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Report A-008/2021

Accident on 19 March 2021 involving a CESSNA 172 aircraft, registration EC-FJS, at Casarrubios del Monte (Toledo, Spain)

GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

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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 and its 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 5.6 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 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

° ' "	Sexagesimal degrees, minutes and seconds
°C	Degrees Celsius
%	Per cent
AEMET	Spain's State Meteorological Agency
AESA	Spain's National Aviation Safety Agency
ATO	Approved training organisation
CPL(A)	Commercial pilot license (aircraft)
CTR	Control zone
FI	Flight instructor
FL	Flight level
ft	Feet
gal	Gallon
GPH	Gallons per hour
GPS	Global positioning system
h	Hour
LT	Local time
HP	Horsepower
IR(A)	Instrument rating (aircraft)
kg	Kilogrammes
km	Kilometres
kt	Knots
LECU	ICAO code for Madrid-Cuatro Vientos Airport
LEGT	ICAO code for Getafe Airport
LEZL	ICAO code for Seville Airport
m	Metres
MEP(land)	Multi-engine piston rating (land)
METAR	Aviation routine weather report
Min	Minutes
N	North
POH	Pilot Operating Handbook
PPL(A)	Private pilot license (aircraft)
RPM	Revolutions per minute
S	South
SEP(land)	Single-engine piston rating (land)
TAS	True airspeed
TMA	Traffic management area
VFR	Visual flight rules
W	West

Synopsis

Owner and operator:	AEROSPACE FLY, S.L.
Aircraft:	CESSNA 172P, registration EC-FJS
Date and time of accident:	19 March 2021: 10:00 LT[1]
Site of accident:	Municipality of Casarrubios del Monte (Toledo)
Persons on board:	One Instructor, one student, unharmed
Type of flight:	General Aviation - Instruction flight - Dual
Phase of flight:	Landing – emergency landing
Flight Rules:	VFR
Date of approval:	29 September 2021

Summary of the accident

On 19 March 2021 at 10:00 h, the Cessna 172P aircraft, registration EC-FJS, was involved in an accident in the municipality of Casarrubios del Monte (Toledo) after suffering an in-flight power loss during a training flight. During the emergency landing on farmland, the aircraft flipped, over sustaining significant damage. There were no injuries.

The investigation has determined the cause of the accident was the performance of an off-airfield emergency landing due to inadequate flight planning.

[1] All times used in this report are local time

1. THE FACTS OF THE ACCIDENT

1.1. Overview of the accident

At 10:00 h on Friday, 19 March 2021, the Cessna 172P aircraft, registration EC-FJS, suffered an accident while carrying out an emergency off-airfield landing in the municipality of Casarrubios del Monte (Toledo), after an in-flight engine failure.

The crew, comprising an instructor and a student, had taken off from Cuatro Vientos Airport the day before to carry out a training flight to Seville. According to the information provided, the engine started to misfire during the return flight, as they were flying over the River Tagus at 4500 ft, between the Castrejón reservoir and Toledo. After selecting a rich mixture and switching on the carburettor heating, the instructor took the controls and headed towards the Camarenilla Aerodrome, with the aircraft gradually losing altitude due to the lack of power. As they approached Camarenilla and were aligning with runway 05 on the final leg, they saw traffic in front of them. Being aware that they may not be able to land safely, they deactivated the heating and performed a go-around, at which time the engine started to function normally again. After climbing to 3500 ft and switching on the carburettor heating again, they proceeded to the Casarrubios del Monte Aerodrome. As they approached it, the engine began to misfire again and eventually cut out completely. They chose a field to land on and did so at about 50 kt with fully extended flaps. The aircraft travelled approximately 15 m before the nose wheel collapsed, causing it to flip over.

Both occupants were unharmed. The accident caused significant damage to the aircraft.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatalities				
Serious				
Minor				
Unharmed	2		2	
TOTAL	2		2	

1.3. Damage to the aircraft

The accident caused the nose leg to collapse, creases in the fuselage and wings and damage to the vertical stabiliser and rudder.

1.4. Other damage

There was no other damage.

1.5. Information about the personnel

The 35-year-old instructor had a CPL(A) license issued on 23 May 2016 with MEP (land), SEP (land) and IR (A) ratings valid until 30 November 2021 and the FI (A) rating valid until 31 January 2022.

He also had a class 1 medical certificate valid until 08 September 2021. At the time of the accident, he had accrued 600 hours of flight experience.

The 29-year-old student-pilot had a PPL (A) license issued on 21 August 2020 and a SEP (land) rating valid until 31 August 2022.

He also had a class 2 medical certificate valid until 04 September 2023. At the time of the accident, he was taking the VFRN rating course and had 68 hours of flight experience.

1.6. Information about the aircraft

The Cessna 172P aircraft, registration EC-JFS, is a single-engine, high-wing aircraft equipped with a 160 HP LYCOMING O-320-D2J engine and a two-bladed propeller. Its empty weight is 687 kg, and its maximum take-off weight is 1088 kg. It has serial number 172-74320, and was registered in the Aircraft Registry of Spain's National Aviation Safety Agency on 03 February 1992.

