



**COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL**

Report ULM A-020/2016

Accident involving a Flight Design CT-LS
aircraft, registration D-MRLM,
in Requena (Valencia, Spain)
on 6 October 2016



GOBIERNO
DE ESPAÑA

MINISTERIO
DE FOMENTO

Report

ULM A-020/2016

**Accident involving a Flight Design CT-LS aircraft,
registration D-MRLM,
in Requena (Valencia, Spain)
on 6 October 2016**



**GOBIERNO
DE ESPAÑA**

**MINISTERIO
DE FOMENTO**

SUBSECRETARÍA

COMISIÓN DE INVESTIGACIÓN
DE ACCIDENTES E INCIDENTES
DE AVIACIÓN CIVIL

© Ministerio de Fomento
Secretaría General Técnica
Centro de Publicaciones

NIPO Línea: 161-18-054-8

NIPO Papel: 161-18-053-2

Depósito legal: M-6899-2018

Maquetación: David García Arcos

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) n° 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	vi
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	3
1.5. Personnel information	3
1.6. Aircraft information	4
1.7. Meteorological information	5
1.8. Aids to navigation	6
1.9. Communications	6
1.10. Aerodrome information	6
1.11. Flight recorders	6
1.11.1 Analysis of GPS route	6
1.12. Wreckage and impact information	8
1.13. Medical and pathological information	8
1.14. Fire	9
1.15. Survival aspects	9
1.16. Tests and research	9
1.16.1 Eyewitness statements	9
1.16.2 Estimated fuel consumption	10
1.16.3 Engine inspection	10
1.17. Organizational and management information	11
1.18. Additional information	11
1.18.1 Information from the Flight and Maintenance Manual	11
1.18.2 Flight planning	11
1.19. Useful or effective investigation techniques	12
2. ANALYSIS	13
2.1. General aspects	13
2.2. Meteorology	13
2.3. Wreckage and impact	13
2.4. Flight path	13
2.5. Landing/field selection	14
2.6. Fuel consumption	14
2.7. Regulation	14

3. CONCLUSIONS 15

3.1. Findings 15

3.2. Causes/Contributing factors 15

4. SAFETY RECOMMENDATIONS 16

Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees centigrade
AEMET	National Weather Agency
AGL	Above Ground Level
ELT	Emergency Locator Transmitter
ft	Feet
Gal/h	Gallons per hour
GPS	Global Positioning System
h	Hours
hp (m, ft)	Pressure altitude (m, ft)
HP	Horsepower
hPa	Hectopascals
IAS	Indicated Airspeed
Km	Kilometers
Km/h	Kilometers per hour
L	Liters
l/h	Liters per hour
LT	Local Time
m	Meters
min	Minutes
N	North
N/A	Does not affect
NM	Nautical Mile
QNH	Altimeter subscale setting to obtain elevation when on the ground
RPM	Revolutions per minute
SAR	Search and rescue
Sec	Seconds
ULM	Powered ultralight aircraft
UTC	Coordinated Universal Time
V _{NE}	Never Exceed Speed
W	West

Synopsis

Operator:	Private
Aircraft:	Flight Design CT-LS, registration D-MRLM
Date and time of accident:	6 October 2016 at approximately 16:24 LT ¹
Site of accident:	Requena (Valencia, Spain)
Persons onboard:	1 pilot (slightly injured) and 1 passenger (not injured)
Type of flight:	General Aviation - Private
Phase of flight	En route - Cruise
Date of approval:	25 October 2017

Summary of the accident:

On Thursday, 6 October 2016, a Flight Design CT-LS aircraft, registration D-MRLM, suffered an accident while making an emergency off-field landing during a flight from the Córdoba Airport to the aerodrome of Requena (Valencia) with two occupants onboard.

The emergency occurred near the end of the flight when the engine stopped as the aircraft was flying over Requena, some 21 km southwest of the destination aerodrome.

The pilot sustained minor injuries and the passenger was not injured. The aircraft was heavily damaged.

