CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE **A**CCIDENTES
E **I**NCIDENTES DE
AVIACIÓN **C**IVIL

Report ULM-A-010/2018

Accident involving a PIPISTREL VIRUS SW 100 aircraft, registration 55SE, at the airport of La Seu d'Urgell (Lleida - Spain) on 16 May 2018

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

Report

ULM-A-010/2018

Accident involving a PIPISTREL VIRUS SW 100 aircraft, registration 55SE, at the airport of La Seu d'Urgell (Lleida - Spain) on 16 May 2018

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO
SUBSECRETARÍA
COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

NIPO Línea: 161-19-058-4

NIPO Papel: 161-19-049-8

Deposito Legal: M- 7504-2019

Maquetación: ASAP Global Solution S.L.

Impresión: Centro de Publicaciones

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35

E-mail: ciaiac@fomento.es
http://www.ciaiac.es

C/ Fruela, 6
28011 Madrid (España)

Foreword

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident object of the investigation, and its probable causes and consequences.

In accordance with the provisions in Article 5.4.1 of Annex 13 of the International Civil Aviation Convention; and with articles 5.5 of Regulation (UE) nº 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1., 4. and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

Contents

ABBREVIATIONS v

Synopsis vii

1. FACTUAL INFORMATION 1
   - 1.1 History of the flight 1
   - 1.2 Injuries to persons 2
   - 1.3 Damage to aircraft 2
   - 1.4 Other damage 2
   - 1.5 Personnel information 2
   - 1.6 Aircraft information 2
   - 1.7. Meteorological information 4
   - 1.8. Aids to navigation 5
   - 1.9 Communications 5
   - 1.10 Aerodrome information 5
   - 1.11 Flight recorders 6
   - 1.12 Wreckage and impact information 10
   - 1.13. Medical and pathological information 13
   - 1.14 Fire 13
   - 1.15 Survival aspects 13
   - 1.16 Test and research 13
   - 1.17 Organizational and management information 15
   - 1.18 Aditional information 15
     - 1.18.1 Eyewitness statements. 15
     - 1.18.2 Information on the weight of the occupants. 16
   - 1.19 Useful or effective investigation techniques 16

2. ANALYSIS 17

3. CONCLUSIONS 19
   - 3.1 Findings 19
   - 3.2 Causes/Contributing factors 20

4. RECOMMENDATIONS 21

Abbreviations

º	Degrees
º ’ ”	Sexagesimal degrees, minutes and seconds
AESA	National Aviation Safety Agency
cm3	Cubic centimeter
CWY	Clearway
E	East
ft	Feet
ft/min	Feet per minute
h	Hours
GPS	Global Positioning System
HP	Horsepower
HPa	Hectopascals
In Hg	Inches of mercury
Kg	Kilograms
Km	Kilometers
Km/h	Kilometers per hour
Kt	Knots
l	Liters
IAS	Indicate airspeed
l/h	Liters per hour
LESU	ICAO location indicator for the aerodrome of La Seo d’Urgell
m	Meters
MAF	Multi-axis fixed wing
METAR	Meteorological Aerodrome Report
mm	Millimeters
N	North
QNH	Atmospheric pressure adjusted to mean sea level
RPM	Revolutions per minute
S	South

s	Seconds
THR	Threshold
TULM	ultralight pilot license
ULM	Ultralight
UTC	Coordinated universal time
VFR	Visual flight rules
W	West

Synopsis

Owner and Operator:	Private
Aircraft:	PIPISTREL VIRUS SW 100, registration 55SE
Date and time of accident:	Wednesday, 16 May 2018 at 10:45 local time[1]
Site of accident:	Airport of La Seu d'Urgell (Lleida - Spain)
Persons on board:	Two (killed)
Flight rules:	VFR
Type of flight:	General aviation. Private. Takeoff
Date of approval:	30 January 2019

Summary of event:

On Wednesday, 16 May 2018 at 10:45, a PIPISTREL VIRUS SW 100 powered ultralight, registration 55SE, was practicing takeoffs and landings on runway 03 at the airport of La Seu d'Urgell (Lleida).

It made an approach and then rose to a considerable altitude while turning left. Immediately afterwards, it turned right and again left before falling to the ground in a vertical attitude and impacting the base of a tree outside the airport, next to the perimeter fence.

On board were the pilot and a passenger, who were killed on impact. The aircraft was destroyed.

The investigation has concluded that the accident occurred because the aircraft stalled as it was performing a go-around maneuver at low speed, exacerbated by the execution of a low-altitude turn and the stoppage of the engine.

The following factors contributed to the accident:

- Taking off with excessive weight, which degraded the aircraft's performance.
- Making a non-stabilized approach.
- Placing the engine at idle in the last climb, with the ensuing engine stoppage.

[1]. Unless otherwise specified, all times in this report are local. To obtain UTC, subtract two hours from local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On Wednesday, 16 May 2018, a PIPISTREL VIRUS SW 100 powered ultralight, registration 55SE, was doing a flight in the vicinity of the aerodrome in La Seu d'Urgell (Lleida).