Its airworthiness review certificate had been renewed on 22 December 2020, being valid for one year. At the time of the accident, it had accrued 11448 flight hours.

The aircraft was equipped with long-range fuel tanks with a capacity of 54 gal, and, according to the *Pilot's Operating Handbook*, a usable capacity of 50 gal.

An image of the aircraft's control panel can be seen in Figure 1.

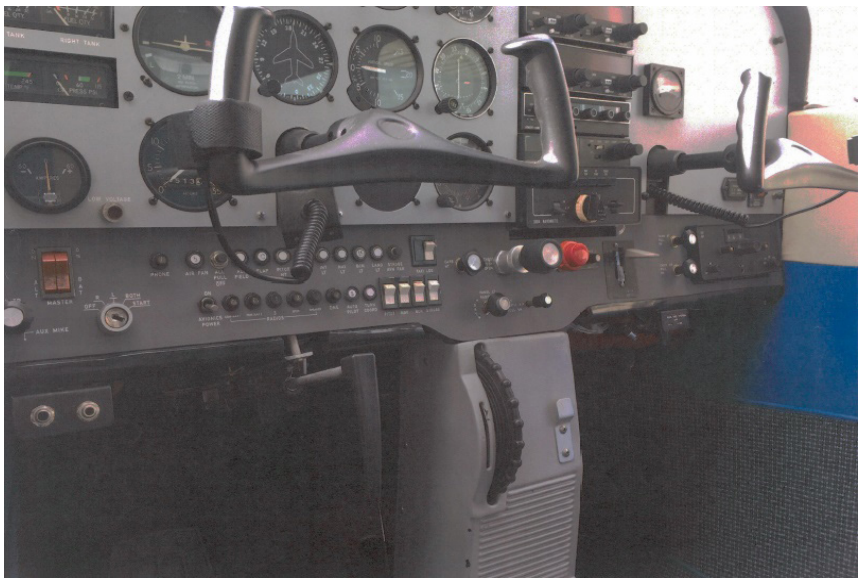

Figure 1. Control panel of aircraft EC-FJS

Figure 2 shows that with these types of tanks, the aircraft can fly at 55% power for around 7 h.

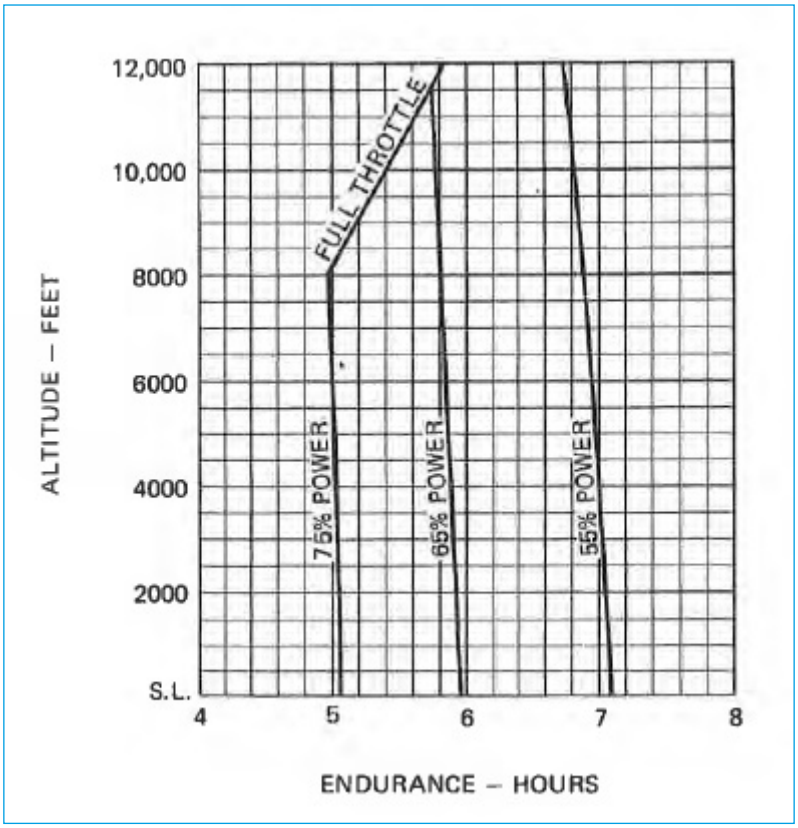

Figure 2. Range at different power settings

Figures 3 and 4 show the aircraft's performance data during the take-off and cruise phases (extracted from the POH).

CESSNA
MODEL 172P

SECTION 5
PERFORMANCE

TIME, FUEL, AND DISTANCE TO CLIMB

MAXIMUM RATE OF CLIMB

CONDITIONS:
Flaps Up
Full Throttle
Standard Temperature

NOTES:
1. Add 1.1 gallons of fuel for engine start, taxi and takeoff allowance.
2. Mixture leaned above 3000 feet for maximum RPM.
3. Increase time, fuel and distance by 10% for each 10°C above standard temperature.
4. Distances shown are based on zero wind.