¹ All times in this report are local unless otherwise specified. On the date of the accident, local time in Spain was UTC+2 hours, and local time in Portugal was UTC+1 hour.

1. FACTUAL INFORMATION

1.1. History of the flight

The aircraft, a Flight Design CT-LS, registration D-MRLM, was part of a group of nine aircraft that were on an organized flight that started on 30 September 2016, originating and concluding in Germany.

According to the GPS log and the information provided by the pilot, the aircraft took the following route:

Date	Origin	Destination
30/09/16	Primasens (Germany)	Besancon (France)
02/10/16	Besancon (France)	Egletons (France)
02/10/16	Egletons (France)	Arcachon (France)
03/10/16	Arcachon (France)	Garray-Soria (Spain)
03/10/16	Garray (Spain)	Viseu (Portugal)
04/10/16	Viseu (Portugal)	Benavente (Portugal)
04/10/16	Benavente (Portugal)	Lagos (Portugal)
06/10/16	Lagos (Portugal)	Córdoba (Spain)
06/10/16	Córdoba (Spain)	Requena (Spain) ²

On 6 October 2016, after a rest day, the aircraft took off from the aerodrome in Lagos (Portugal) at 09:40 LT with two occupants onboard. After crossing the Portugal-Spain border, they turned north to head to the area of the Rio Tinto mines, following the course of the river. They then continued to the Córdoba Airport, where they landed and rested for approximately an hour and a quarter. They then resumed the flight, heading direct to Requena.

After flying for one hour and forty minutes, as the aircraft was some 21 km southwest of the aerodrome, the engine misfired twice before coming to a stop.

The pilot then decided to make an emergency landing on a road that was 1 NM to his left. In light of the wind conditions, he opted to make a 180° turn in order to land into the wind. Once in position over the road, the aircraft did not lose altitude quickly enough to land on the straight section of road, and since a blind turn to the right followed the straight section, the pilot eventually opted to turn left and land on a lightly wooded and inclined area.

² 21 km southwest of the Requena aerodrome.

The pilot was slightly injured and the passenger uninjured. The aircraft sustained heavy damage.

