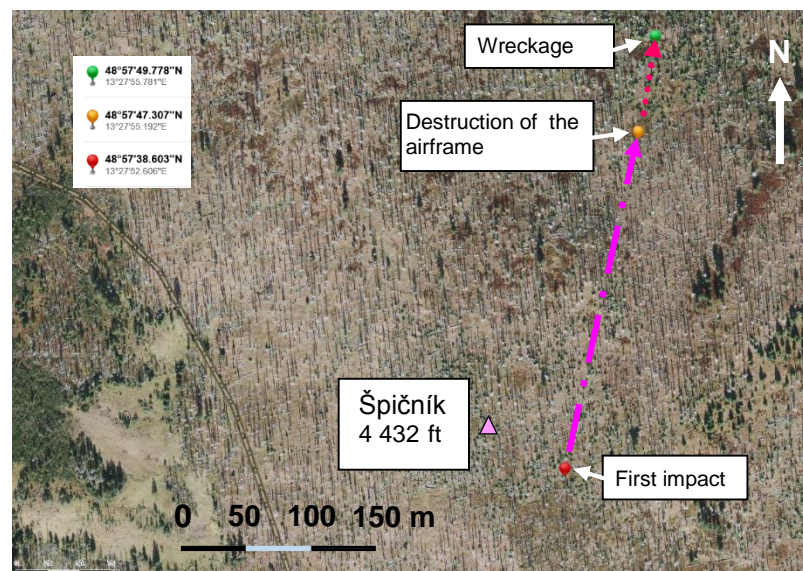


Figure 1

1.1.3 Flight plan

The copy of flight plan:

(FPL-LNDSF-VG
-RV7/L-Y/S
-EDMF1600
-N0150VFR DCT
-EDCY0111 EDCM
-DOF/140823 EET/LKAA0011 EDMM0053 ORGN/KBLIHAEX RMK/PILOT²⁾
SUPP INFO RQS KBLIHAEX)

¹⁾ Level according to the standard pressure 1013,25 hPa.

²⁾ Pilot's name and the telefon number.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	0	0
Serious	0	0	0
Minor/None	0/0	0/0	0

1.3 Damage to aircraft

The aircraft was destroyed due to the collision with the tree trunks and with the ground.

1.4 Other damage

The aircraft crashed at a location in Zone I of the Šumava National Park (non-interference zone) where an unascertained amount of engine oil and fuel contaminated the soil at the crash point.

1.5 Personnel information

1.5.1 Pilot

Personnel data:

- male, aged 38 years,
- he held valid private pilot licence for airplane PPL (A), issued by Federal republic of Germany, valid rating SEP(land), TMG, Night Flying Qualification,
- he held valid medical certificate Class 2.

1.5.1.1 Flying experience:

According to the pilot logbook entries starting from 1999 (Flugbuch No. 1), the pilot had experience with flying L-13SL Vivat, Cessna 172, Pa-18, DA 20/40, Rutan Vari-Eze, and RV-7 aircraft. The last entry into the pilot logbook was made on 10 June 2014. The total flight time on the stated types of aircraft was, in accordance with the entries into the pilot logbook made by the pilot, up to the stated date in total of:

- total pilot time on all types: 250 hours 3 minutes
- in last 90 days: 0 hours 24 minutes,
- total pilot time on RV-7: 102 hours 9 minutes
- on RV-7 in last 90 days: 0 hours 24 minutes,

After 10 June 2014 no more entries of flights were made into the pilot logbook.

1.5.1.2 Pilot's Qualifications

The pilot had the necessary skills and knowledge required in order to perform a VFR flight. He had been flying on RV-7 since June 2011. He was not a holder of a licence qualifying him to perform the flight under IMC.

1.5.1.3 Former Air Accident

According to the statement of a body authorised to carry out air accident investigations in Norway, the pilot was an owner of an experimental type of aircraft – Rutan Vari-Eze with the identification mark LN-MAB. During the flight from the Flensburg aerodrome to the Jarlsberg aerodrome on 5 June 2008 a power unit cut-out occurred south of Sandefjord. During the attempted emergency landing the pilot collided with the trees, though, and the aircraft was overturned. The pilot was seriously injured, another person on board was injured lightly. The aircraft was destroyed. According to the final report, the probable cause of the stated accident was the fuel starvation during the flight.

1.6 Aircraft information

1.6.1 General information

RV-7 is a low-wing all-metal monoplane two seater with the seats in side-by-side configuration. The aircraft is marketed as a construction kit for home assembly. The kit includes parts of the aircraft frame. The owner has to obtain namely the power unit, the instruments, and the avionics. The construction kit is checked by the FAA and conforms to all the requirements in the experimental category, and the requirement for the aircraft to be built in an extent of at least 51 per cent by the amateur or by a non-profit organisation of amateurs for their own and no commercial purposes.

The power unit consists of a four-stroke air-cooled Lycoming YIO 360 1B engine with an adjustable two-blade metal propeller Hartzell.

1.6.2 Crashed aircraft

Type:	RV-7
Registration:	LN-DSF
Manufacturer:	Van's Aircraft
Year of manufacture:	2011
Serial number:	71683
Special Certificate of Airworthiness:	valid
Airworthiness Review Certificate:	valid
Total flight time ³⁾ :	103 hours 50 minutes
Assurance certificate:	valid
Type of engine:	Lycoming YIO 360 1B
Manufacturer:	Lycoming
Serial number:	L 3326
Propeller:	Hartzell C2YR 1BFP
Serial number:	45466B

1.6.3 Operation of the aircraft

Lycoming YIO 360 1B engine is an uncertified type of engine using identical parts as the certified engines Lycoming IO 360 1B by the same manufacturer. It is supplied together with the aircraft home assembly kit. The engine was mounted onto the frame of RV-7 with the registration mark LN-DSF most likely in 2011. On 17 June 2014, the maintenance work after 100 flight hours was performed according to the entry in the aircraft logbook. Up to 17 June 2014 the engine had worked for 103 h 50 min. No further entry has been made into the aircraft logbook about the operation of the aircraft.

³⁾ Total Flying time according to aircraft logbook.

1.7 Meteorological information

1.7.1 Synoptic situation according to CHMI Expert Opinion

Under the report of the Aeronautical Meteorological Service of the CHMI, a weakening ridge of high pressure was retreating eastward, followed by a warm occluded front progressing across Germany and Austria, which started affecting the border area of Český les and Šumava with layered clouds and light precipitation between 18:00 and 19:00 UTC. The Czech borderline mountains became possibly covered with clouds no sooner than after 19:00 UTC. According to expert estimate prepared by the CHMI, the meteorological situation at the place of air accident was as follows:

Surface wind: 230°- 280°/ 6 – 12 kt,
 Wind: 2,000 ft AMSL 250°/ 6 kt, 5,000 ft AMSL 230°/ 13 kt
 Visibility: over 10 km, after 10:00 UTC 5 – 8 km in rain
 Present weather: cloudy, at time 15:30 – 16:00 STC
 Sky condition: STC CU, SC BASE 5,000 ft AMSL, TOP 8,000 ft AMSL, after 18:00 UTC BKN LVR 4,000 ft, TOP above 10,000 ft AMSL
 Turbulence: NIL
 Temperature: 2,000 ft +13°C, 5,000 ft +5°C