WEIGHT LBS	PRESSURE ALTITUDE FT	TEMP °C	CLIMB SPEED KIAS	RATE OF CLIMB FPM	FROM SEA LEVEL		
					TIME MIN	FUEL USED GALLONS	DISTANCE NM
2400	S.L.	15	76	700	0	0.0	0
	1000	13	76	655	1	0.3	2
	2000	11	75	610	3	0.6	4
	3000	9	75	560	5	1.0	6
	4000	7	74	515	7	1.4	9
	5000	5	74	470	9	1.7	11
	6000	3	73	425	11	2.2	14
	7000	1	72	375	14	2.6	18
	8000	-1	72	330	17	3.1	22
	9000	-3	71	285	20	3.6	26
	10,000	-5	71	240	24	4.2	32
	11,000	-7	70	190	29	4.9	38
	12,000	-9	70	145	35	5.8	47

Figure 3. Take-off performance

SECTION 5
PERFORMANCE

CESSNA
MODEL 172P

CRUISE PERFORMANCE

CONDITIONS:
2400 Pounds
Recommended Lean Mixture (See Section 4, Cruise)

PRESSURE ALTITUDE FT	RPM	20°C BELOW STANDARD TEMP			STANDARD TEMPERATURE			20°C ABOVE STANDARD TEMP		
		% BHP	KTAS	GPH	% BHP	KTAS	GPH	% BHP	KTAS	GPH
2000	2500	---	---	---	76	114	8.5	72	114	8.1
	2400	72	110	8.1	69	109	7.7	65	108	7.3
	2300	65	104	7.3	62	103	6.9	59	102	6.6
	2200	58	99	6.6	55	97	6.3	53	96	6.1
	2100	52	92	6.0	50	91	5.8	48	89	5.7
4000	2550	---	---	---	76	117	8.5	72	116	8.1
	2500	77	115	8.6	73	114	8.1	69	113	7.7
	2400	69	109	7.8	65	108	7.3	62	107	7.0
	2300	62	104	7.0	59	102	6.6	57	101	6.4
	2200	56	98	6.3	54	96	6.1	51	94	5.9
	2100	51	91	5.8	48	89	5.7	47	88	5.5
6000	2600	---	---	---	77	119	8.6	72	118	8.1
	2500	73	114	8.2	69	113	7.8	66	112	7.4
	2400	66	108	7.4	63	107	7.0	60	106	6.7
	2300	60	103	6.7	57	101	6.4	55	99	6.2
	2200	54	96	6.1	52	95	5.9	50	92	5.8
	2100	49	90	5.7	47	88	5.5	46	86	5.5
8000	2650	---	---	---	77	121	8.6	73	120	8.1
	2600	77	119	8.7	73	118	8.2	69	117	7.8
	2500	70	113	7.8	66	112	7.4	63	111	7.1
	2400	63	108	7.1	60	106	6.7	58	104	6.5
	2300	57	101	6.4	55	100	6.2	53	97	6.0
	2200	52	95	6.0	50	93	5.8	49	91	5.7
10,000	2600	74	118	8.3	70	117	7.8	66	115	7.4
	2500	67	112	7.5	64	111	7.1	61	109	6.8
	2400	61	106	6.8	58	105	6.5	56	102	6.3
	2300	55	100	6.3	53	98	6.0	51	96	5.9
	2200	50	93	5.8	49	91	5.7	47	89	5.6
12,000	2550	67	114	7.5	64	112	7.1	61	111	6.9
	2500	64	111	7.2	61	109	6.8	59	107	6.6
	2400	59	105	6.6	56	103	6.3	54	100	6.1
	2300	53	98	6.1	51	96	5.9	50	94	5.8

Figure 4. Cruise performance

1.7. Meteorological information

Figures 5 and 6 show the maps for hazardous weather and wind and temperature at FL050, respectively, provided by AEMET for 19 March.