On board were the pilot and one passenger, who had taken off at 10:20 from runway 03 with the intention of practicing takeoffs and landings.

During the third landing, shortly before 10:45, the pilot tried unsuccessfully to touch the ground and then rose to a considerable altitude while turning left.

Immediately afterwards, the aircraft turned right and left again before falling to the ground and impacting the base of a tree outside the airport, next to the perimeter fence, to one side of the runway 21 threshold

Both occupants were killed on impact.

The aircraft was destroyed, ending up in a vertical position. The front end, cockpit and right wing were severely damaged.

Figure 1. Photograph of the aircraft

1.2. Injuries to persons

Both occupants were killed on impact.

1.3. Damage to aircraft

The aircraft was destroyed.

1.4. Other damage

There was damage to vegetation at the accident site.

1.5. Personnel information

The pilot was 73 years old and had an ultralight pilot license (TULM) issued by the Civil Aviation General Directorate of France on 1 October 2014, with multi-wing fixed-axis (MAF), ULM passenger transport and on board radio operator ratings.

The French authority reported that neither the license nor the ratings expire.

The medical certificate had been issued by Spain's National Aviation Safety Agency (AESA) and was valid until 20 April 2019. AESA had also issued the pilot a temporary permit to engage in general, sports and ultralight flight activities in Spain that was valid from 15 January until 31 December 2018.

Investigators were unable to ascertain the pilot's flight experience, but several sources reported that he did not fly regularly.

1.6. Aircraft information

The PIPISTREL VIRUS SW 100 powered ultralight, with French registration 55SE, was manufactured in Slovenia in 2013 and had serial number 532SWN100.

It is a high-wing aircraft with tricycle landing gear. It is 1.85 m high, 6.5 m long and has a wingspan of 10.71 m. Its empty weight is 289 kg and its maximum takeoff weight is 450 kg, as required for the ULM aircraft category for which it is certified; however, the Flight Manual states that in certain conditions, the maximum takeoff weight can be as high as 472.5 kg.

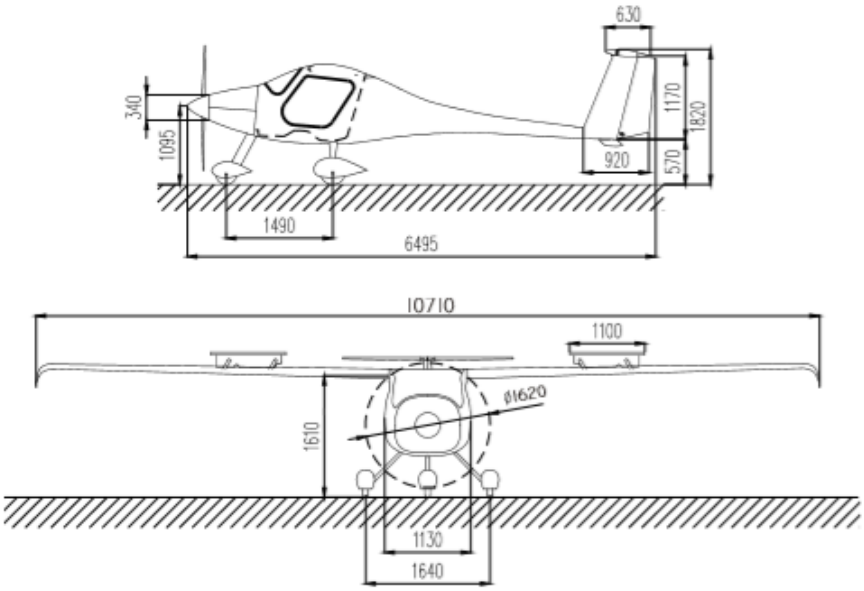

Figure 2. Views of the aircraft

Specifically, the Flight Manual states that "If any of the values specified earlier is exceeded, the weight must be reduced in order to keep the maximum takeoff weight below 450/472.5[2] kg. Pay particular attention to the weight of the baggage, since this is the only weight that is applicable throughout the length of the fuselage that affects the center of gravity. Exceeding the baggage weight limits can displace the aircraft's balance to such an extent that it can become uncontrollable in flight".

As concerns the weight and balance, the Manual specifies that the safe position of the center of gravity ranges between 25% and 37% of the mean aerodynamic chord, and between 267 mm and 375 mm back of the reference datum, which is at the leading edge of the wing.

Figure 3. Photograph of the standard cockpit

[2]. The Maximum takeoff weight 472,5 Kg is considered if you have installed an emergency parachute.

The wing has two flaperons which act as high-lift surfaces that, depending on the desired configuration, are deployed symmetrically, acting as flaps, or asymmetrically, in which case they act as ailerons.

According to the Flight Manual, the stall speeds are as follows:

- With the flaperons deflected 5º upward: 85 km/h (45.8 kt)
- With the flaperons in neutral position: 79.75 km/h (42.6 kt)
- With the flaperons deflected 9º: 71 km/h (38.3 kt)
- With the flaperons deflected 18º: 64 km/h (34.5 kt)

The manual also states that the aircraft has two, 50-l fuel tanks that hold 76 kg of fuel when full. It also specifies that the maximum weight of the occupants in the cockpit must not exceed 180 kg.