1.7.2 Extract from SYNOP reports from station Churáňov; (A) – automatic

Station (CHMI) 11457 Churáňov (1,122 m AMSL) is located approx. 10 km ENE from the village of Modrava. Abstract from the SYNOP reports of the Churáňov station:

Time	Surface wind direction/ Wind speed	Visibility	Weather phenomena	Cloud amount	Clouds/ Clouds Height	Temp.	Dew point
15:00	230° 8 kt	35 km		8	1/2200 ft CU 8/24000 ft	14°C	7°C
16:00	250° 6 kt	20 km		- (A)	1/2200 ft 3/5000 ft	13°C	7°C
17:00	240° 4 kt	20 km		8	1/2400 ft CU 8/23000	12°C	7°C
18:00	260° 4 kt	30 km	SHRA	8	6/2600 ft CU	11°C	7°C
19:00	260° 4 kt	30 km	RESHRA	8	4/2900 ft CU 3/4500 ft	11°C	8°C

1.7.3 Photographs of the on-site situation.

Footage of the web camera placed at the Březník station (1,170 m AMSL), has been acquired from the operating records of the Šumava National Park. In ten-minute intervals, the camera records a view of the borderline crest of Šumava with a southward view angle of approx. 180 degrees. At 18:10 and 18:20 local time (CEST), the following meteorological conditions were captured:

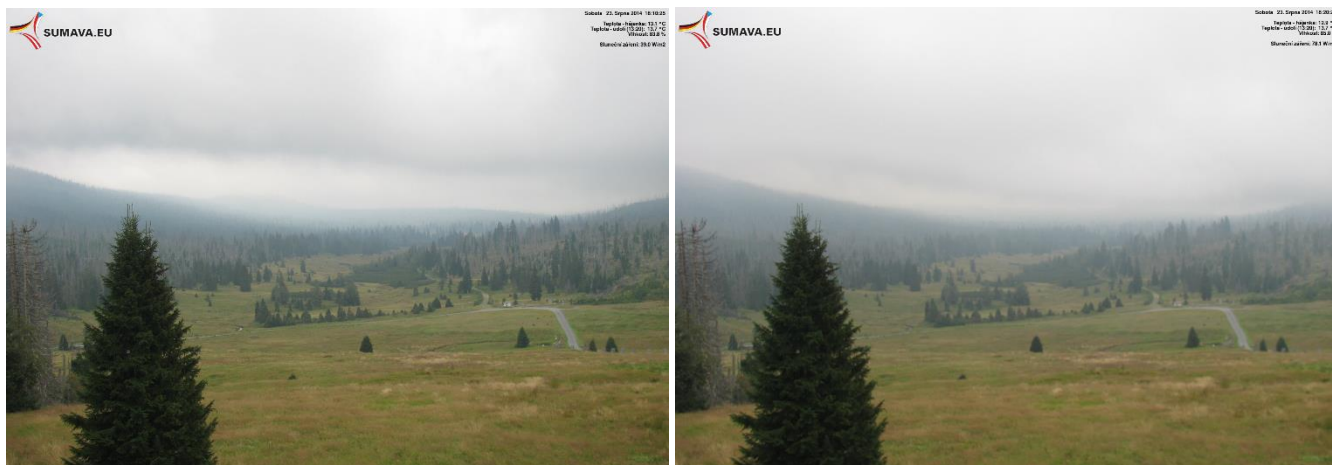


Figure 2 The camera records at Březník station at 18:10 a 18:20 local time (CEST)

The photographs allowed for evaluation of an approximate location of the cloud base on the mountainside of Špičník at approx. 1,200 m AMSL.

1.7.4 Meteorological Radar

According to the records of the CHMI met. radar at the Brdy Skalky station, and to the satellite images, the situation between 16:00 and 16:20 was as follows:

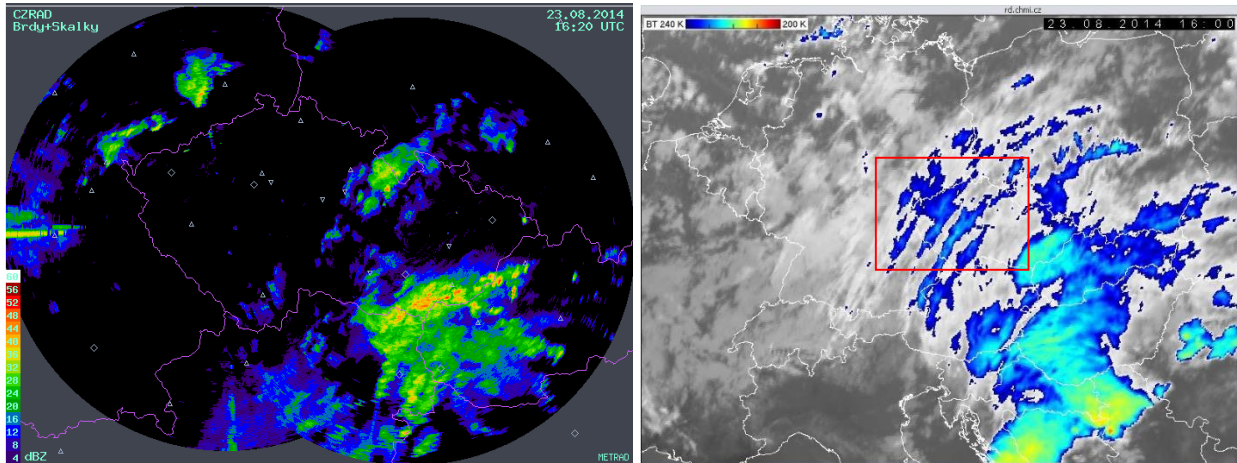


Figure 3 The records of met. radar at 16:20 UTC (18:20 CEST)

1.8 Aids to navigation

NIL

1.9 Communications

1.9.1 ATS frequencies FIC Praha:

- 126,1 MHz PRAHA INFORMATION sector - part West
- 136,175 MHz PRAHA INFORMATION sector - part East

Transmission by the LN-DSF pilot was observed neither on the FIC Praha frequency, nor on other ATS frequencies.

1.9.2 Communication of the pilot of the LN-DSF aircraft with the Munich FIS

At 16:10:54, after the take-off from EDMF, the pilot established contact on the frequency of the Munich FIC (120.650 MHz). For transcription of communication see Appendix No. 2. The pilot of the LN-DSF aircraft transmitted the last message at 16:12:10. The pilot did not respond to calling of the Munich FISo at 16:22:54 and at 16:23:10. The aerodromes on the assumed route and the ATS site did not capture any transmission of messages by the pilot of the LN-DSF aircraft.

1.10 Aerodrome information

The Fürstenzell (EDMF) is public airfield situated 1 NM E Fürstenzell. Coordinates ARP - 48° 30,78'N / 13° 20,77'E. An elevation of centre of RWY 15 / 33 (size 485 x 12 m) is of 1 345 ft / 410 m.

1.11 Flight recorders and Other Means of Recording

No flight recording device was placed on board of the LN-DSF aircraft. The Commission used the data files, seized by the police force from SD cards, found in the navigational devices on the aircraft instrument board.