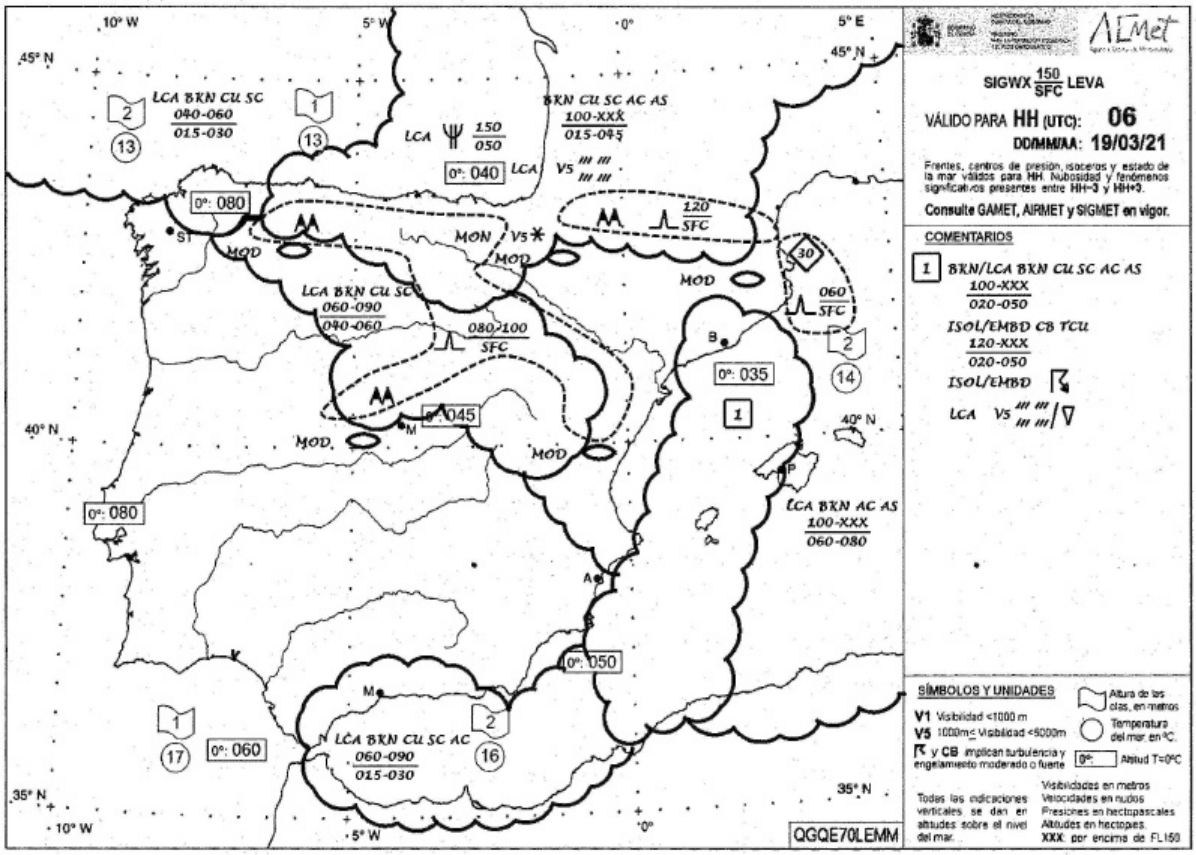

Figure 5. Hazardous weather map

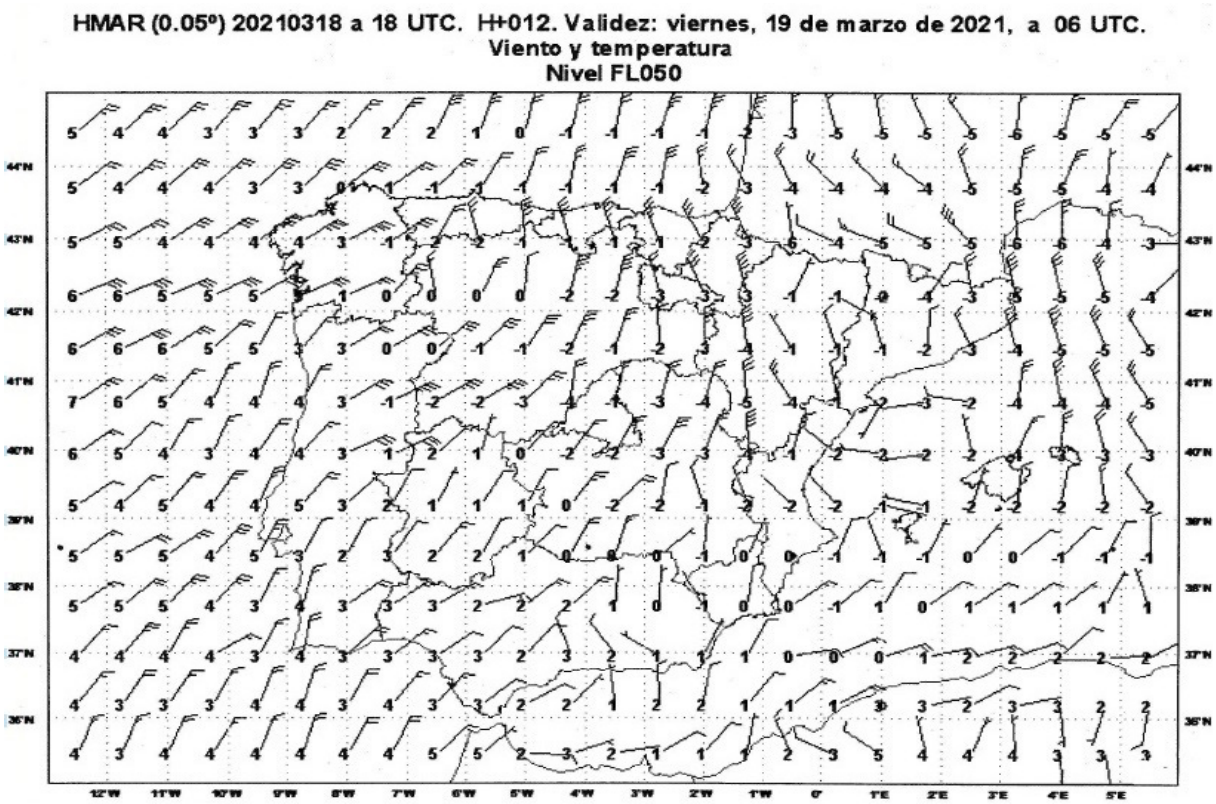

Figure 6. Wind and temperature at FL050 map

The METARs for the Cuatro Vientos and Getafe Airports around the time of the accident were:

METAR LECU 190900Z 26005KT 9999 FEW024 07/M00 Q1015=

METAR LEGT 190900Z 27004KT 230V310 CAVOK 07/M01 Q1015=

1.8. Aids to navigation

N/A.

1.9. Communications

N/A.

1.10. Aerodrome information

N/A.

1.11. Flight recorders

The aircraft was not equipped with a flight data or cockpit voice recorder because they are not a regulatory requirement for this type of aircraft.

1.12. Aircraft wreckage and impact information

The pilot landed on farmland about 20 km north of the Camarenilla Aerodrome and 4 km south of the Casarrubios del Monte Aerodrome. After the landing, the properties of the terrain caused the aircraft to flip over and remain in an inverted position, as can be seen in the two images in Figure 7.

Figure 7. Final position of the aircraft

The nose leg had detached, and there were track marks on the ground made by the landing gear and the impact of the propeller cone.

According to the head of the school, fuel was seen spilling from the tanks, although the amount of fuel remaining in the aircraft at the time of the landing is unknown.

1.13. Medical and pathological information

Both occupants were unharmed.

1.14. Fire

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

1.15. Survival aspects

The aircraft's cabin was not deformed in any way that could have endangered the lives of the crew. The safety seat belts fulfilled their restraining function, with both occupants being unharmed and able to exit the aircraft without assistance.

1.16. Tests and research

1.16.1. Aircraft inspection

The aircraft was removed from the scene of the accident and transported to Cuatro Vientos Airport, where it was subsequently examined.

The inspection found minor deformations to the fuselage and vertical stabiliser, produced by the impact with the ground when the aircraft flipped over.

There was no damage to the propeller blades, which suggests they weren't rotating on landing.

The aircraft engine was removed for an external visual inspection which found nothing unusual other than the presence of soil due to the impact when the aircraft overturned.

The spark plugs were removed, finding that both the plugs and their electrodes were in good condition, with no signs of damage. When the crankshaft was rotated, there was equal compression in all the cylinders. The oil level was correct, and on removing the magneto housing, all the contact points were found to be open and in good condition.

Traces of fuel were found in the carburettor tank. The carburettor heating system was deformed by the impact, but its various parts (butterfly valve, rubber gasket, throttle shaft roller bearings) were in good condition.

Figure 8. Engine and carburettor heating air intake

Images of the engine and carburettor heating system are shown in Figure 8.

1.16.2. Fuel consumption information

Based on the information provided by the crew, we have estimated the amount of fuel consumed. The attached tables show the flight plan data for the LECU-LEZL flight made on 18 March and the return flight on 19 March.

According to the data, on the outbound flight they started the engines at 17:20 h, took off at 17:45 h, and landed in Seville at 19:50 h. They then taxied to the runway head at 19:55 h to take off again for a local flight. After performing five landings and take-offs, they then left the traffic pattern via waypoint S, skirted Seville via waypoint W and re-entered the pattern at waypoint N. They did not have to perform any holding manoeuvres and landed at 21:05 h on runway 09 before taxiing to the general aviation parking apron, which took about 10 min.

Flight callsign: EC-FJS	Origin AD: LECU	Destination AD: LEZL	1st Alternative AD: LEMT	2nd Alternative AD: LEJR

Total distance: 207.4 NM	Total fuel: 50	Date: 18-03-21 / Sunset: 18:26Z	ETD: 17:20	ATD: 17:50

REPORTING POINTS	COM Ident / Freq	NAV Ident / Freq	Rmt / Alt/Fl	TAS / GS	Leg distance / Remaining	TIME ETE / ATE	TIME ETA / ATA	FUEL Estimated / Surplus
LECU-W	TOWER 118.700		261º	100	6.9	4’	17:54	0.6
			3,000’	100	200.5	4’	17:54	49.4
W-TLD	MADRID 124.230	TLD 113.2	220º	100	29.4	18’	18:12	3
			3,500’	90	171.1	16’	18:10	46.4
TLD-Cabañero	133.200		210º	100	26.2	16’	18:28	2.00
			6,500’	112	144.9	13’	18:23	44.4
Cabañeros-HIJ	133.200	HIJ 114.7	201º	100	68.4	41’	19:09	4.1
			7,500’	115	76.5	37’	19:49	40.3
HIJ-N LEZL		SVL 113.7	215º	100	68.6	41’	19:50	4
			1,100’	115	7.9	49’	19:49	36.3
N-LEZL	TOWER 118.100		188º	100	7.9	5’	19:55	0.5
			1,100’	110	0	5’	19:54	35.8
TOTAL					**207.4**	**02:05** / **02:04**		**35.8**

LECU-W: a time of 4 min and consumption of 0.6 gallons was estimated for the leg between take-off and waypoint W. In the “Time, Fuel and Distance to climb” table in Figure 2, the aircraft manufacturer establishes a consumption of 1.1 gal for start-up, taxi and take-off. This must be added to the calculation, giving a total consumption of 1.7 gal.

