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Report
ULM A-025/2016

Accident involving a Mainair Gemini Flash 2A aircraft, registration EC-ILC, in Malgrat de Mar (Barcelona, Spain) on 1 December 2016

GOBIERNO DE ESPAÑA

MINISTERIO DE FOMENTO

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SUBSECRETARÍA
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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 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

° ' "	Sexagesimal degrees. Minutes and seconds
° C	Degrees centigrade
AEMET	National Weather Agency
AESA	National Aviation Safety Agency
cm	Centimeters
E	East
FI (WSC)	Weight-shift control flight instructor
FI (MAF)	Multi-axis fixed-wing ultralight flight instructor
ft	Feet
g	Acceleration due to gravity
H	Hours
HP	Horse Power
HPa	Hectopascals
Kg	Kilograms
Kg/dm^3	Kilograms per cubic decimeter
Km	Kilometers
Km/h	Kilometers per hour
Kt	Knots
L	Liters
l/h	Liters per hour
m	Meters
m^2	Meters squared
MAF	Multi-axis fixed wing
N	North
QNH	Atmosphere pressure adjusted to mean sea level
rpm	Revolutions per minute
TULM	Power ultralight pilot license
ULM	Ultralight Motorised Aircraft
V_A	Maneuvering speed
V_{NE}	Never exceed speed
VFR	Visual flight rules
WSC	Weight-shift control rating

Synopsis

Owner and operator:	Private
Aircraft:	MAINAIR GEMINI FLASH 2A, EC-ILC
Date and time of accident:	Thursday, 1 December 2016 at 10:10 h[1]
Site of accident:	Malgrat de Mar (Barcelona, Spain)
Persons aboard:	1 flight crew and 1 passenger, not injured
Type of flight:	General aviation– Private
Flight rules:	VFR
Phase of flight:	En route
Date of approval:	7 June 2018

Summary of incident:

On Thursday, 1 December 2016, a Mainair Gemini Flash 2A, registration EC-ILC, took from the Palafolls airfield on a local flight lasting 30 minutes. Aboard the aircraft were an instructor and a passenger.

Shortly after takeoff, the engine began giving signs of failing and eventually stopped, which forced the pilot to look for a field in which to make an emergency landing.

During the landing, the nose wheel gave way and stuck in the ground, causing the aircraft to flip over.

The instructor and passenger were uninjured and exited the airplane under their own power.

The aircraft was heavily damaged.

The investigation has determined that the accident was caused by an off-field landing on highly irregular terrain due to the stoppage of the engine in flight. The engine was stopped by not having enough fuel in the front tank, which had been selected on the ground before the flight, after having transferred the fuel to the rear tank.

1 All times in this report are local unless specified otherwise.

1. ACTUAL INFORMATION

1.1. History of the flight

On Thursday, 1 December 2016, a Mainair Gemini Flash 2A, registration EC-ILC, took from the Palafolls airfield (Barcelona) to make a local flight lasting 30 minutes. Aboard the aircraft were an instructor and a passenger.

Figure 1. Condition of aircraft after impact

They were planning to do an introductory flight[2] because the passenger wanted to take the ultralight pilot course.

Shortly after takeoff, the engine began giving signs of failing and eventually stopped. The pilot notified the passenger they would have to make an emergency landing and looked for a suitable field.

During the landing, the nose wheel gave way and stuck in the ground, causing the aircraft to flip over.

Neither occupant was injured and they exited the airplane under their own power..

1.2. Injuries to persons

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

2 Regulation EU 965/2012 of the Commission of 5 October 2012 defines an introductory flight as any short-duration flight made in exchange for remuneration or other valuable consideration that is offered by a recognized training organization or an organization created for the purpose of promoting aerial sports or recreational aviation, in order to recruit new students or new members.

1.3. Damage to aircraft

The aircraft was heavily damaged.

1.4. Other damage

The field where the emergency landing took place, on which vegetables were planted, was damaged.

1.5. Personnel information

The pilot, 51, had an ultralight pilot license (TULM) issued by the National Aviation Safety Agency (AESA) on 14 October 1992 with weight-shift control (WSC), shift-control ultralight instructor (FI WSC), multi-axis fixed-wing (MAF) and multi-axis fixed-wing ultralight instructor (FI MAF) ratings, all of them valid until 30 November 2017. He also had the corresponding medical certificate, which was valid until 29 October 2017.

He had a total of 2,500 flight hours, of which 1885:30 had been on the type

1.6. Aircraft information

1.6.1. General information

The GEMINI FLASH 2A is a single-engine powered ultralight with a swinging delta wing[3], and is outfitted with a fixed tricycle landing gear. It was manufactured in the United Kingdom in 1995 by MAINAIR SPORT Ltd. with serial number 1057-1195-7-W855.