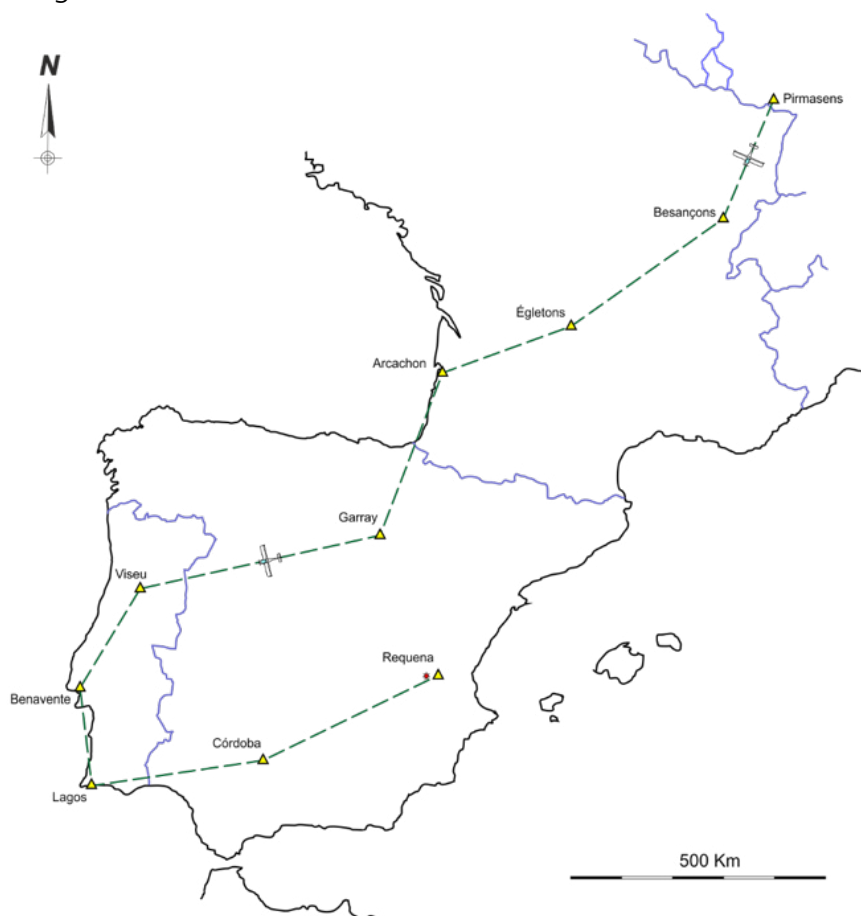


Figure 1. Route flown.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor	1		1	
None		1	1	
TOTAL	1	1	2	

1.3. Damage to aircraft

The aircraft sustained heavy damage throughout practically all of its structure (fuselage, wings, landing gear, propeller, etc.).



Figure 2. Aircraft wreckage.

1.4. Other damage

There was no additional damage.

1.5. Personnel information

The pilot, a 55-year old German national, had a Luftfahrerschein für Luftsportgeräteführer (Sport Pilot) license issued by Deutscher Ultraleichtflugverband (German Ultralight Association) that was valid and in force until 7 January 2019.

According to information provided by the pilot, he had a total of 148 h 43 min of flying experience, of which 125 h 22 min had been on the aircraft type. In the previous 30 days he had flown 21 h 16 min and in the previous 48 h he had flown 5 h 59 min (all on the accident model).

1.6. Aircraft information

The aircraft, registration D-MRLM, is a two-seat Flight Design CT-LS ultralight, manufactured in 2008 with serial number F-08-06-02 and equipped with a 100-HP ROTAX 912 ULS engine and a three-blade Neuform CR3-65-47-101.6 composite propeller. Its never exceed speed (V_{NE}) is 235 km/h.

The fuel consumption specified by ROTAX is shown in the table below:

Fuel consumption in l/h (US gal/h)	912 S/ULS
At take-off performance	27.0 l/h (7.1 gal/h)
At max. continuous performance	25.0 l/h (6.6 gal/h)
At 75% continuous performance	18.5 l/h (4.9 gal/h)
Specific consumption at max. continuous performance	285 g/kWh (0.47 lb/hph)

The aircraft's Flight and Maintenance Manual has no information on fuel consumption. According to the aircraft's distributor in Spain, the reference consumption figures used are those provided by the engine manufacturer plus a small safety margin, such that at 75% performance, a consumption of 20 l/h is assumed.

At the time of the accident the aircraft had 440 flight hours.

According to information provided by the pilot, on 18 March 2016, with 400 flight hours on the aircraft, a 100-hr inspection was conducted. As detailed in the aircraft manual, this inspection includes checks of the aircraft's structure and controls and of the various systems (electrical, fuel, cooling and lubrication), as well as inspections of the engine and propeller.

The aircraft had an ultralight certificate of airworthiness that was valid until April 2017 and issued by the Federal Ministry of Transport of the Federal Republic of Germany.



Figure 3. Flight Design CT-LS aircraft.

1.7. Meteorological information

Based on the information provided by the National Weather Agency (AEMET), the weather situation over the peninsula did not indicate clouds or precipitation phenomena along the route followed by the aircraft. There were no significant winds at low levels along the route, meaning that significant meteorological events can be ruled out. However, and based on the data recorded at the weather station in Utiel, located 10 km northwest of Requena (16 km northeast of the accident site), there were the westerly dry ground winds typical in Valencia, which can be very intense and gusty.

The data recorded at the weather station in Utiel were as follows:

Good visibility on the surface, clear, temperature of about 28° C, QNH of 1010 hPa, relative humidity of 18% and wind from the west (270°) at 30 km/h, gusting up to 46 km/h.

The 500-hPa and 850-hPa maps show that there was practically no wind aloft.

1.8. Aids to navigation

Not applicable.

1.9. Communications

There were no communications or emergency calls.

1.10. Aerodrome information

Not applicable.

1.11. Flight recorders

The aircraft was not equipped with conventional flight data or voice recorders. The relevant aviation regulation does not require this type of aircraft to have any kind of recorder.