It was outfitted with a ROTAX 912-ULS engine, serial number 6780888, which could generate a maximum of 100 HP, and two constant-depression carburetors, one for cylinders 1 and 3, and another one for cylinders 2 and 4. The fuel consumption is 17.8 l/h.

This engine model has 3 l of oil, which is 1 l more than similar models. This is because it includes an oil thermostat, which requires more lines in the oil system.

The aircraft had an airworthiness declaration issued by the French civil aviation authority on 2 May 2013 that was valid until 31 May 2015[3].

1.7. Meteorological information

The 10:30 METAR for the airport was as follows:

METAR LESU 160830Z 0000KT 9999 FEW050 0VC065 10/06 Q1014

According to the METAR, there was no wind, the horizontal visibility was in excess of 10,000 m, there were few clouds at 5,500 ft and the sky was overcast at 6,500 ft.

The temperature was 10º C, the dew point 6º C and the QNH was 1014 hPa.

[3]. The French system is declarative. An airworthiness review certificate is not granted, but an airworthiness declaration is made.

1.8. Aids to navigation

The flight was being conducted under visual flight rules.

1.9. Communications

The pilot contacted in the air / air frequency on five occasions, the first to report taking off from runway 03, then two more times to report vacating runway 03, then to report it was on the downwind leg for runway 03 and finally to report it was on final for runway 03.

All the reports were made in French, except for one which was made in Spanish.

1.10. Aerodrome information

The airport of La Seu d'Urgell (LESU, Lleida) is located 3.8 km southwest of the town by the same name. Its reference point is at coordinates 42° 20° 46" N - 0° 12° 45" E and an elevation of 802 m (2630 ft).

Its hours of operation are restricted from Monday to Thursday to between 06:30 and 16:40. Other days of the week it is open from 06:30 until 21:00. Air traffic services are only provided on Friday, Saturday and Sunday from 09:00 to 17:00. The rest of the time the communications are made in the published air / air frequency.

It has one asphalt runway in a 03/21 orientation that is 1,267 m long and 28 m wide. Only visual flight rules (VFR) operations are allowed at the airport.

According to the rules of the airport, all traffic patterns are flown to the east of the runway.

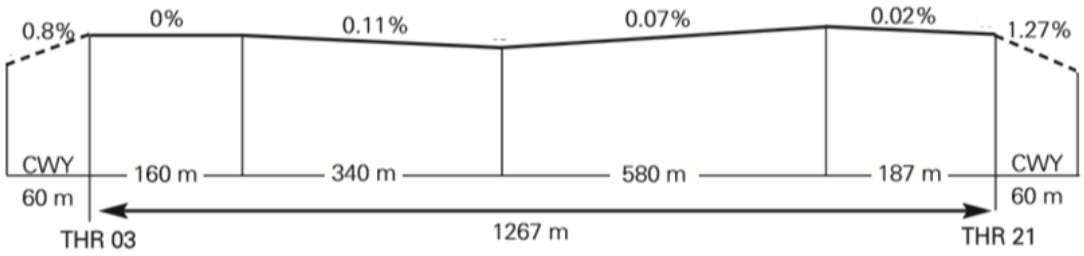

Figure 4. Runway profile

Figure 5. Runway profile

1.11. Flight recorders

The aircraft did not have recorders as they were not required by law.

However, a global positioning system (GPS) device was recovered from the accident site, as were two cockpit displays used for navigations that recorded and displayed information and flight data.

The GPS device was too damaged to yield any kind of information. The two displays were sent to the manufacturer to have it extract the information stored in them, but only one yielded the flight data that were used to reconstruct the flight.

The system records a total of 102 parameters, including several involving the engine. Each one was contained in the table that was prepared after the data were extracted, as if it had been recorded 16 times per second.

A study of the data recorded showed that the aircraft had been operating on runway 03.

It made four takeoffs and three landings, with the landing run for the three landings

doubling as the takeoff run for the last three takeoffs. The accident occurred during the fourth takeoff.

After each of the first three takeoffs, the pilot flew three very similar flights in the vicinity of the aerodrome.

In all three cases, after taking off, he turned right (to the east of the runway) and entered the downwind leg, as if flying the standard aerodrome pattern; however, instead of flying the base and final legs of the pattern, which would have required making two consecutive 90º-right turns, he crossed the extended centerline of runway 21 and flew outbound to the southwest before making a very wide 180º left turn and completing the flight by making a long final approach to runway 03 (see Figure 6).

The specific data indicate that the first takeoff run started at 10:20:27, that the aircraft took off 13 s later at an IAS of 58.5 kt and that 16 s later it started to turn into the crosswind leg. At that point, it was at an altitude of 50 m (164 ft) and had a speed of 77.7 kt.

It flew the crosswind leg at an average distance of 2.7 km away from the runway 03 threshold.

The first circuit lasted 7:04 minutes, with the farthest distance reached being 5.25 km southwest of the aerodrome.