The police force had seized the ENIGMA rec. file on a SD card, which was uploaded to the Commission's computer and analysed by means of the relevant manufacturer's software⁴). The last recorded flight is dated 23 August 2014. The respective flight data were acquired by conversion to IGC, KML and Excel files. The KML file has been analysed in the Google Earth map application. The IGC file has been analysed employing the SeeYou Flight Data. For parameters from the time before the end of the event flight see Appendix No. 3.

See Table No. 1 for the data from the last section of the flight, approx. 20 seconds before the recording ends (16:17:15 – 16:17:34) regarding the vertical position on the basis of the pressure altitude (ALT [m]), GPS altitude (GPS_{ALT} [m]) and the GPS above the ground level (AGL [m]), ground speed on the basis of the GPS (Gsp [km x h⁻¹]), track angle based on the GPS (Trk [°]), and the data concerning the mode of operation of the power plant (RPM [rotations x min⁻¹]).

Table No. 1

Time	16:17:15	16:17:16	16:17:17	16:17:18	16:17:19	16:17:20	16:17:21	16:17:22	16:17:23	16:17:24	16:17:25	16:17:26	16:17:27	16:17:28	16:17:29	16:17:30	16:17:31	16:17:32	16:17:33	16:17:34
ALT	1347	1348	1348	1347	1348	1347	1347	1348	1346	1346	1346	1347	1349	1349	1348	1346	1346	1346	1365	1376
GPS _{ALT}	1366	1366	1365	1365	1365	1364	1365	1365	1363	1363	1363	1364	1365	1366	1365	1364	1363	1363	1364	-
AGL	261	236	202	166	138	118	103	92	79	67	55	42	29	20	13	6	0	-6	10	-
Gsp	313	313	313	313	313	313	313	313	313	316	313	313	316	313	313	316	316	313	310	-
Trk	7	8	7	7	7	7	7	8	7	7	8	7	7	8	8	7	8	8	10	10
RPM	2392	2378	2387	2375	2380	2380	2384	2380	2385	2385	2383	2383	2378	2380	2379	2385	2385	2389	2396	2284

1.11.2 Recordings of the Information Provided by the Radar

The relevant radar records from the stations at Großhager Forst and Mittersberg (FRG) and in Austria were available. The flight of LN-DSF was performed at too low altitude for the other radars' recordings processed in the E2000 multitrack. The flight of LN-DSF was hidden behind the Šumava range, therefore the multilateration on the territory of the Czech Republic could not have been performed. No position was detected.

The first indication of a radar position of the aircraft LN-DSF at the Munich FIC occurred at 16:08:20. According to the information on the level derived from the C SSR mode, the aircraft reached the level of 44 (4,400 ft) with an admissible tolerance at 16:15:14 and was flying at the speed of 160 kt. Up until 16:17:10 the flight was being performed at the same level of 44. At 16:17:10, the information about the level of 45 (4,500 ft) was displayed.

From 16:17:15 up until 16:17:45, in the last 7 positions, the level of 44 (4,400 ft) and speed of 160 kt are still being displayed. The coordinates of the last tracking were 48°57' 55" N and 013°28' 00" E.

Figure No. 4 shows plotted positions of the aircraft LN-DSF processed in the multitrack during a time span of the flight track between 16:16:00 and 16:17:25. The plots show positions processed based on predictions up to 16:17:50. For the plots of indicated positions of the LN-DSF aircraft from the time of the flight see Appendix No. 3.

⁴) Enigma Black Box Viewer – MGL Avionics

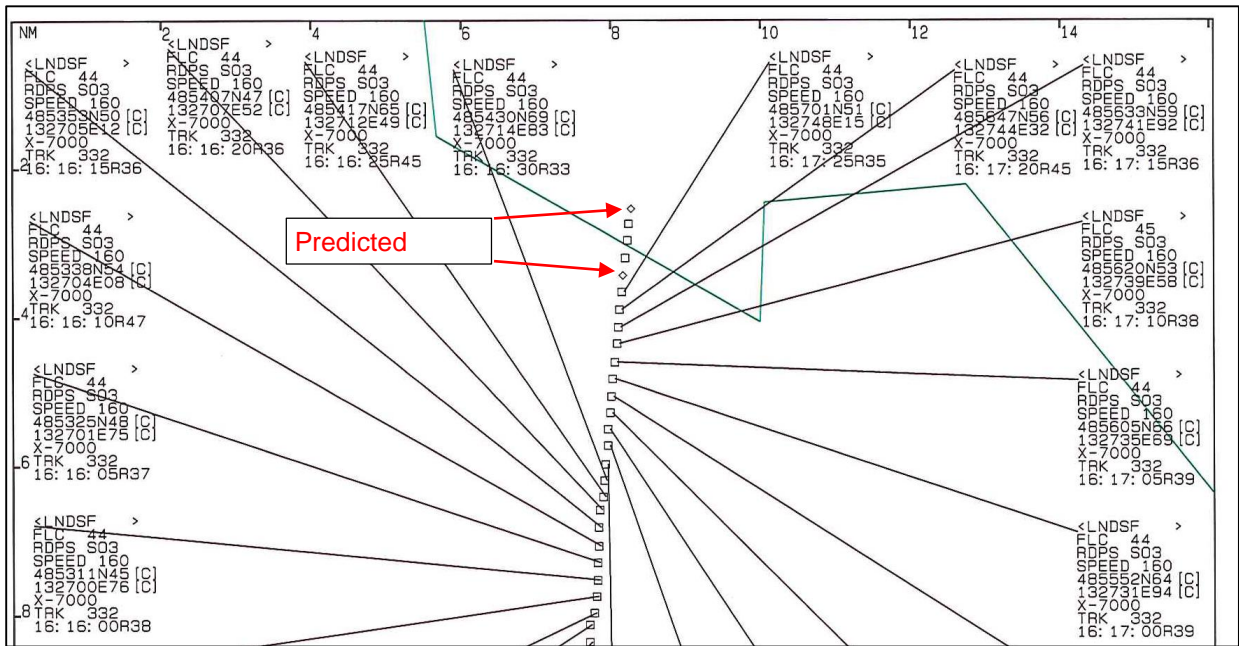


Figure 4 The plotted positions of the aircraft LN-DSF processed in the multitrack (16:16:00–16:17:25)