There was a Garmin 695 GPS device, which provided information on the flights made from the start of the scheduled trip, the date of the flights and their duration.

1.11.1 Analysis of GPS route

According to data taken from the GPS, the aircraft began to move³ on 6 October 2016 at 08:32:56 UTC, taking off at 08:39:24 UTC.

It landed at the Córdoba Airport at 11:10:28 UTC, taxiing for a few minutes before coming to a stop at 11:13:20 UTC, for a total flight duration of 2 h 40 min 14 sec.

After a period of inactivity of approximately 1 h 17 min, at 12:30:39 UTC the aircraft began moving again, taking off at 12:36:00 UTC en route to Requena. Finally, at 14:24:33 UTC, the aircraft stopped when it impacted the ground at an elevation of 634 m, for a total flight duration of 1 h 53 min 54 sec.

On the day of the accident, the aircraft was in motion a total of 4 h 34 min 8 sec.

According to the GPS data, during the flight from Lagos to Córdoba, the aircraft traveled 431 km, and during the second leg, between Córdoba and the point of impact, it traveled 371 km.

³ The GPS data downloaded indicate when the aircraft is moving.

During the day's first flight, the aircraft initially flew along the Portuguese coastline, and once over Spanish territory, it turned inland, at which point it had to fly higher in order to maintain its altitude above ground level. On the second flight of the day, between Córdoba and Requena, the elevation of the terrain was generally higher, meaning the altitude at which most of this flight took place was also increased.

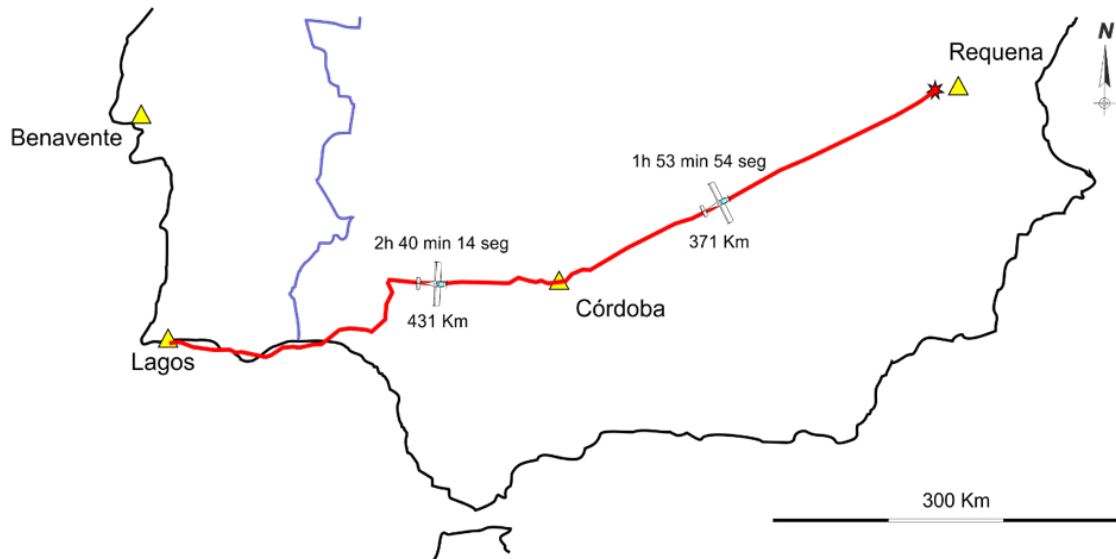


Figure 4. GPS track.

The speeds recorded by the GPS (with respect to the ground) show different values that on occasion exceeded 200 km/h. During the first stage, the values were primarily below 200 km/h, while during the second leg the speeds were mostly above 200 km/h.

In the last part of the flight, the aircraft is seen making a 180° turn to line up with a nearby road before finally turning left again to land in a field next to the road.