It has a wingspan of 10.6 m, a length of 3.4 m and a maximum height of 3.83 m. It has a wing surface area of 15.56 m^2, an empty weight of 151 kg and a maximum takeoff weight of 370 kg.

Its maneuvering speed (V_A) is 38 Kt (70,3 km/h), its stall speed with maximum takeoff weight is 24 Kt (44 km/h) with a single occupant and its never-exceed speed (V_{NE}) is 77 Kt (142.6 km/h).

It was equipped with a Rotax 503-2V two-cylinder engine, with serial number 4489143, with a maximum power of 47 HP at 6800 RPM. It had a three-blade,

3 Also known as trikes, the flight is controlled by shifting the center of gravity.

157.48-cm diameter wood propeller installed with a variable pitch that could be adjusted on the ground.

According to the engine user manual, the fuel consumption for this model is 25 l/h at takeoff, 15 l/h in cruise at 75% power.

It had a valid school-3-normal[4] category special restricted certificate of airworthiness issued by the National Aviation Safety Agency (AESA) on 17 July 2002.

Its last maintenance check had been conducted by the same pilot on 30 July 2016, with 1125:50 h on the aircraft.

1.6.2. Aircraft weight on takeoff

Assuming each occupant weighed85 kg, the takeoff weight would have been:

- Empty weight:	151 kg
- Pilot:	85 kg
- Passenger:	85 kg
- Fuel in the rear tank (18 l)[5]	13 kg
- Fuel in the front tank (5,4 l)	4 Kg
- TAKEOFF WEIGHT:	**338 kg**

1.6.3. Fuel system

The fuel system has a tank located under the engine, and is thus behind the occupants' seats.

It also has an optional tank located under the occupants' seats.

Both tanks are removable to facilitate their remote filling and the front tank has to be removed to allow the structure to fold during wing assembly.

A selector valve can be used to select the tank that is supplying fuel to the engine.

The total capacity of both tanks is 44 l.

4 School (type of flight made by aircraft) - 3 - (aircraft used for visual flight only) normal (aerobatic flying or tailspins prohibited).

5 The density of 95-octane gasoline is between 0.709 and 0.727 kg/dm^3 at 15° C, but for calculation purposes, an average density of 0.71 kg/dm^3 is assumed

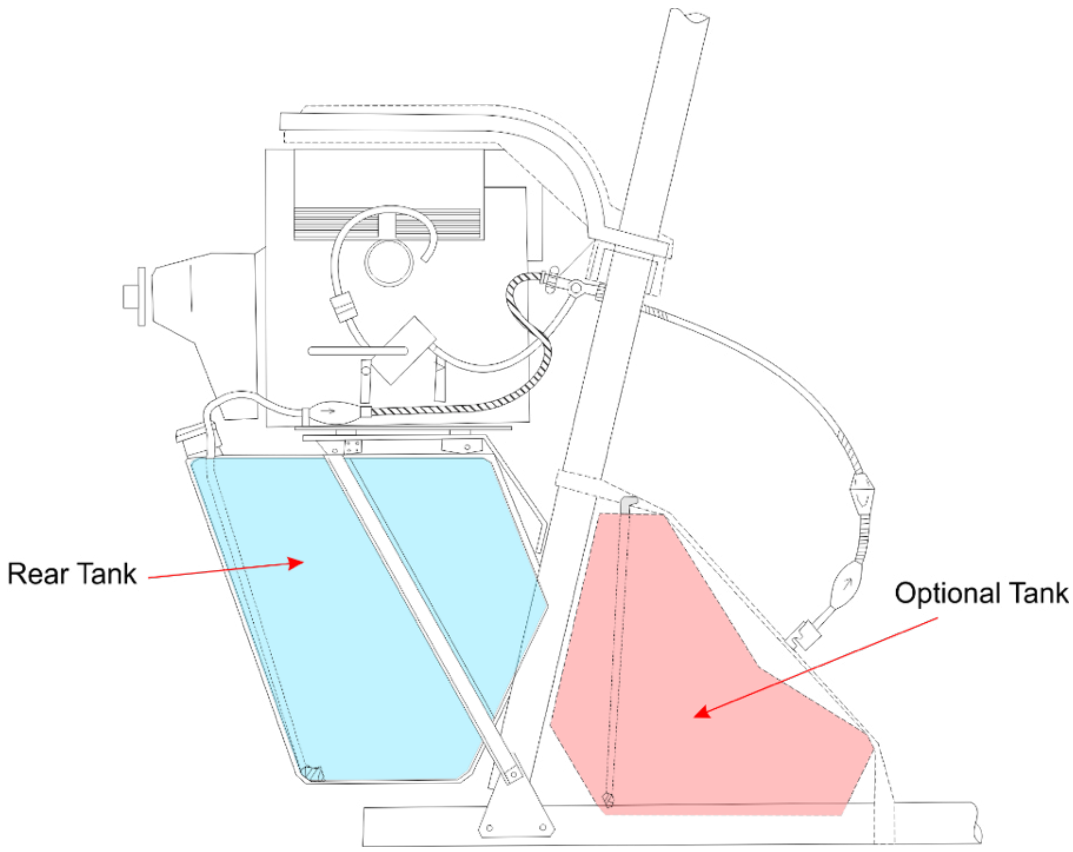

Figure 2. Diagram of fuel system

The aircraft manual instructs to check the position of the fuel valve during the pre-flight inspection.