According to the data recorded, the aircraft did not land on the first approach[4]. The lowest altitude reached was 16 ft when it was 150 m past the runway 03 threshold, at a speed of 52.4 kt. The flaperons were deflected 5º[5]. During the descent, its average vertical speed in the final 100 ft was approximately 415 ft/min.

[4]. Keep in mind that the data recorded in terms of position and height is based on GPS and can not be considered to be totally accurate

[5]. The position recorded for the flaperons does not match any of the positions described in the Flight Manual.

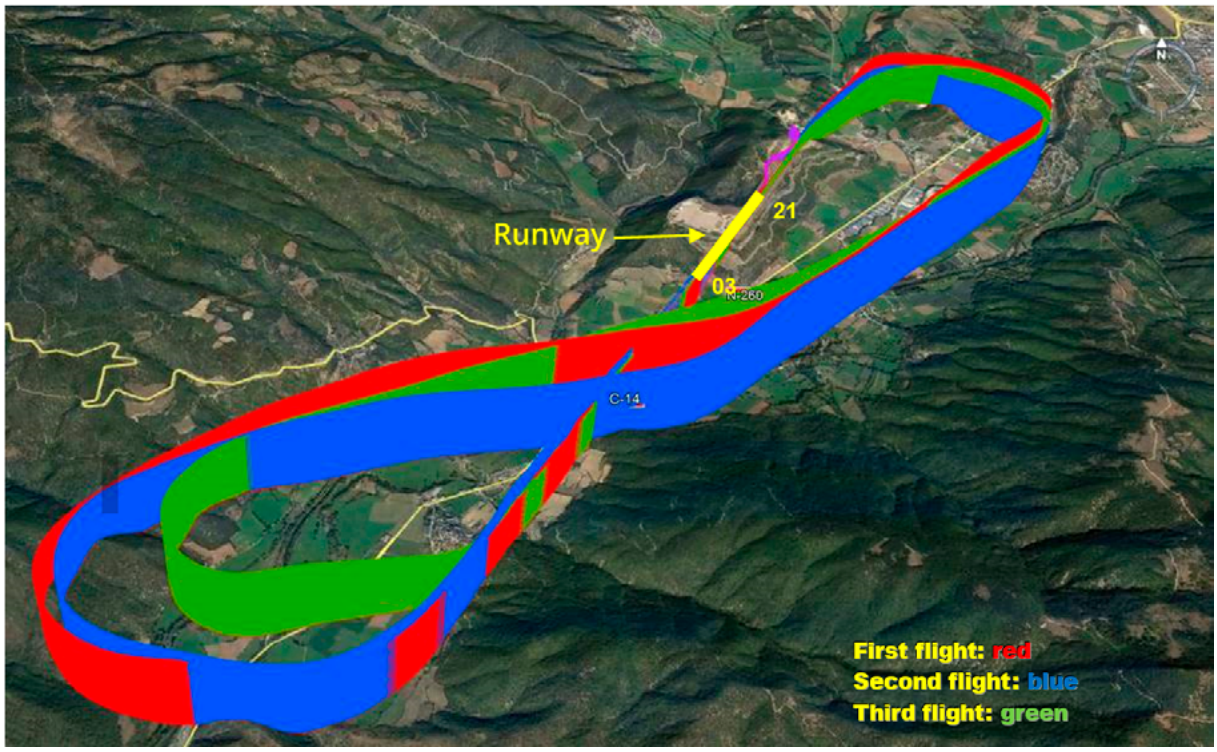

Figure 6. Flights around the aerodrome

On the second circuit, it turned to the crosswind leg earlier than in the first flight and once it started to descend, it took 29 s to level off at an altitude of 50 m, at which point its speed was 84.2 kt and its vertical speed was 324 ft/min.

This second flight lasted 7:54 minutes and also took the aircraft southwest of the aerodrome, though not as far as the first flight, 5.23 km.

According to the data, on the second approach it also did not touch down. The lowest altitude reached was 24 ft, with the aircraft 135 m past the runway 03 threshold, at a speed of 55.6 kt and the flaperons deflected 5º. During the descent, its average vertical speed in the final 100 ft was approximately 420 ft/min.

After the third takeoff, it took 35 s to turn to the crosswind leg from the time it started to climb. It leveled off at an altitude of 50 m, at which point its speed was 76.4 kt. Its vertical speed was 641 ft/min.

The third circuit lasted 6:58 minutes and again took the aircraft to the southwest of the airport, but only to a distance of 4.4 km away.

The recorded data show that the aircraft also did not touch down during the third approach, reaching a minimum altitude of 6 ft.

At that point, it was 330 m past the runway 03 threshold. Its speed was 52.3 kt and the flaperons were also deflected 5º. During the descent, its average vertical speed in the final 100 ft was approximately 465 ft/min.

The gradient on the third approach was steeper. Figure 7 shows the first approach in pink, the second approach in green and the third in purple, with each one being steeper than the last.