1.12 Description of crash site and aircraft

1.12.1 Generally

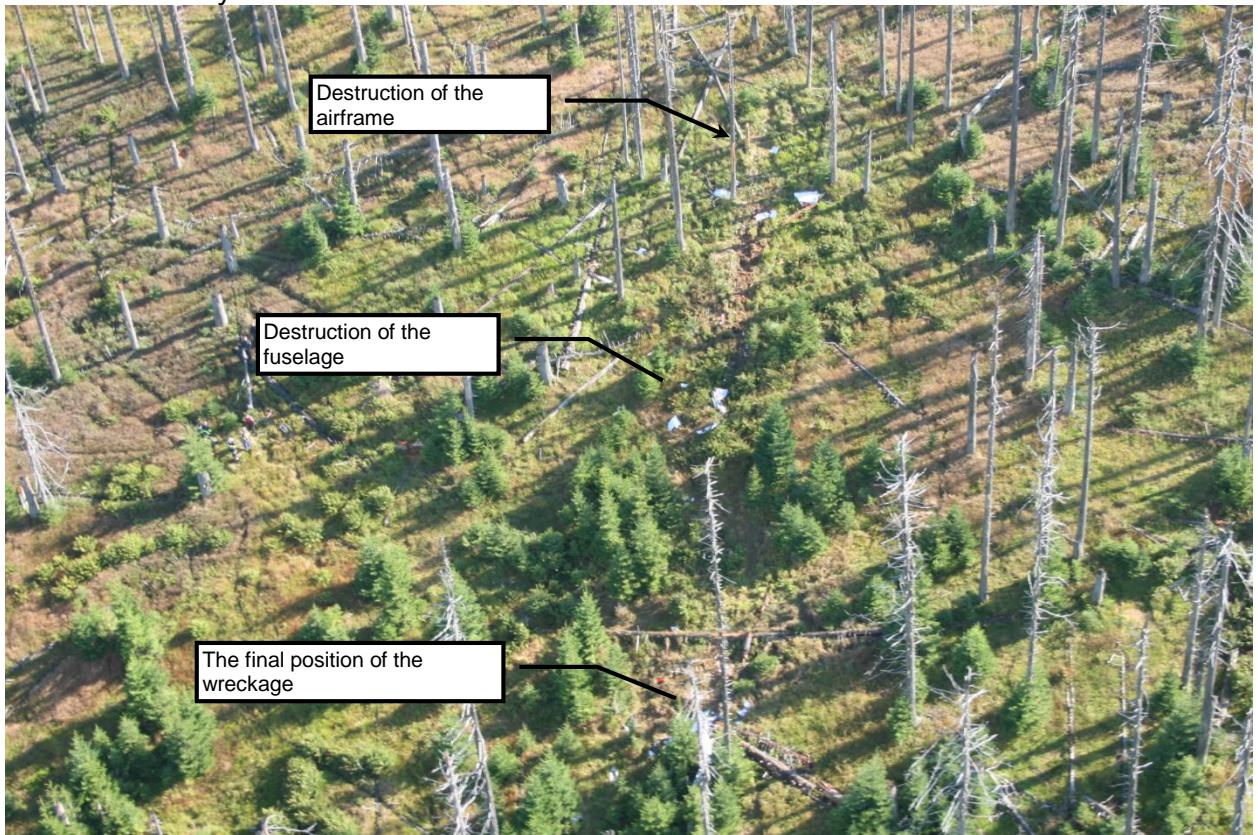


Figure 5 View of the accident site

At the location of the aircraft fuselage debris, the ELEV is 1,305 m and the coordinates are: 49°57'49.8" N and 013°27'55.8" E. From the on-site evidence it was

clear that after the first impact to the tree trunks at the summit of the Špičník mountain the cockpit canopy was shattered. The inspection of the air accident location and of the aircraft debris corroborated the fact that no important part of the airframe structure was detached or separated from the aircraft prior to the crash. The aircraft movement trajectory, most likely uncontrolled, continued along the mountainside. The complete destruction of the aircraft fuselage, the wing, and the tail assembly was a consequence of a succession of impacts into the tree trunks and into the ground. Parts of the debris were scattered in a short distance from the places of collision with the trees. Fragments of paint and metal from the aircraft structure have been found in the wood mass of the trees, and scrape marks and cuts on the surface of the trees. The fuselage wreckage had to be divided on the site for the purpose of transportation into the terrain accessible for machinery suitable for loading and transporting the said fuselage into the place designated for its depositing.

1.12.1 Wreckage Inspection

The wreckage inspection was being performed while the body of the pilot was being extracted. Severely deformed aircraft fuselage wreckage was on its starboard side, with the cockpit wedged among several spruce trunks. The engine was torn out in relation to the longitudinal axis. The engine bed was torn off and deformed.

The cockpit structure and the canopy frame were severely deformed due to the collision. The Plexiglas glazing of the canopy was shattered. Number of fragments had been found already in the location of the first contact with the tree trunks. The instrument board was torn out from the assembly. The navigational equipment consisting of two EFIS devices was damaged. The pointer in the speed indicator was at the zero position. The pointer in the altimeter which had been set for the pressure of 1,014 hPa was pointing to the level of 3,990 ft. The radio station and the SSR transponder were regarded by visual inspection as only slightly damaged. Electrical switches and other controls were found set in different positions. The position of controls of wing flaps and of the pitch balance could not be determined. The fuel tap was in the "Right Tank" position.

The body of the pilot was stuck in the debris of the aircraft, on starboard. The pilot had the safety belt buckled from the left-hand side seat position. He had an iPad holster strapped to his right leg. The iPad was found damaged.

1.12.3 Detailed Wreckage Inspection

The damage to the aircraft was extensive and the AAIL Commission performed detailed inspection of the debris in the location of its depositing. The torso of the fuselage was divided for the transportation purposes into two parts at the plane behind the crew seats. The metal structure was torn in longitudinal and transversal directions in several places. The front part of the engine frame up to the canopy frame together with a part of the instrument board was torn off at several places and reversed aslant to the right. The cockpit floor was deformed. The fuselage structure was ruptured towards the starboard, approx. 40 degrees from the axis of symmetry of the fuselage. Behind the cockpit, on the left-hand side, approx. from the level of the trailing edge of the wing to the keel surface root, the fuselage was torn longwise and crosswise at the places of riveted joints with protruding irregular cracks and deformities in the upper part of the fuselage. The starboard side was torn and severely deformed in several directions. The cracks continued to the rear part of the fuselage. There was a deformation mark caused by an impact of a cylindrical object before the vertical tailplane on the starboard side of the fuselage. The torso of the fuselage ended with a deformed suspension node of both sides

of the horizontal tailplane with the elevator control rod, remainder of the torn-off part of the vertical tailplane structure and the tail wheel with control cables.

Both the halves of the wing were torn off at the root and torn into several badly deformed parts. On the left half of the wing, in the area just before the connection of the wingtip arc, there was a deformation mark left after a collision with a cylindrical object whereas the remaining part of the leading edge to the depth up to the wing spar was torn and deformed. The flap remained attached in the damaged hinges, the aileron was torn off due to the collision. On the right half of the wing, which had been torn into two parts, the leading edge was torn at the area of the fuel tank up to the half of the span and deformed from the frontal direction. The flap was broken and torn out from the hinges, the aileron was torn off.

The keel area and the rudder were torn off as a consequence of a collision with a tree trunk from the starboard side. Only a part of the wing spar remained connected to the fuselage wreckage. Both halves of the horizontal tailplane were torn and there was a deformity caused by a collision with a tree trunk. The right side of the elevator was torn off. The pitch-trim tab was connected by a pull rod.

1.12.4 Control

The controllers in the cockpit have been preserved, partly deformed. The pull rod of the pitch control was connected to the node on the horizontal tailplane on one end and to the lever in the fuselage on the other end where the autopilot servodrives were connected in the pitch control. The autopilot servomechanism was found in the right half of the wing. The pull rod connected to the roll control mechanism was broken.