1.7. Meteorological information

The source of the information provided by the National Weather Agency (AEMET) was the weather station in Santa Susana (Barcelona), located 5 km southwest, and the one in Blanes (Girona), 5 km northwest.

Santa Susanna:

Temperature: 10°C, relative humidity 78 %, average wind speed 6 km/h, gusting to 14 km/h, from the northeast veering to the southwest.

Blanes:

Temperature 11.8°C, relative humidity 73 %, average wind speed 4 km/h, gusting to 10 km/h, from the northwest rolling to the southwest.

There were few clouds and the QNH at the closest airports was 1027 HPa (Girona) and 1028 Hpa (Barcelona-El Prat).

In summary, there were no significant weather phenomena at the time or place of the accident.

1.8. Aids to navigation

The flight was taking place under visual flight rules.

1.9. Communications

This ULM was not equipped with a radio.

1.10. Aerodrome information

The Palafolls airfield is located in the town of the same name, in the province of Barcelona. It is at an elevation of 46 ft (14 m) and it has one 600-m long dirt/grass runway in a 12/30 orientation.

1.11. Flight recorders

The aircraft was not equipped with any recorders, nor was it required to by aviation regulations.

1.12. Wreckage and impact information

The accident took place in a vegetable field that is located some 100 m away from the junction of road B-682 and the N-II highway, in the town of Malgrat de Mar, part of the judicial district of Arenys de Mar (Barcelona), at coordinates 41° 39' 24.85" N - 2° 44' 2.94" E. The field was plowed with furrows oriented north to south.

The aircraft landed toward the west and traveled approximately 21 m beyond the first mark it left on the ground until it came to a stop. The initial impact was with the left main landing gear wheel.

This was followed by a second impact 0.90 m away, and a third, also 0.90 m further forward.

The final touch down on the main gear occurred approximately 2 m away from this last mark. Further on there were wheel marks left by the front gear over some 10 m, until the front leg finally collapsed, causing the aircraft to tip over on its right side, with the front part facing south.

The front landing gear collapse, and did a hole in the front of the fuselage. The flight controls were broken, as were the flight instruments in the cockpit. One propeller blade was also broken. At the accident site, the pilot noticed that the fuel valve was selected to draw from the front tank.

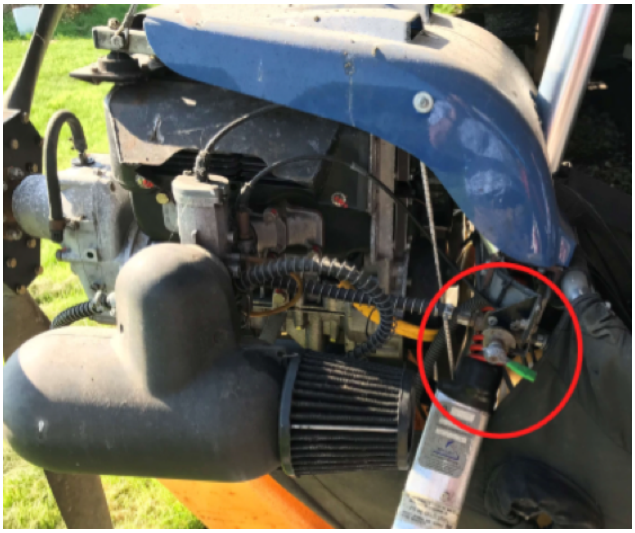

Figure 3. Fuel selector valve

1.13. Medical and pathological information

Not applicable in this case.

1.14. Fire

There was no fire.

1.15. Survival aspects

Neither the seats nor the seat belts broke or failed. Both worked properly to restrain the aircraft's occupants. The helmets worn by the occupants also kept them from receiving head injuries.

The emergency services were notified at 10:20, and several public safety units from the regional police reported to the site, along with the local police, firefighters and one ambulance.

The two occupants were taken to the Blanes county hospital, where they underwent a thorough medical exam.

1.16. Tests and research

1.16.1. Information provided by the pilot

The pilot reported that before taking off, he verified that there was not enough fuel in both tanks to make the flight as planned, if each tank is considered separately. He thus decided to transfer fuel from the front to the rear tank, which was left with approximately 18 l, an amount he calculated would allow him to fly for approximately one and a quarter hours.