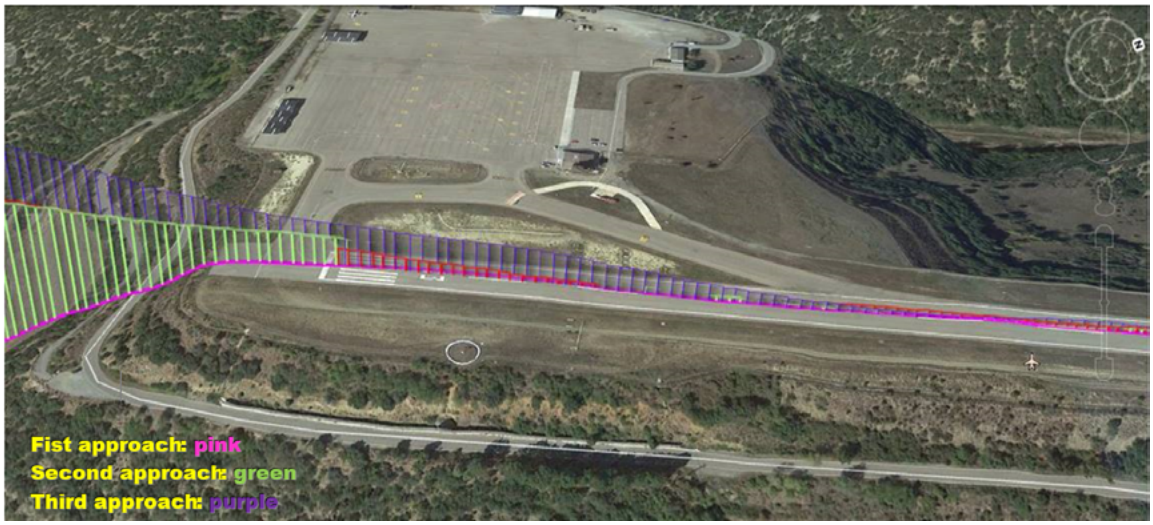

Figure 7. Side view of the three approaches to runway 03

After the third approach, on the same run the pilot started the fourth takeoff, during which the aircraft veered 20º to the left for 6 s, banking left and heading for a hill that is on the left side about halfway down the runway, inside the aerodrome complex. It then banked right for 13 s, flying back over the runway and then veering 20º to the right. It finally turned left again for 8 s before crashing to the ground.

In the final seconds of the flight, the pitch angle recorded was around 24º (24.9º at 10:43:38). Also recorded were high left and right bank angles and, in the final 3 s, a high dive angle (up to 61º).

The angle of attack was not recorded.

The final coordinates place the aircraft practically over the impact point. The data recording stopped at 10:43:44. The last data set showed a balance angle of 15º and an IAS of 42 kt.

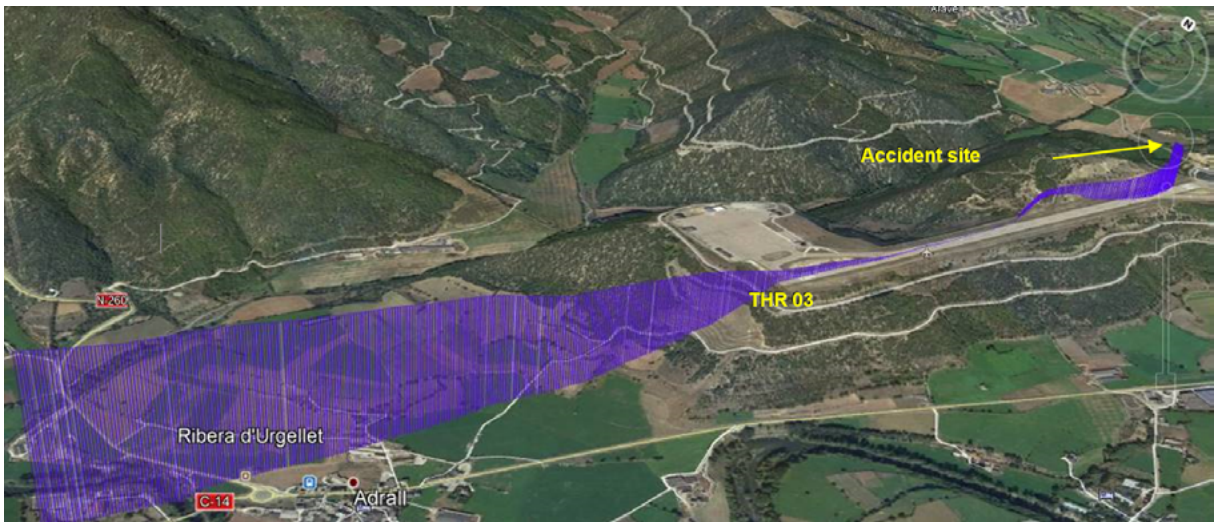

Figure 8. Third approach and fourth takeoff

At the point of closest approach to the ground during the final approach, which occurred at 10:43:15, the engine RPM were 5619 and the intake pressure was close to 28 in Hg. One second before the final data set, the RPM had fallen to 2013 and the intake pressure was 18 in Hg. The final data set indicated that the engine RPM were 3405.