1.12.5 Power Plant

The engine without the propeller and the gear rim for starting together with a part of the engine bed were broken off by a collision to the right. Due to deformation and destruction of the engine bay it was impossible to determine the settings of control levers. The engine was detached from the debris of the wrecked aircraft fuselage and was transported from the place of debris deposition to the AAll disposal site and then to the authorised maintenance organisation's operation site. The propeller with the gear rim was located approx. 15 m before the fuselage debris. Both blades were unevenly bent with marks of collision.

1.12.6 Detailed Power Plant Inspection

A detailed inspection of the power plant has been carried out under the direct supervision of the AAll Inspector.

The engine bed was deformed, the valve cover on cylinder No. 2 was missing. The engine box wall was cracked at the place of the first cylinder. Cylinders No. 3–1 were pressed together and dismantled as a compound. Head of cylinder No. 2 was partially torn off from the working part of the cylinder. Internal surface of cylinders and of the engine box was covered with an oil film. The rear part of the engine was fitted with units; all the mechanical drives and gear wheels were engaged and were not damaged. Elastic tubing of fuel and oil units of the engine was damaged by the collision. The tube ends were connected to hose sockets and secured. The crank shaft was twisted at the flange joint. Hose sockets of the exhaust piping were deformed by the impact from the front and from below. Electric wiring was torn and incomplete.

After the spark-plugs had been dismantled, the engine could be revolved manually without exerting great force. Mechanical parts of the valve mechanism were complete

and when revolved manually, the valve mechanism was capable of standard operation. The operation of the lower part of the valve mechanism was not limited; valve lifter pushing rods were slightly deformed. The engine parts to be removed were dismantled without the use of force. Screw joints of the engine box and cylinders were complete and were dismantled with the use of appropriate force corresponding with individual joints. Sliding lining of the bearings in the crank shaft and the connecting rods were not damaged, whether mechanically or thermally.

The cases of both magnetos were not damaged. The terminal ends of high voltage cable outlets were connected into the magneto cases. Loose terminal ends of high voltage cables were ripped, the outlets to spark-plugs were connected. The type of installed magnetos was correct. The Champion REM 38E spark-plugs were dismantled and tested with SPCT 100. Spark-plug testing did not indicate a fault condition. The measured distance between electrodes was 0.6-0.7 mm.

Oil System

The oil tank forms a part of the lower engine box. Its internal surface was not contaminated with any deposits and metal particles. The filling sleeve with a dipstick was knocked off and pulled out of the engine box. The cover plug with a dipstick was closed. The quantity of oil could not be measured. Approx. 0.5 l of dark brown (honey-coloured) oil was collected from various places. The metal body of the oil bath filter insert was deformed on the surface. No deposits or metal chips were discovered on the surface of the paper insert. The lower oil suction filter was clean. The oil pump drive was not damaged. The working parts of the pump and gearing were free of any damage. The oil cooler was perforated from below and oil was leaking.

Fuel System

The diaphragm fuel pump was broken at the place of mechanical diaphragm drive while the rubber diaphragm and working springs were not damaged. Petrol residue was found in the pump chamber. The fuel injector body was torn off the crankcase flange. There were wooden chips at the place of break. The laminate sleeve of the injector choke valve was torn off and disconnected. The inflow piping to individual cylinders was deformed. The inside of the piping was contaminated with laminate residue, which was also found in the area above pistons in cylinders. The control levers and control cables leading to the fuel injector were complete and secured in terminal positions. The linkage was deformed by the collision. The choke valve actuator was located in the position of maximum choke.

The assessment of the condition of the engine and systems and the analysis of detected damage prove that the engine wear-and-tear corresponds to the number of hours flown and that the damage was caused by the collision of the front part of the aircraft against a solid barrier. It is possible to conclude on the basis of the condition of mechanical engine parts and contamination of the inflow piping with the laminate particles from the inflow sleeve that the engine was running immediately before the collision.

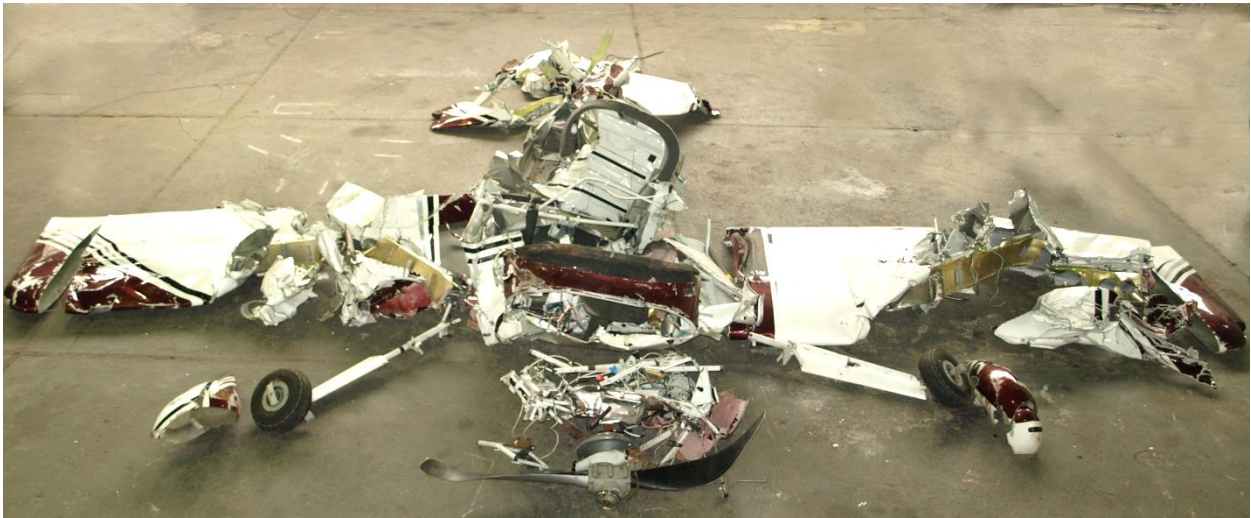


Figure 6 The wreckage at the deposit area

1.13 Medical and pathological information

1.13.1 Medical Certificate

The pilot had a valid class 2 medical certificate, issued on 3 January 2014 with no limitations.

1.13.2 Forensic Medical Examination

The forensic medical examination concludes as follows:

- 1) The immediate cause of death was a crushing injury to the head. Death occurred immediately after the injury had been caused by the crash of the aircraft into the wooded terrain.
- 2) The injury cause can be explained well by the mechanism of the air accident concerned, by the crash of the aircraft into the trees wherein the fatal injury was caused by the collision of the cockpit into a fully grown tree. The pilot had his right upper limb stretched in front of himself, he was clutching a cylindrical object in his right hand – probably the main control lever. The lower limbs, bent in the knee joints, were not placed directly on the foot controls. The pilot was duly strapped in the four-point harness.
- 3) No traumatic changes have been found that could not be explained by the mechanism of the air accident concerned. There have been found no such pathological changes that might have been involved in the causes of the accident, or that could have been considered as a causal link with the pilot's death. No trace of alcohol or other substance prohibited for aviation duty was proven in the pilot's blood stream by the toxicological examination.
- 4) Based on the results of the biochemical analysis of the psychosomatic state, in context with all the available data, it can be concluded that the body of the pilot had been experiencing intensified and extended stress reaction.