W-TLD: The estimations for this leg were 29.4 NM, 3500 ft of altitude, a TAS of 100 kt and a time of 18 min with a consumption of 3 gal. The actual flight time recorded for the leg was 16 min, which means that according to the “Cruise Performance” table (Figure 3), with a standard temperature and a power setting of around 55%, the approximate fuel consumption would be 6.2 GPH, which means the actual consumption for this leg was 1.65 gal.

TLD-Cabañeros: the estimations for this leg were 26.2 NM, 6500 ft of altitude, a TAS of 100 kt and a time of 16 min with a consumption of 2 gal. The actual flight time recorded was 13 min.

The aircraft first climbed from 3500 ft to 6500 ft. In the "Time, Fuel and Distance to Climb" table, we can see that the climb takes about 6 min and consumes approximately 1.2 gal of fuel.

The remainder of the leg lasted 7 min at 6500 ft. Therefore, based on the "Cruise Performance" table and a power setting of 2200 RPM, the approximate fuel consumption would be 5.9 GPH, resulting in an actual consumption for this leg of 0.68 gal.

If we add the two values together, we get a total consumption for the leg of 1.88 gal.

Cabañeros-HIJ: the estimations for this leg were 68.4 NM, a speed of 100 kt and 7500 ft of altitude, with a time of 41 min and a consumption of 4.1 gal. The actual flight time recorded for the leg was 37 min.

In this leg, the aircraft climbed from 6500 to 7500 ft. The relevant table tells us that the climb would have taken about 3 min and consumed approximately 0.4 gal.

The remainder of the leg lasted 34 minutes with a consumption rate of 6.2 GPH, meaning that 3.51 gal were consumed.

Taking both sections of the leg into account, the aircraft consumed a total of approximately 3.91 gal.

HIJ-N LEZL: the estimations for this leg were 68.6 NM, 1100 ft of altitude, 41 min, and a fuel consumption of 4 gal at 100 kt. The actual flight time recorded for the leg was 49 min.

We can assume that the first part of the leg lasted for 20 min at an altitude of 7500 ft, resulting in a consumption rate of 6.1 GPH. The second part began when they initiated the descent to 1100 ft after passing the mountain range; it lasted for 29 min with a consumption rate of 6.3 GPH.

In these two sections, the aircraft consumed 2.03 gal and 3.04 gal, respectively, giving a total fuel consumption of 5.07 gallons.

N-LEZL: in this leg the aircraft maintained 1100 ft of altitude for 5 min at a speed of 100 kt, resulting in a consumption rate of 6.3 GPH and a total fuel consumption of 0.5 gal.

Taking into account the fuel consumed in each leg, the total amount of fuel consumed during the LECU-LEZL flight was 14.71 gal.

After landing, the crew opened a new local flight plan. This second flight consisted of five landings and take-offs and visual navigation via the Seville CTR reporting points,

taking off at 20:00 h and landing at 21:05 h. The instructor also indicated that the taxi to the general aviation parking apron was a long one, taking approximately ten minutes.

The fuel calculations for this flight are based on an altitude of 1000 ft, standard temperature, and a power rating of 2400 RPM. In addition, the POH indicates that the aircraft consumes 1.1 gal during start-up, taxi and take-off. According to the tables, a consumption rate of approximately 7.7 GPH would have resulted in a consumption of 8.3 gal during the flight, which, when added to the consumption during start-up, taxi and take-off, gives a total consumption of 9.4 gal.

Thus, the total fuel consumption on 18 March was approximately 24.11 gal, leaving 25.89 gal of fuel in the tanks for the return flight on 19 March.

According to the crew, the following day (19 March), they carried out the pre-flight inspection and verified that they had approximately half a tank of fuel left. As this was sufficient for the return flight to Cuatro Vientos, they decided not to refuel. After the pre-flight inspection, they requested start-up and waited for twenty minutes with the engine running before taking off at 07:10 h. They then left the traffic pattern at waypoint N and climbed to 6500 ft. There was a headwind of up to 20 kt throughout the flight, and they maintained altitude until they had passed the Montes de Toledo. When they neared the Cabañeros area, they requested clearance from Control to begin the descent before entering the TMA. They adjusted the power to 2100-2200 RPM and began the descent to 5500 ft. Although there were clouds in the area they managed to avoid them, and with the help of the GPS, set a direct course to waypoint S at Cuatro Vientos, continuing the descent to 4500 ft.