A check of the RPM over the course of the entire flight shows values of around 5600 at moments of maximum engine demand, that is, when the throttle lever is fully open, and values of around 2100 (or lower) at times when the engine is at idle, that is, with the throttle lever at its minimum position.

The same happens with the intake pressure, with the maximum values of 28 in Hg coinciding with the power maximums, and levels of below 18 in Hg when the engine is near idle.

1.12. Wreckage and impact information

The aircraft ended up west of the runway, outside the aerodrome, 15 m away from the perimeter fence, with its longitudinal axis facing 125º true. It was 90 m away from the runway centerline as measured perpendicularly, and 20 m ahead of the runway 21 threshold, measured along the centerline; specifically, the wreckage was at coordinates 42º 21' 47" N – 3º 36' 49" W.

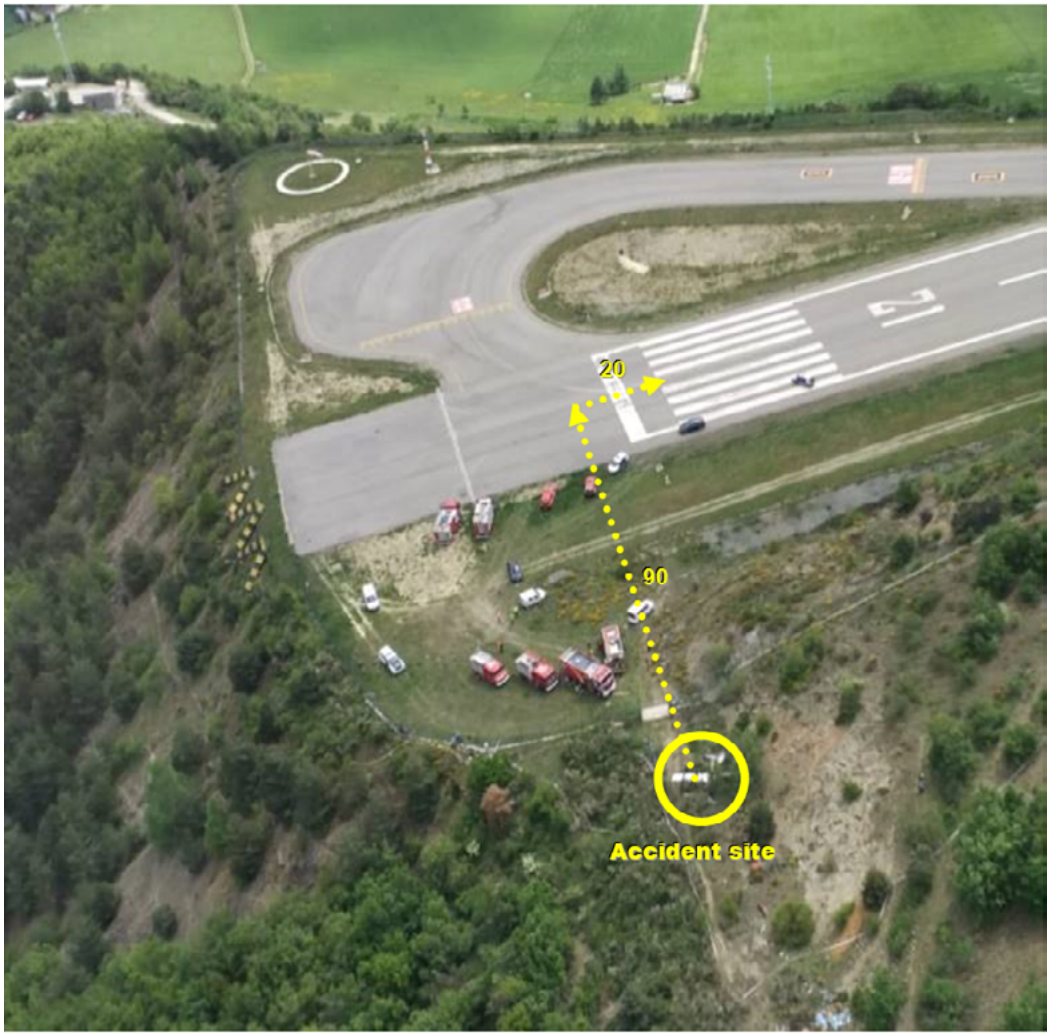

Figure 9. Aerial view of accident site

The front of the aircraft had impacted the ground, and specifically, against the base of a tree, remaining in a vertical position.

The engine and cockpit compartments were the areas most affected by the crash and sustained heavy damage.

The front landing gear wheel was lodged underneath the engine.

The throttle lever was identifiable in the cockpit, though its exact position could not be determined due to the post-impact deformation. There was no continuity between the lever itself and the control cable that ran to the motor.

The propeller blade pitch control was in the forward position and the throttle control for cold start was activated.

Figure 10. Condition of aircraft

The fuel selector valve position indicated that the right tank was selected.

The ignition key was in its place, but bent at a right angle. However, it was evident that it was in the slot that indicates that both magnetos were selected.

The master switch was in the "Off" position and the indicating switch for the avionics elements was connected, but all the breakers were in their normal position (none had tripped). The control lever for the flaperons was in the 5° position.