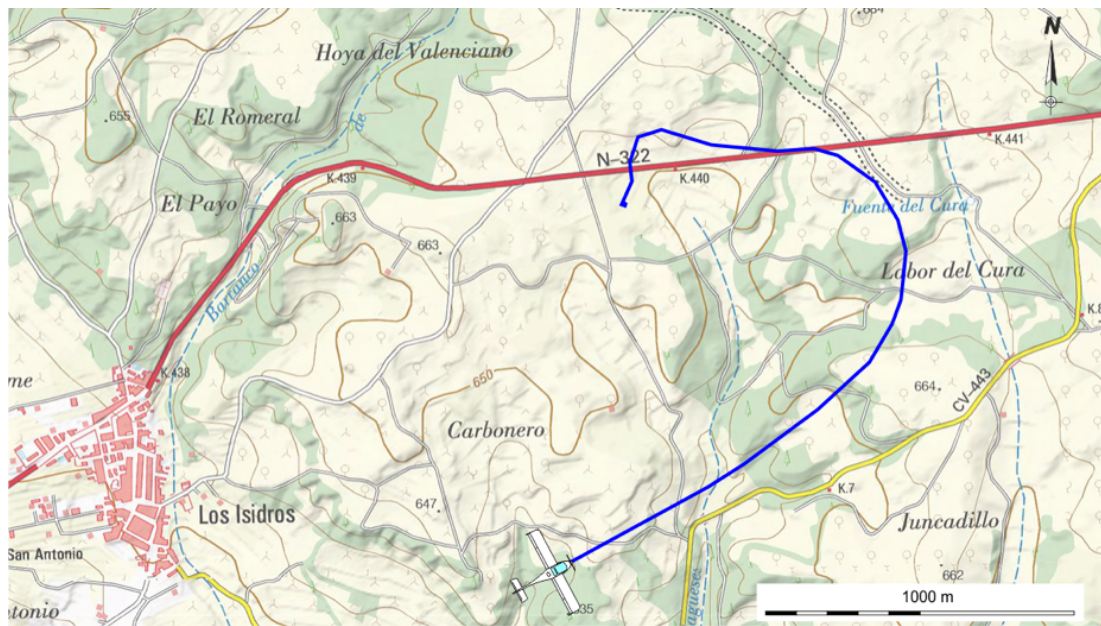


Figure 5. Emergency landing segment.

1.12. Wreckage and impact information

The aircraft wreckage was located in an area of low hills next to a pine forest called "Cuesta de la Muela", located along kilometer 4.4 of national road N-322, southwest of the town of Requena and within its municipal limits, at coordinates 39° 25' 37.4"N 1° 16' 24.7" W and an elevation of 650 m.

The debris field was highly concentrated, with all of the components located within this field. The damage to the aircraft consisted of fractures and deformations to the front and bottom of the fuselage, landing gear, both wingtips and interior of the cockpit. Two of the propeller's three blades were broken.

There were two marks on the ground consistent with the fuselage's impact against the terrain.

There was no fuel in the left wing tank and only 1.5 l in the right wing tank.

There were no abnormalities in the tanks that could have resulted in a fuel leak.

There was route planning documentation found among the wreckage.

1.13. Medical and pathological information

N/A.

1.14. Fire

There were no signs of a fire during the flight or after the impact.

1.15. Survival aspects

The occupants exited the aircraft under their own power.

1.16. Tests and research

1.16.1 Eyewitness statements

The aircraft's pilot provided a statement to investigators, in which he stated:

"We were on an organized flight, along with eight other aircraft, leaving from Germany, flying to Besancon (F)⁴, Arcachon (F), Garra (E)⁵, Viseu (PT)⁶, Benavente (PT), Lagos (PT), Córdoba (E), Requena (E), and then returning to France and Germany.

After a rest day, we left at 09:39 (LT)⁷ from Lagos (PT) with a total of 90 l of fuel after having refueled 50 l. After passing Faro and crossing the border, near Huelva, we turned north, following the course of the Tinto River toward the old mines, and then headed almost straight to Córdoba. There we rested for approximately 45 minutes. Before going into the aircraft to resume the flight, I checked the aircraft and I measured 50 l of fuel. Since we were planning to go direct to Requena, I calculated a distance of 377 km.