Flight callsign: EC-FJS	Origin AD: LEZL	Destination AD: LECU	1st Alternative AD: LEMT	2nd Alternative AD:

Total distance: 207.4 NM	Total fuel:	Date: 19/03/2021 Sunset:	ETD: 06:27	ATD: 06:27

REPORTING POINTS	COM Ident / Freq	NAV Ident / Freq	Rmt / Alt/Fl	TAS / GS	Leg distance / Remaining	TIME ETE / ATE	TIME ETA / ATA	FUEL Estimated / Surplus
LEZL-N	TOWER 118.1	SUL 113.7	008º	100	7.9	5’	06:32	0.6
			1,100’	90	199.5	6’	06:33	27.4
N-HIJ		HIJ 114.7	035º	90	68.6	46’	07:18	6
			6,500’	80	130.9	54’	07:27	21.4
HIJ-Cabañeros	133.2	HIJ 114.7	021º	100	68.4	41’	07:59	4.1
			6,500’	85	62.5	54’	08:21	17.3
Cabañeros-TLD	MADRID 124.23	TLD 113.2	030º	100	26.2	16’	08:15	1.6
			5,500’	90	36.3	19’	08:40	15.7
TLD-SLECU	MADRID 124.23	TLD 113.2	049º	100	29.4	18’		1.76
			3,500’		6.9			13.94
S-LECU	TOWER 118.7		035º	100	7.9 0	4’		0.5
			3,000’					13.44
TOTAL					**207.4**	**02:10**		**13.44**

LEZL-N: the planned duration for this leg was 5 min, but the actual time subsequently recorded was 6 min. The approximate consumption in this leg was 1.1 gal for start-up, taxi and take-off plus 0.7 gal consumed during the flight. 1.8 gal in total.

N-HIJ: the planned duration for this leg was 46 min, but the actual time subsequently recorded was 54 min, during which time the aircraft climbed to 6500 ft. According to the “Time, Fuel and Distance to Climb” table, the climb took 10 min and consumed approximately 1.9 gal. The remainder of the leg lasted for 44 min with a consumption rate of 6.4 GPH, giving a fuel consumption of 4.69 gal. Therefore, the approximate total consumption was 6.59 gal.

HIJ-Cabañeros: the planned duration for this leg was 41 min, but the actual time subsequently recorded was 54 min, resulting in a fuel consumption of 5.76 gal.

Cabañeros-TLD: the planned duration for this leg was 16 min, but the actual time subsequently recorded was 19 min, resulting in a fuel consumption of 2 gal. The flight plan notes indicate that the aircraft reached the VOR TLD, but according to the information provided by the instructor, the engine began to misfire at 4500 ft over the River Tagus, between the Castrejón reservoir and Toledo. Therefore, it is unknown whether or not they reached that point. Up until this point, the flight had taken 2:13 h and according to our calculations, there would have been approximately 9.74 gal of fuel left in the tank.

According to the information provided, the emergency landing took place at 10:05 h, giving a total flight time of 2:55 h. In the remaining 42 min of the flight, the crew went to the Camarenilla Aerodrome, carried out the approach and go-around manoeuvres and then proceeded northwards, where they made the emergency landing at 40°11'41.97"N 04°02'53.20"O. During that time, at a power setting of 2400 RPM and a consumption rate of 7.3 GPH, 5.11 gal were used. Therefore, after the emergency landing, there was approximately 4.63 gal of fuel remaining in the tanks.

1.16.3. Potential for carburettor ice formation

The Cuatro Vientos and Getafe Airport METARs for 19 March at 10:00 h report dew-point temperatures of around 0ºC.

The graph in figure 9 shows the potential for ice to form in the engine, depending on the environmental conditions.