The fuel tanks had a large amount of fuel and there was no indication that a break in the tanks had caused a significant amount of the fuel to spill.

The right wing had detached at the root from the rest of the aircraft due to the impact with a tree.

The tip had been scratched by impacts with tree branches. The flaperon had detached from the rest of the wing.

The tail section and the vertical and horizontal stabilizers did not exhibit any damage.

The left wing was attached to the aircraft and showed no signs of impact.

The flaperon was deflected upward.

The landing gear also exhibited no damage.

The two propeller blades had detached from the hub, but were practically in one piece (see Figure 11).

Figure 11. Propeller blades

The engine exhibited a strong impact mark but no elements were found to have detached.

1.13. Medical and pathological information

The two occupants were killed.

The respective autopsies did not reveal any facts of relevance to the investigation[6].

1.14. Fire

There was no fire.

1.15. Survival aspects

The accident was first reported by way of a telephone call placed to the medical emergencies office (061) at 10:50:19 by someone who had witnessed the accident directly, and who did not report seeing a fire.

The office notified the operations center of the regional police force, which relayed the message to the various emergency services, which then immediately reported to the accident site.

A total of eight firefighting teams (four fire engines and four all-terrain vehicles) responded, along with medical personnel and Civil Guard agents from the airport's security detachment, as well as officers from the regional police force.

Despite this, the occupants were unable to be rescued alive.

The firefighters dowsed the accident site with foam to prevent a fire from breaking out and retrieved the bodies of the occupants once authorized to do so by the judicial authority.

1.16. Tests and research

The engine was removed from the crash site and analyzed with the help of a mechanic specializing on the specific engine type, which yielded the following findings:

[6]. Information on the weight of the occupants was not provided in the autopsies.

The mount had been deformed and bent by the impact.

The oil tank was completely empty. There was a dent in the bottom. The oil that remained inside the engine was taken out, a total volume of approximately 900 cm^3, almost one-third of the total amount it should have had.

There were no broken lines in the oil system or in the fuel supply system. All the lines were well protected, though some did exhibit minor damage due to the impact, but not breaks through which the oil could have spilled out.

There were also no signs that the oil had spilled to the outside, since there were no oil residue or stains on the outside of the lines or anywhere on the engine. Also, the line that absorbs any oil that may overflow was burned, along with the outlet, and its end was sealed, which would have prevented a potential loss of oil.

The oil radiator was also broken by the impact. The main bolt holding it in place was barely tightened. The position of the radiator would have prevented the oil from draining out through the hole. It is thus safe to say that any oil that did spill out of the radiator would have been practically negligible.

The oil filter was dented but it had no oil stains on the outside and, upon opening it, there was almost no oil inside.

No fuel was found in the pan of either carburetor.

The screws that regulate the idle position were in bad condition due to the strong impact sustained by the engine, and thus could not be used to determine for certain if the engine was at idle.

The screw on the gascolator filter, which is installed forward of the fuel pump, was very loose. A few drops of gasoline were removed. The gasoline contained no water and the filter was clean, not clogged.

The radiator was removed. There was very little coolant left in it. The expansion bottle had been broken by the impact.

The chip detector did not show signs that the engine had seized. It did have some chips, but they were very small.

The fuel pump did have fuel, it was practically full. It may have gravity filled. When it was removed, fuel came out the inlet, and when it was pumped, all of the fuel remaining inside was removed through the discharge.

As for the spark plugs, the one for the #2 cylinder had ash-colored soot residue. In general terms, this means that fuel is not reaching the spark plug.

The spark plug for the #4 cylinder looked normal (black), as did the spark plug for the #1 cylinder.

The spark plug for the #3 cylinder also looked normal in general, but it had dirt residue, which indicates that it had not been operating properly.

The condition of the pickups that send the ignition (up) signal showed that the engine was stopped at the moment of impact, because the cams on the pickups had not been damaged by the rotation; that is, they exhibited no circumferential damage. The damage they did show had been caused by the impact.

Finally, the engine could not be rotated because it had buckled on impact.

1.17. Organizational and management information

Airport officials told investigators that the pilot had owned a hangar at the airport for three years.

On the day of the accident, the pilot entered the grounds at 09:44, as recorded on the airport's access control system.

The airport has security cameras, but none of them was aimed at the runway, and so no images from any point of the flight were available.

1.18. Additional information

1.18.1. Eyewitness statements

Two people witnessed the accident directly.

The first was a helicopter pilot who was landing when the event occurred. He reported that he had been listening to the pilot of the accident airplane report in the Air 7 air frequency the approach to the airport, and how the approach maneuver had been executed at an excessive angle.

The second eyewitness was doing maintenance work on the airport facilities and stated that the accident airplane had been doing takeoffs and landings since approximately 10:15.

He saw the airplane approach at an altitude that was higher than the normal landing altitude, and it seemed that the airplane finally managed to land, but during the same run it took off, and he saw the aircraft fly toward the mountain to the left of the runway, and then try to avoid it by turning right, but by then it had lost too much speed.