The airplane needs between 13 and a maximum of 20 liters per hour. At 5000 RPM, which is equivalent to an IAS of 200 km/h, it consumes between 16 and 17 liters per hour.

I calculated a range of 3 h and an estimated flight time of 2 h. We had also been having a tailwind of at least 20 m/h.

Around 7 min before reaching the destination, after flying for 1 h 40 min, the engine misfired twice and the propeller stopped. At the time conditions were normal, on straight and level flight, power at 90%, speed 200 km/h and 5000 RPM. I tried

⁴ F-France.

⁵ E-Spain.

⁶ P-Portugal.

⁷ Local time in Portugal.

to start the engine but it was impossible. Being at about 800 ft AGL, there were not many options. The terrain around us was slightly mountainous, so I decided to land the aircraft on a road that was 1 NM to our left. Since we had had a tailwind of around 40 km/h, I had to turn the aircraft 180° in order to land into the wind.

The airplane did not lose enough height over the road (due to the strong wind I think) and since the road turned right and I could not see what lay beyond, I decided to turn left toward the slightly mountainous terrain.

We were only some 2 m off the ground when the airplane started to stall, due to the turn and the drop in speed. I pulled on the stick and the airplane lost all forward motion and fell to the ground. I lost consciousness for a second or two, then I turned off all the electrical devices, closed the fuel valve and removed the keys. I talked with the passenger, who had not been injured, and we exited the aircraft.

At that point I realized I was bleeding from a cut on my head. After a while I was able to find my mobile phone, which had been ringing, and I realized that I had a call from SAR, which had been alerted by the ELT. I was later taken to a hospital".

1.16.2 Estimated fuel consumption

Considering the consumption figures provided by the manufacturer of the ROTAX 912 ULS, and the safety margin indicated by the aircraft's distributor in Spain, as well as the time that the GPS shows the aircraft was in motion, we can establish:

- Time in motion recorded by the GPS: 4 h 34 min 08 sec
- Consumption rate of 20 l/h when in operation

The consumption estimate yields a total result of 91.33 l. The consumption associated with the engine start-up and the tests carried out prior to commencing any flight must also be taken into account, along with the time that the engine is running between when the aircraft stops at the conclusion of the flight and when the engine is turned off.

The above consumption estimate would also have to consider the aircraft's weight and configuration. Furthermore, any potential increase in engine power considerably raise fuel consumption.

1.16.3 Engine inspection

The engine was inspected after the accident. The damage found was fully compatible with the impact, there being no signs of a malfunction in any of its components.

1.17. Organizational and management information

1.18. Additional information

1.18.1 *Information from the Flight and Maintenance Manual*

As described in Section 4, Normal Procedures, point 4.8, Cruise, the most efficient performance during cruise flight is obtained at 4800 RPM. A higher RPM yields greater speed but at the expense of a large increase in fuel consumption. The longest range is obtained at a relatively low value of 4300 RPM.

The amount of fuel must be monitored constantly during the flight by checking the fuel gauges at the wing roots. Despite their simplicity, they provide clear information on the fuel quantity in the tanks, and particularly on how the fuel level is dropping.

1.18.2 *Flight planning*

The flight planning performed by the pilot shows the following information:

It indicated the straight-line distance between the start and end points and an estimate of the actual distance to travel.

The flight time calculation is done by taking the estimated distance as a reference and for two different speeds: 150 km/h and 200 km/h.

Thus, for the segments for 6 October, the plan indicates:

Segment 1: Lagos-Córdoba 360 - 380 km

Flight duration:

- 150 km/h: 2 h 53 min
- 200 km/h: 1 h 54 min

Segment 2: Córdoba – Requena 360 - 380 km

Flight duration:

- 150 km/h: 2 h 53 min
- 200 km/h: 1 h 54 min

There is no type of analysis or information involving any fuel calculations or estimates for the different segments.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. General aspects

The aircraft was on an organized flight along with eight other aircraft, which started on 30 September, with two persons onboard. After a day of rest, they started a new day of flying divided into two stages, one from Lagos to Córdoba and the other from Córdoba to Requena.