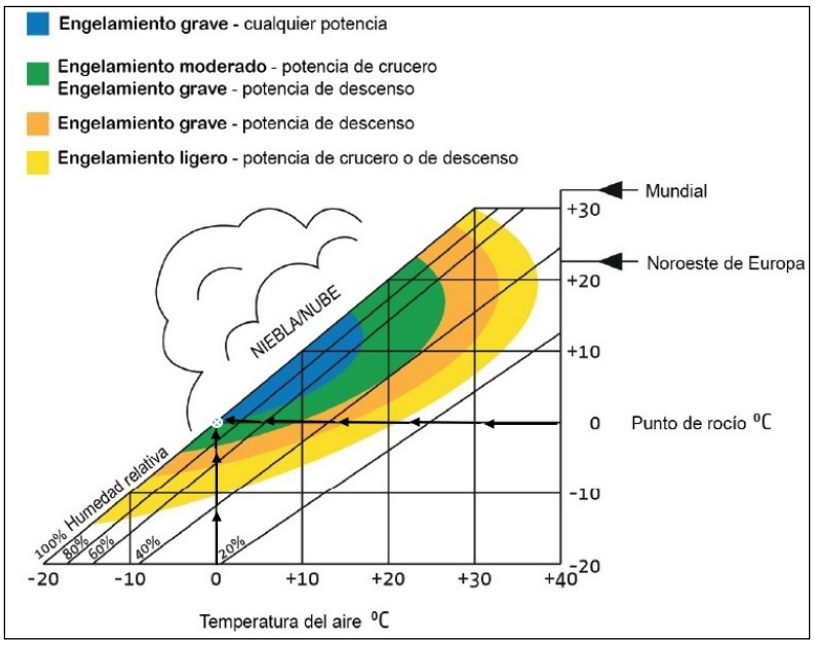

Figure 9. Graph showing the potential for ice formation in the carburettor

The hazardous weather map in Figure 4 shows ISO 0 at FL045 in the area and around the time of the accident. The graph indicates that for air and dew-point temperatures of 0ºC, there is a possibility of moderate ice formation while cruising and serious ice formation when descending (green zone).

1.17. Organisational and management information

AEROSPACE FLY S.L. training centre has AESA approval number E-ATO-291. It operates out of Madrid-Cuatro Vientos Airport.

1.18. Additional information

1.18.1. Annexe VII Part NCO. NCO.OP.125 Fuel and oil supply - Aeroplanes

a) The pilot-in-command shall only commence a flight if the aeroplane carries sufficient fuel and oil for the following:

(1) for visual flight rules (VFR) flights:

(ii) by day, to fly to the aerodrome of intended landing and thereafter to fly for at least thirty minutes at normal cruising altitude.

1.19. Special investigation techniques

None required.

2. ANALYSIS

2.1. Fuel consumption

The aircraft took off on 18 March from Cuatro Vientos Airport for a training flight to Seville, with the return flight being scheduled for the following day. The tanks were fully refuelled, providing 50 gal of usable fuel. According to the POH, based on a flight plan with a 55% power setting (the most efficient performance setting), the aircraft would have been able to fly for approximately seven hours without refuelling.

According to the information in the flight plan, the LECU-LEZL flight took 2:04 h, 1 min less than the time initially calculated. Our fuel consumption calculations for the outbound flight were based on the data recorded by the crew but also took into account an additional 1.1 gal for start-up, taxi and take-off, as per the indications of the aircraft manufacturer.

According to the data provided by the crew, the return LEZL-LECU flight the following day took longer than initially planned due to a headwind throughout, with the corresponding increase in fuel consumption. Thus, we calculated that based on a power setting of 55%, there would have been 4.63 gal of fuel in the tanks at the time of the emergency landing. That said, it's important to note that the actual consumption may have been higher because it's unlikely they would have maintained a single power setting throughout the flight.

Although we were unable to verify the actual quantity of fuel remaining in the tanks after landing, we can confirm that when the emergency landing occurred, the aircraft did not have enough fuel to fly, by day, to the aerodrome of intended landing and thereafter for at least thirty minutes at normal cruising altitude. Given the estimated fuel consumed, the engine outage was likely related to a lack of fuel. The earlier misfires could have been caused by the formation of ice in the carburettor.

With regard to the fuel seen spilling onto the ground after the emergency landing, we would point out that, according to the POH, these types of tanks contain 4 gal of unusable fuel.

2.2. Ice formation in the carburettor

The crew reported that the engine began misfiring over the River Tagus at 4500 ft. This was followed by a reduction in power, resulting in a gradual loss of altitude. The hazardous weather map in Fig 4 showed ISO 0 in the area at FL45, and the METARs indicated a dew-point of 0ºC. Therefore, according to the graph shown in Fig. 8, the conditions at the time were favourable for carburettor icing.

According to the information provided, after switching on the carburettor heating and selecting different power settings, the engine recovered and functioned normally while flying over the Camarenilla Aerodrome. It's possible, therefore, that the power loss was

caused by the formation of ice in the carburettor, which would have been resolved by switching on the heating. This sequence of events would be compatible with the fact that the engine started to function normally again, allowing them to climb to 3500 ft and continue the flight for a further 20 km. According to the crew, the heating remained on throughout the last part of the flight, making it unlikely that ice would have reformed on the carburettor and caused the engine to shut down completely.

Based on the above, we cannot rule out the possibility that the momentary power loss and subsequent engine outage were caused by the existing environmental conditions and fuel management, respectively. Therefore, the flight planning in regard to these factors is deemed to have been inadequate.

3. CONCLUSION

3.1. Findings

- After fully refuelling the tanks, the crew took off from Cuatro Vientos Airport for a training flight to Seville.
- They performed several landings and take-offs at the destination, in addition to a local flight.
- After the engine failure during the return flight, the crew carried out an emergency landing on farmland in the municipality of Casarrubios del Monte.
- No evidence of aircraft or engine malfunction was found.
- The fuel consumption calculations (based on the most economical power setting) indicate that there would have been 4.63 gal of fuel remaining at the time of the landing.
- The environmental conditions at the time were favourable for the formation of ice in the carburettor.

3.2. Causes/contributing factors

The cause of the accident was the performance of an off-airfield emergency landing due to inadequate flight planning.

4. RECOMMENDATIONS

No recommendations are issued.