1.14 Fire

The aircraft wreckage did not catch fire. Sušice Fire Brigade, Srní Voluntary Fire Brigade and Voluntary Fire Brigade of the Šumava National Park and Protected Landscape Area as well as the Mountain Rescue Service were operating at the site of the accident.

1.15 Search and rescue

1.15.1 Rescue Search Organised by the Prague RCC

The rescue search for the aircraft was commenced by the Prague RCC on 23 August 2014 at 18:22. The said search was initiated upon the request by the Münster RCC to check the radar records and track specifications of the LN-DSF flight over the territory of the Czech Republic. The search result at the Prague FIC was negative; therefore at 19:23 the Prague RCC notified the Münster RCC of this fact.

Based on the assumption of the Münster RCC that the aircraft had been moving over the territory of the FRG in the vicinity of Dresden, and then flew into the Prague FIR with the last position approx. near Lovosice, the Prague RCC examined whether the searched for aircraft landed on any aerodrome on the territory of the Czech Republic. The presence of the said aircraft was not ascertained. All of the data available were relayed to the Münster RCC. In the evening hours, the rescue operation was interrupted at 20:53 after the coordination process.

In the morning hours on 24 August 2014, the rescue operation was resumed employing the Mi-17 SAR helicopter in the area of the loss of radar information after the departure of the aircraft from EDMF, and the notification was made to the rescue operation of the Air Rescue Service of the Czech Police Force. At 09:10, Stavanger RCC (Norway) relayed the information about the ELT aircraft equipment as well as about the competence of the pilot. However, throughout the time of the search no ELT emergency signal was detected.

At 10:08, the SAR helicopter pilot announced finding of the aircraft debris in the area approx. 7 km south from the village of Modrava. A rescue worker was deployed to the ground who confirmed the identity of the LN-DSF aircraft. The aircraft pilot was found among the debris without any sign of life. This information was relayed to the operating centre of the Police of the Czech Republic so that the ground rescue operation could be coordinated.

1.16 Tests and research

1.16.1 Emergency Locator Beacon ELT

The AK-451-(21) emergency locator beacon installed in the aircraft was not located by the rescue operation forces, which extended the time of search considerably. It was found in the aircraft wreckage during the examination of the debris at the air accident location. The unit was found with no visible mechanical damage with some residues of soil and working fluids. The "ON/OFF/ARM" switch was in the ARM position. The green signalling light was on. After it had been collected from the debris and its state had been documented, the switch was put to the "OFF" position. There was a remainder of the linking connector with visibly torn out conductors in the "REMOTE" connector socket. Remainder of the BNC connector without the middle conductor was connected to the antenna connector.

The emergency locator beacon was handed over for examination to a specialised site of the organisation approved for maintenance so as to verify the authenticity of an ID code and the functionality by a serial line self-test. The emergency locator beacon was not mechanically damaged by the fall. The battery life was sufficient.

The test has proven its functionality and correctness of programming. With an antenna being connected, the retrieval of data on the frequency of 121.5/243 MHz has

been proven. The data on the frequency of 406 MHz have not been retrieved. After an antenna was disconnected, the failed retrieval of data on the frequency of 121.5/243 MHz has been proven.

1.17 Organizational and management information

The RV-7 LN-DSF aircraft was operated by a private person. The aircraft was used for personal purposes.

1.18 Additional information

1.18.1 Requirements of the Rules

The regulatory requirements for preflight preparation are stipulated, on the basis of ICAO standards, Annex 2, Rules of the Air, by Rule L 2 from the Rules of the Air, Chapter 2(2.3.2):

Before beginning a flight, the pilot-in-command of an aircraft shall become familiar with all available information appropriate to the intended operation. Pra flight action for flights away from the vicinity of an aerodrome, and for all IFR flights, shall include a careful study of available current weather reports and forecasts, taking into consideration fuel requirements and an alternative course of action if the flight cannot be completed as planned.

The pilot intended to perform the flight in compliance with the visual flight rules. The minima depend on the level and speed of a given flight and the class of airspace where the aircraft flies.

The rule governing that a flight must be conducted so that the aircraft would be flying in visibility of and at an equal or higher distance from clouds than that set forth by the rules applied to the situation of the VFR flight during which an air accident happened.

Based on the ICAO standards, Annex 2, Rules of the Air, Chapter 3(3.9) stipulates the Visual Meteorological Conditions (VMC) Visibility and Distance from Cloud Minima and Chapter 4 (4.1) in Rule L 2 stipulates the Rules of the Air.

3.9 VMC visibility and distance from cloud minima are contained in Table 3-1.

Table 3-1

Airspace class	G
Flight visibility	5 km*
Distance from cloud	Clear of cloud and with the surface in sight

* When so prescribed by the appropriate ATS authority:
a) flight visibilities reduced to not less than 1500 m may be permitted for flights operating:
1) at speed that, in the prevailing visibility, will give adequate opportunity to observe other traffic or any obstacles in time to avoid collision; or
2) in circumstances in which the probability of encounters with other traffic would normally be low, e.g. in areas of low volume traffic and for aerial work at low levels.

4.1 Except when operating as a special VFR flight, VFR flights shall be conducted so that the aircraft is flown in conditions of visibility and distance from clouds equal to or greater than those specified in Table 3-1.

Furthermore, Section 4.11 applies to the Czech Republic:

4.11 The flights of VFR aircraft which are not equipped for IFR flights or are equipped for IFR flights, but the pilot is not qualified for IFR flights, must be conducted in constant visibility of the ground at all times. Flights above clouds may be performed if the coverage of the sky with clouds under the aircraft is not more than 4/8 and it is feasible to carry out the flight according to map matching.

1.19 Useful or effective investigation techniques

The cause of the accident was investigated in accordance with Annex 13.

2 Analysis

2.1 General

The LN-DSF aircraft had a valid certificate of airworthiness inspection. During inspection of the wreckage no evidence of aircraft's inoperability before the air accident was detected on parts of the frame, power plant and aircraft systems. All damage may be placed to the account of deforming forces applied in collisions against trees and the ground. According to the records of data from the monitoring system the engine was operating in a standard mode.

The pilot of the LN-DSF aircraft was fit to fly only VFR flights. The Commission has not acquired any evidence as to whether during preflight preparation the pilot gained information about expected meteorological conditions at the time of assumed flight over the mountainous and hilly terrain of the Bavarian Forest and Šumava.

No message transmitted by the pilot of the LN-DSF aircraft during communication on the Munich FIC operating frequency indicated any conditions not suitable for continuous flying under VFR at the attained level of 4,400 ft. The pilot reported no facts which would suggest a defect, incorrect operation or failure of the aircraft and aircraft systems. Also, the pilot did not set any special code on the SSR transponder (in the case of emergency – code 7700).

2.2 Critical Accident Sequence

The aircraft collided against tree trunks on the mountain range near the summit of the Špičník mountain (4,432 ft / 1,351 m) during a stable horizontal flight. The shapes of the consequent local deformities on the aircraft frame correspond to the diameter of tree trunks where fragments of paint and metal were found.