2.2. Meteorology

According to information provided by AEMET, there were no clouds or precipitation, no significant winds aloft on the route, though on the surface the wind was from the west (270°) at 30 km/h and gusting to 46 km/h, which is a typical situation in Valencia with a dry, westerly wind on the ground that can be intense and gusty. The weather conditions are thus not deemed to have been limiting to the flight. The data provided in terms of the wind on the surface is consistent with the maneuver made by the pilot to make the emergency landing into the wind.

2.3. Wreckage and impact

There were two impact marks on the ground with no signs of forward motion and paint marks on some stones. This, combined with the highly confined debris field, indicates that the aircraft impacted the ground in a practically horizontal position as the result of stalling at a low altitude. This fact is corroborated by the pilot who, in his statement, stated that at an altitude of 2 m, the aircraft started to stall due to the turn and the loss of speed, as well as due to his pulling back on the control stick, which helped the aircraft lose all its forward speed and fall to the ground.

A check of the fuel revealed that the left wing tank was empty and the right wing tank had a liter and a half, an entirely insufficient quantity to perform the flight.

2.4. Flight path

Based on the data recorded in the GPS, the aircraft made two flights that day, lasting a total of 4 h 34 min 8 sec.

The distances traveled were 431 km in the first flight and 371 km in the second, which total 802 km without reaching Requena. This is in contrast to the 760 km considered by the pilot for both segments in his flight plan.

The ground speeds calculated from the data recorded by the GPS indicate that the values during the second segment were slightly higher than during the first. Moreover, the altitude at which the aircraft flew during the second segment was higher due to the higher elevation of the terrain and to the need to maintain a safety margin above the ground.

2.5. Landing/field selection

The pilot stated that he decided to land on a nearby road left of his flight path since the topography of the terrain was, in general, slightly inclined and he was only 800 ft above the ground.

There were two nearby fields, one on either side of the road, that could have been used to make an emergency landing. Perhaps the fact that the pilot initially considered the road as a landing site - which can always lead to a compromising and/or dangerous situation for the pilot and for any vehicles that may be traveling on it at the time or that appear unexpectedly – and the urgency to act as a result of the low altitude, made it difficult for the pilot to evaluate a more extensive area that might have been available to carry out an emergency landing.

2.6. Fuel consumption

According to the information in the flight plan, the pilot used distances that were shorter than actual and did not take into account the aircraft's run time on the ground. In addition, the consumption rate figures specified by the pilot were below those provided by the engine manufacturer. In any event, the planning did not include any fuel consumption calculations for either the entire flight or for regular segments, as would be expected in a proper Operational Flight Plan.

2.7. Regulation

The aircraft's user manual contains information on efficient cruise performance and the corresponding RPM. There is no specific information, however, on the aircraft's fuel consumption.

A recommendation is issued to the manufacturer to have it include this information in the Manual, as it is of interest to the safety of operations.

3. CONCLUSIONS

3.1. Findings

- The aircraft's documentation was valid.
- The pilot had a valid license and medical certificate.
- The pilot had experience flying the aircraft type.
- The accident flight was a group flight consisting of nine aircraft.
- The weather conditions were not limiting to the performance of the flight.
- The aircraft's Flight and Maintenance Manual does not specify how much fuel the aircraft consumes in the different phases of flight.

3.2. Causes/Contributing factors

The accident was caused by fuel starvation in flight as a result of deficient planning of the fuel consumption along the planned route.

The following contributed to this accident:

The lack of documentation and information on fuel consumption in the aircraft's Flight and Maintenance Manual.

The process of selecting a landing field and the last-minute change to said field contributed to aggravating the consequences of the accident.

4. SAFETY RECOMMENDATIONS

The following recommendation is issued as a result of the analysis of the accident:

REC 71/17. It is recommended that FLIGHT DESIGN, as the aircraft manufacturer, consider including information in the Flight and Maintenance Manual on the aircraft's fuel consumption during the different phases of flight.