He then saw the airplane veer left, near the runway 21 threshold, and he lost it from sight. He quickly reported this to the airport operations office, informing that there had probably been an accident. The office then notified emergency services.

1.18.2. Information on the weight of the occupants

Based on the statements provided by several people who knew the occupants, and by some of the first responders, the pilot's weight was in excess of 120 kg, and the passenger's weight was not below 100 kg.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

As for the flight planning on the day of the accident, the investigation has determined that the airplane took off with a maximum takeoff weight of 509 kg.

As concerns the operation, the fact that the three flights made in the vicinity of the airport did not conform to the traffic pattern, but were very similar to one another, flying outward to a relatively nearby point and then making a very long final approach, could indicate that the real purpose of the flight was primarily to practice takeoffs and landings, which is more basic than completing a pattern, which, in addition to the takeoff and landing maneuvers, requires maintaining a certain altitude in each leg and being in a range of speeds, all within the standard time and space requirements needed to complete the pattern.

Analyzing the flights from the recorded data shows that the second was more destabilized than the first, descending at a steeper angle. But the third flight was the least stabilized of all, not only because the slope was the steepest of them all, but because by the time the airplane reached the closest point of approach to the runway, it had gone further past the threshold than on the two previous occasions, even going as far the runway midpoint.

The excess weight undoubtedly had a negative influence on both the landing attempts and the subsequent takeoffs. The greater the weight, the higher the approach speed, and therefore the longer landing distance that is needed.

On the other hand, both the recorded data and the position in which the lever was found, would indicate that the flaperons were deployed 5º, a configuration that is prohibited for both takeoffs and landings

Based on the parameters recorded, the aircraft did not touch down and travel on the runway in any of the three attempts, which added even more instability when it came time to start the takeoff. As a result, in the final approach, when the airplane was almost halfway down the runway by the time it reached its lowest point and started the next takeoff, the best thing would have been to touch down on the runway (there was sufficient runway remaining), brake the aircraft and return to the threshold to start a new takeoff run that made use of the entire runway length. By continuing with the fourth takeoff during the same run, the pilot had already used up half the runway.

The bank angles recorded in the final phases of the flight were high to both the right and left sides, and the pitch angle was as high as 24º. Even though the angle of attack was not recorded, it is safe to assume that it was high as well.

The last recorded value for IAS was 42 kt, which would have been almost 5 kt below the stall speed (46.7 kt).

From then on, high nose-down pitch angles were recorded, with is fully consistent with the aircraft's final position, namely vertical, after the front of the aircraft struck the base of a tree. This explains why the engine housing and cockpit sustained greater damage and deformations. The engine mount was highly warped and the front landing gear wheel was lodged underneath the engine mount.

This is all consistent with the airplane stalling.

The engine had one-third of the oil it should have had. The evidence found indicates that this oil did not spill out after impact. As for the operation of the engine, the fact that the cams on the pickups that send the ignition signal were not damaged circumferentially indicates that the engine was stopped.

It was also noted that the engine was highly deformed (seized) and thus did not rotate freely. The size of the particle inside the chip detector indicates that the engine did not malfunction, meaning it seized due to the impact. The good condition of the propeller blades provide another indication that the engine was stopped, or at least producing little power (idle), when the aircraft impacted the ground.

This is consistent with the data recorded in the final seconds of the flight, i.e. with the engine RPM and intake pressure falling to values very close to idle.

All of the above leads to the conclusion that during the climb after the go around, the engine was placed at idle and that once set at that speed, it eventually stopped.

3. CONCLUSIONS

3.1. Findings

- The pilot had a valid license and medical certificate.

- The purpose of the flight was to remain in the vicinity of the aerodrome and practice takeoffs and landings.

- The takeoff weight was in excess of the maximum authorized takeoff weight of 450 kg.

- The pilot did not fly a standard pattern around the aerodrome on any of the three approaches.

- The aircraft did not touch down on and travel on the runway on any of the three maneuvers.

- The accident occurred during the fourth takeoff maneuver.

- The last landing followed a steeper slope than the previous approaches, and during the lowest point of the run it was almost halfway down the runway.

- During the last takeoff the aircraft diverted left, then turned right, centered over the centerline for a few seconds before again turning left.

- During the final turn, the aircraft stalled.

- It impacted the base of a tree, falling from a low altitude in a vertical position.

- There was no fire.

- The occupants were killed on impact.

- An analysis of both the engine and the condition of the propeller blades showed that the engine had stopped by the time the aircraft reached the ground, and that it had been at idle in the final moments of the flight.

- An analysis of the engine showed that it had one-third of the oil it should have had, and that at the moment of impact, there was no fuel inside the carburetors.

3.2. Causes/Contributing factors

The accident occurred because the aircraft stalled as it was performing a go-around maneuver at a very low speed, exacerbated by the execution of a low-altitude turn and the stoppage of the engine.

The following factors contributed to the accident:

- Taking off with excessive weight, which degraded the aircraft's performance.
- Making a non-stabilized approach.
- Placing the engine at idle in the last climb, with the ensuing engine stoppage.

4. RECOMMENDATIONS

None.