Having considered this situation and available information about the flight history, the Commission may deduce with high probability that the pilot did not have a constant outlook to the ground and an adequate outlook to the front because he did not respond to the imminent threat of collision with the terrain at a sufficient distance. The conclusion of forensic medical examination regarding pilot's intensified and extended stress reaction must be also taken into consideration. The aircraft was, in fact, flying in a mode allowing for an ascent.

2.2.1 Flying into IMC

It was not possible to determine the exact moment and extent of the loss of visibility of the ground. The manner of flight performance since the take-off from EDMF indicates that approx. at 16:09:55 the pilot of the LN-DSF aircraft ascended first to the level of approx. 2,640 ft. At approx. 16:09:55 he began ascending to the level of approx. 4,000 ft where he continued in the horizontal flight. The indication of the radar position of the LN-DSF aircraft in the FIC air traffic situation display was confirming the stated level.

A general principle for the VFR flights is that if the weather deteriorates and whenever the situation appears to be such that the flight might not be completed safely under the VMC conditions, the pilot is obliged to decide to perform the flight to an alternate

aerodrome, or to the take-off aerodrome. The Commission was unable to determine the reasons for which the pilot of LN-DSF had not made the said decision.

Should the pilot have reported the deteriorating weather conditions below the minima under VFR on the Munich FIC frequency, it is probable that the Munich FISO could have been able to provide the pilot with the maximum aid available, namely the information about the safe altitude above obstacles, or other navigational aid.

It was not possible to determine the real reason for the pilot to commence the climb at approx. 16:14:40 and to reach the level of approx. 4,400 ft at 16:15:04. He then continued in the horizontal flight with a small alteration at approx. 16:16:05. From the time approx. 16:16:12 the aircraft was flying in the horizontal direct and stable flight at the level of 4,420 ft / 1,347 m. This was a collision level with the mountain ridge terrain situated ahead in the trajectory of the aircraft. Though the closest level for performing the VFR flight was 5,500 ft / 1,700 m, it is likely that the flight on such level would not have been carried out above the clouds.

2.2.2 Controlled Flight into Terrain

Controlled flight into terrain (CFIT) is a term denoting a situation in which an operable Aircraft fully under control of the Pilot is unintentionally guided into the ground, mountain, or other obstacle. The pilot of such aircraft becomes aware of such fact only in the moment when it is late.

Even though no credible information was gathered regarding the sky obscuration, the cloud base altitude, and the visibility in the direction of inward flight into the area of the Czech-German border of the Bavarian Forest, the situation at the Czech Republic state border at Březník in the area of the Špičník mountain is corroborated by the photographs made by the camera at 16:10:25 and 16:20:24 (18:10:25 and 18:20:24 CEST). The cloud base in relation to the mountainside of the Špičník can be recognised in the said photographs at approx. 1,200 AMSL. It can be deduced, therefore, that the low base of clouds on the southern slope was in approximately the same above sea level as on the Czech side of the mountain.

It has not been possible to determine whether the LN-DSF aircraft pilot used any of the available EFIS modes of terrain clearance warning⁵⁾.

The terrain in the area of the trajectory of in-flight under the track angle of approx. 008 degrees towards the Špičník mountain side (approx. 2.7 km before its summit), gradually ascends to the above sea level of 950 m and reaches 1,200 m approx. 1.09 km under the summit.

Throughout the last approx. 1 min 20 s before the impact, the LN-DSF aircraft maintained the flight level with the ± 10 ft tolerance. At the time approx. 15 s before the impact it was already approx. 150 m above the terrain level of the Špičník mountainside and the pilot did not respond to the hazardous proximity of the terrain. He was flying at the speed of approx. 150 kt IAS. This speed does not render the pilot to have an adequate opportunity to see obstacles in time that allows the avoidance of collision.

The LN-DSF aircraft pilot probably maintained the flight trajectory with the aid of the autopilot. It was not possible, however, to determine the mode used. The LN-DSF aircraft has not been approved for the IMC flights, the autopilot was therefore only an auxiliary device to reduce the strain borne by the pilot.

⁵⁾ „EFIS terrain awareness and warning systém“ -

The symbol for the LN-DSF flight with a set code A7000 with the C mode switched on appeared on the situation display for the last time at 16:17:45 with the elevation information of 4,400 ft AMSL related to 1,013 hPa.

According to the weather information in the surroundings of the air accident location, it can be securely assumed as very probable that during the time before the collision into the trees the pilot could not have had an adequate visual contact with the ground so that he could have avoided the collision with the trees at the Špičnák mountain summit. The Aeronautical Information Publication of the Czech Republic reads the area minimum altitude (AMA) in the area of the air accident 7,300 ft.

Inspection of the cockpit debris has revealed that the altimeter scale was set at the pressure value of 1,013.5 hPa, which corresponds to a difference of approx. 1.5 hPa against the areal QNH (the difference equals 26 ft). The pointer of the altimeter found in the debris showed the value of 3,990 ft.

2.3 Impact Analysis

It may be deduced from the traces of impacts left by the aircraft and from the aircraft debris on the spot that immediately before the first impact against the trees at the summit of the mountain the aircraft was performing a horizontal flight. The aircraft collided against at least two tree trunks and broke the treetops. Although it is not possible to precisely determine the location of the aircraft after the first impact, it is obvious that the destruction of the aircraft was a result of an impact against one tree trunk by a root of the left side of a wing and of another impact by the middle part of the leading edge of the right side of a wing; due to rotation of the aircraft, the impact was directed from the right-hand side to the root of the keel area and to the fuselage before the leading edge of the horizontal tailplane. During collision against the ground the propeller was torn off and the fuselage was further vastly deformed.

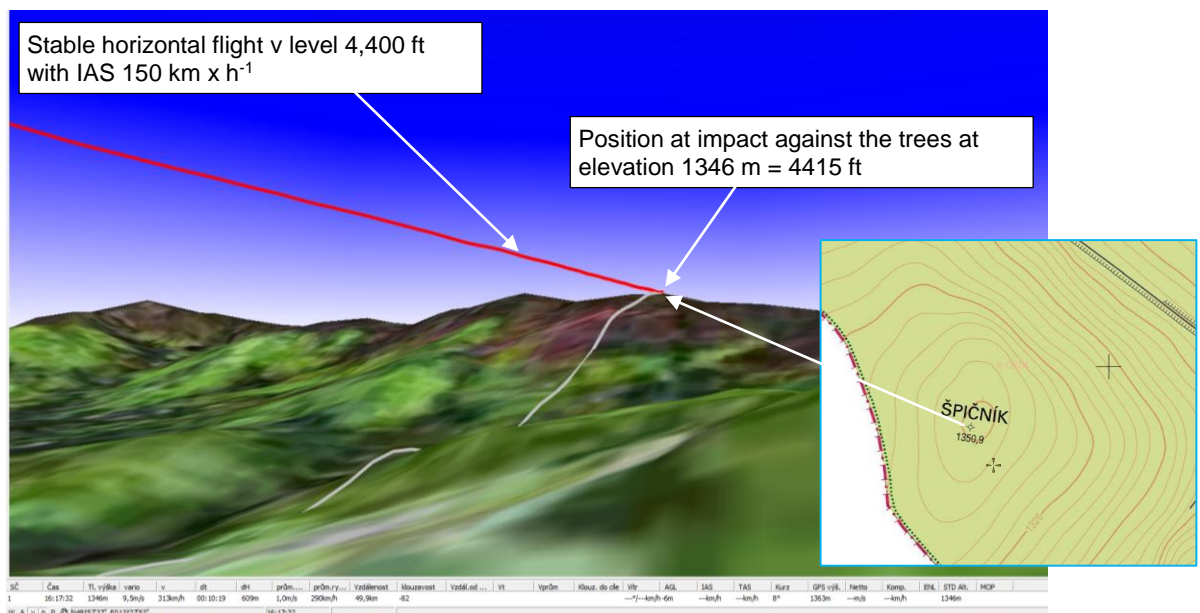


Figure 7 Animation of the trajectory before the collision into the trees

3 Conclusion

3.1 The AAI Commission concludes the following

3.1.1 Aircraft

- the aircraft had a valid certificate of airworthiness inspection;
- no evidence of aircraft's failure prior to its collision against the trees was found;
- the aircraft frame shows deformities which are practically identical with the shape of tree trunks and the nature of destruction corresponds to impacts to trees and the ground.