He did it this way because the rear tank is more visible and thus easier to check in flight than the front tank. The planned duration of the flight was around 30 minutes. He planned to fly to the coast and return to the airfield, which should not have been a problem with the amount transferred.

As he stated, after transferring the fuel, he made the mistake of leaving the fuel selector valve to supply fuel from the front tank.

The pilot said that there was some fuel remaining in the front tank, but he could not specify how much.

After transferring the fuel, he did the pre-flight check and started the engine. The engine had been running for some 12 minutes before the two-minute taxi to the runway, after which he took off.

After they had been in the air for about 10 minutes, the engine stopped and he had to find a place to make an emergency landing. He found a crop field with no apparent obstacles and decided to land there.

After landing, the aircraft tipped over. After he was helped by medical emergency personnel, he recalled that after transferring the fuel, he may not have selected the right fuel tank to supply the engine.

1.16.2. Information provided by the passenger

The passenger said that he wanted to obtain his ultralight pilot license, and so on 1 December he met with the instructor for the first time and went to the Palafolls airfield.

The instructor explained to him a little about how the ultralight worked and then, at about 10:00, they climbed aboard to start the flight.

He said that the takeoff was very good and after they had been in the air for about 15 minutes, the instructor informed him that the engine had stopped. They were flying over the town of Tordera. At first he thought it was a joke, but the instructor's reaction and heavy breathing indicated that it was not

The instructor made a very sharp turn looking for some place to land, and they went straight toward a tree top and from there to the ground.

Later an ambulance arrived and he was seen by medical personnel.

Right there the pilot told him that he knew what had happened, telling him that he had mistakenly selected the wrong tank and opened the one without gasoline, and that they had been flying without fuel.

1.17. Organizational and management information

Not applicable.

1.18. Additional information

None.

1.19. Useful or effective investigation techniques

Not applicable in this case.

2. ANALYSIS

The pilot reported that after making the transfer, there were approximately 18 l left in the rear tank.

Based on his statement, they were on the ground with the engine running a total of 14 minutes (0.23 h), of which 12 were at idle and another 2 taxiing to the threshold to take off. The minimum fuel consumed during this time would have been around 1 l.

Assuming that the takeoff phase lasted 5 minutes (0.083 h), a further 2 l would have been consumed during this phase.

This would have left 15 l, which should provide for 60 minutes of cruise flight, meaning he had sufficient fuel to fly double the planned flight time.

However, contrary to what he thought, the engine was being supplied by the front tank, not the rear one.

Repeating this same calculation and assuming a consumption of 3 l prior to reaching the cruise phase, in order to have flown 10 minutes (0.16 h), there would have to have been an additional 2.4 l in the front tank.

In total, after making the transfer, there would have been at least 5.4 l left in the front tank.

The aircraft manual clearly states that the position of the fuel valve must be checked during the pre-flight inspection. In this case, as the pilot himself recognized, he either did not check it or did not realize that he had not left it in the desired position, that is, supplying the engine from the rear tank. In other words, he had a mental lapse and made an involuntary mistake that results from an error or oversight.

He did not realize it during the flight, but even if he had noticed his mistake, the position of the valve makes it hard to operate while airborne.

Had he noticed it, he could have at least returned to the airfield or had more time to choose a more suitable field in which to make an emergency landing.

Once the engine stopped, he saw a field that seemed to offer good conditions for making an emergency landing, but in reality, since it was plowed, it had furrows that made it difficult to taxi after landing.

In landings of this type, the correct technique is to land in the direction of the furrows, as this makes it easier to taxi. Landing perpendicular to the furrows increases the odds that the wheels will dig into the ground and collapse, causing the airplane to overturn, as happened in this case.

3. CONCLUSIONS

3.1. Findings

- The pilot and aircraft had all of the documentation necessary to make the flight.
- The weather conditions were not limiting for a visual flight.
- The pilot transferred fuel from the front to the rear tank on ground.
- The pilot selected the fuel valve to supply the engine from the front tank.
- There was insufficient fuel in the front tank to fly for the planned duration of the flight.
- No attempt was made to change the position valve in flight.
- The pilot did not notice the mistake during the flight. He realized it after the accident.
- The engine stopped mid-flight.
- He landed in a plowed field perpendicular to the furrows.
- During the landing the front wheel dug in, collapsed and the aircraft overturned.
- The occupants were not injured.

3.2. Causes / Contributing factors

The investigation has determined that the accident was caused by an off-field landing on highly irregular terrain due to the stoppage of the engine in flight. The engine was stopped by not having enough fuel in the front tank, which had been selected on the ground before the flight, after having transferred the fuel to the rear tank.

4. SAFETY RECOMMENDATIONS

None.