3.1.2 Pilot

- had a valid rating for the intended and planned VFR flight and in terms of flying skills had also recent relevant practice on the RV-7 aircraft for such a flight;
- had a valid medical certificate and reported no health complaints before the event flight;
- did not have a rating for IFR flights in spite of the fact that the aircraft was equipped with a navigational device allowing for flights under IFR.

3.1.3 Meteorological Conditions

- in the flight area there were clouds of operating significance and the summit of the Špičník mountain and its surroundings were covered with clouds with an indistinct cloud base;
- the meteorological conditions at the flight level were highly probably below the minima for VFR flights.

3.1.4 The flight sequence

- the pilot was performing the VFR flight at the level which did not ensure a safe altitude above the terrain of the Šumava mountain range;
- it is not clear why the pilot ascended only to the level of 4,000/4,400 ft;
- assessment of the weather in close vicinity of the mountain range makes it highly likely that the line of flight was at the level which made it impossible for the pilot to fly outside the clouds with visibility set forth for a VFR flight;
- the pilot performed the flight against the slope of a mountain range and probably under very unfavourable circumstances when not only the mountain summit, but also the surrounding terrain of the mountain range was above the level of an indistinct cloud base;
- the stable flight parameters until the moment of the first impact show that the pilot did not have an appropriate visual contact with the ground in order to avoid collision with the terrain;
- it cannot be determined whether the EFIS warning functionality predicted the imminent collision against the terrain;
- given the nature of the first impact, the pilot did not have time to avert the collision with the tree trunks at the summit of the Špičník mountain;

- given the shape of deforming traces on the wreckage, after the first impact the aircraft was probably in a positive roll near the ground in the critical stage of the flight;
- the overall destruction of the aircraft was caused by impacts to tree trunks on the slope and to the ground.

3.2 Causes

The probable cause of the air accident was pilot's inadequate decision to continue in flight at the level where the conditions did not allow for flying in visibility set forth for VFR flights and in constant visibility of the ground. As a result, the pilot failed to maintain a safe altitude and was unable to avoid a collision against trees in the mountainous terrain in time.

The situation was probably adversely affected by the following concurring circumstances:

- The pilot did not report his situation and his intended procedure to the FIC in time.
- When flying into the clouds, the pilot depended on the autopilot and did not use the warning mode regarding the imminent danger of an impact to the ground in time.

4 Safety recommendations

Given the circumstances of the air accident, the AAI issues no safety recommendation.

Appendices

No.	Appendix
1.	Photographic documentation
2.	Communication transcript
3.	Flight parameters from the time before the end of the flight
4.	Plots of indicated positions of the LN-DSF

Distribution:

AAI Czech Republic
 AIB Norway
 BFU Germany

Accident Photographs



An overall view of the accident site and the scene of an impact



The view of the scene of the impact



The view of a part of wreckage



The view of wreckage



Closeup view of the wreckage



Closeup view of the deformed cockpit



The right part of the wing



The left part of the wing



The deformation of the tail and the root of elevator



The propeller blades and the engine bed



The damaged dashboard



The airspeed indicator and the altimeter

Communication transcript between LN-DSF and FIC München


 Umschrift von Sprachdatenaufzeichnungen
 Recorder Transcription

Betreff: Unfall LNDSF
Subject:
Datum des Vorfalls: 23.08.2014
Date of incident:
Flugverkehrsstelle: Niederlassung CC München
ATS-Unit:

Diese Sprachdatenumschrift enthält
 This recorder transcription contains

Sprechfunkverkehr zwischen: MMC11 und: LNDSF
Radio communications between:
Fernsprechverkehr zwischen: und:
Telephone communications between:
Frequenz, falls zutreffend: 120,650 MHz
Frequency, if applicable:
Aufzeichnungsgerät: MVR01 **Aufzeichnungskanal:** K016
Voice recorder: **Channel:**
Anzahl der Seiten (inklusive Deckblatt): 2
Number of pages (including cover sheet):

Anmerkung: Die Sprachdatenumschrift enthält die wortgetreue Wiedergabe des relevanten Fernmeldeverkehrs zwischen den betreffenden Teilnehmern. Unverständliche Teile des Fernmeldeverkehrs sind durch einen entsprechenden Vermerk in runden Klammern gekennzeichnet. Zeitangaben: Koordinierte Weltzeit (UTC) in Stunden : Minuten : Sekunden

Remarks: The recorder transcription contains the verbatim reproduction of the relevant communications between the participants concerned. Unreadable portions of communications are indicated by respective remarks in parentheses. Times: Universal Time Coordinated (UTC) in hours : minutes : seconds

UTC:	Sender:	Sendung:
16:10:54	LNDSF	München information for lima november delta sierra foxtrot
16:11:01	MMC11	Lima november delta sierra foxtrot münchen
16:11:05	LNDSF	Lima november delta sierra foxtrot ich empfangen euch mit 1 ah v f r flug von Fürstzell nach echo delta charlie yankee startzeit war 1606 in Fürstzell ahm erbitte öffnen des flugplanes und ah verkehrsinformation für meine strecke
16:11:24	MMC11	Lima november delta sierra foxtrot 1606 ist verstanden werd ich weitergeben melden sie luftfahrzeugmuster
16:11:32	LNDSF	Luftfahrzeugtyp ist eine R V 7 und die position ist 9 nautische meilen östlich Vilshofen airfield und der transponder ist 7000
16:11:41	MMC11	Lima november delta sierra foxtrot in radarkontakt angezeigt im moment 4000 fuss QNH 1015
16:11:50	LNDSF	1015 und ich verstehe (...) nach wie vor nur mit 1
16:12:02	LNDSF	Ah münchen hatte wir den flugplan aufgemacht
16:12:06	MMC11	Ah lima november delta sierra foxtrot positiv 1606
16:12:10	LNDSF	Alles klar habe ich jetzt verstanden 10 ah 1606 delta sierra foxtrot
16:22:54	MMC11	Lima november delta sierra foxtrot münchen
16:23:10	MMC11	Lima november delta sierra foxtrot münchen

keine weitere Sendung den Vorfall betreffend

Plots of indicated positions of the LN-DSF

