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COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report A–017/2015

Accident involving a TECNAM P2002JR aircraft, registration EC-KQG, at the Griñón airfield (Madrid) on 30 June 2015

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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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.

Contents

Abbreviations

ACC	Active Clearance Control
ARO	Air Traffic Services Reporting Office
ATS	Air Traffic Services
cl	Centiliters
CTR	Controlled Traffic Region
DWS	West Director Sector in south configuration
ENAIRE	Spanish Air Navigation Services Provider
EW	Empty Weight
Ft	Feet
Hpa	Hectopascal(s)
hr	Hour(s)
ISA	International Standard Atmosphere
Kg	Kilograms
km	Kilometers
Kt	Knots
L	Liters
LECU	Cuatro Vientos aerodrome
LEMT	Casarrubios aerodrome
LETJ	Trebujena aerodrome
LH	Left Hand
m	Meters
Mb	Milibars
MTOW	Maximum Take Off Weight
N	North
N/A	Not applicable
NM	Nautical Miles
PPL(A)	Private Pilot License (Airplane)
QNH	Altimeter sub-scale setting to obtain elevation when on the ground.
RH	Right Hand
SEP	Single Engine Piston
S/N	Serial Number
TWR	Tower

ULM	Powered ultralight
UTC	Universal Time Coordinated
VLA	Very Light Aircraft
W	West
WSS	West Southwest Sector in south configuration

Synopsis

Owner and Operator:	Private
Aircraft:	Tecnam P2002JR, registration EC-KQG
Date and time of accident:	Tuesday, 30 June 2015 at 13:30 local time[1]
Site of accident:	Griñon airfield (Madrid)
Persons onboard:	1, pilot, minor injuries.
Type of flight:	General aviation - Private
Date of approval:	28 September 2016

Summary of the accident:

The pilot was going to fly from the Cuatro Vientos aerodrome (LECU) to the Casarrubios aerodrome (LEMT), a flight estimated to last 20 minutes. The aircraft took off at approximately 13:00. After a few minutes in the air, the pilot, fearing he might succumb to heatstroke due to the temperature in the cockpit, decided to divert and land at the Griñón airfield, with which he was familiar. During the landing run he overshot the runway and the aircraft ran into the perimeter fence and turned over, coming to a stop on an embankment next to the M-407 road. The pilot sustained minor injuries, but the aircraft was heavily damaged.

While inspecting the aircraft at the accident site and later in a hangar at the airfield, it was found that there was no fuel in the wing tanks. The carburetors and pumps had some fuel, but less than usual. No signs were found that the aircraft and/or its components malfunctioned.

Investigators concluded that the accident occurred as a result of an improperly executed approach and landing by the pilot at an airfield other than the destination aerodrome specified in the flight plan, with a runway much shorter than those normally used by the pilot.

[1] All times in this report are local unless otherwise specified. To obtain UTC time, subtract 2 hours from local time.

Contributing to the accident were:

- the imminent lack of fuel due to improper flight planning,
- the high temperature and turbulent conditions associated with atmospheric instability,
- and the exceptional stress and concern generated by the two previous factors.

1. FACTUAL INFORMATION

1.1. History of the flight

The pilot co-owned the aircraft along with another partner. According to his account, both had come to an agreement to sell the aircraft and the pilot had gone to pick it up at the Cuatro Vientos aerodrome (LECU) following its annual inspection (100-hr check) to prepare it for the sale. His plan was to fly the aircraft from Cuatro Vientos to the Casarrubios aerodrome (LEMT), where the new owner would go pick it up a few days later. On the day of the accident, the pilot had wanted to do the flight at about 10:00, but due to unforeseen paperwork, he ended up leaving at 13:00. According to both the flight plan and the pilot's statement, the flight was expected to last 20 minutes. The pilot loaded the fuel using two jugs he had brought with him[2] and he took off from the Cuatro Vientos aerodrome at 12:53, as logged in the flight progress strip by the ATS provider. It was a June afternoon, it was hot and the aircraft had been parked out in the sun at the aerodrome. As a result, after a few minutes in the air, the pilot started to sweat and to feel hot, though he stated that he remained in control of the aircraft at all times. However, fearing that he could succumb to heatstroke, which would leave him incapacitated to fly, he decided to land at the Griñón airfield, an area he was familiar with. The pilot touched down about halfway down the runway and the aircraft continued to travel on until it went off the end of the runway and ran into the perimeter fence separating the airfield from the M-407 road. The aircraft flipped over (see appendix A), causing minor injuries to the pilot but significant damage to the aircraft.

[2] The aircraft's engine is able to run on automotive fuel (95 octane gasoline), which is not available at the Cuatro Vientos aerodrome.

Photograph 1. Aircraft after the accident

1.2. Injuries to persons

The pilot sustained minor injuries.

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal				
Serious				
Minor	1		1	N/A
None				N/A
TOTAL	1		1	

1.3. Damage to aircraft

The aircraft sustained heavy damage (see Section 1.12., Wreckage and impact information).

1.4. Other damage

The fence separating the ditch at the end of the airfield and the M-407 road was damaged over a span of about 23 meters.

1.5. Personnel information

The pilot, a 48-year old Spanish national, had a private pilot license (PPL(A)) with a single-engine piston (SEP) rating that was valid and in force until 30 November 2016, and a class 2 medical certificate that was valid and in force until 8 September 2016. According to the pilot's logbook, on 7 June 2015 the pilot had a total of 136:44 flight hours, of which 7:36 hours had been on the same type as the accident aircraft. His first flight with the aircraft had been on 9 May 2015. He had done 18 landings with that aircraft, according to the aircraft logbook, all of them at the Cuatro Vientos (LECU), Casarrubios (LEMT) and Trebujena (LETJ) aerodromes.

The information on his pilot's license showed that he was a resident of Griñón.

1.6. Aircraft information

The aircraft, a TECNAM 2002 JR, registration EC-KQG and serial number (S/N) 091, was built in 2008. It had a VLA category[3]. It was a two-seat (side-by-side), low-wing aircraft with retractable landing gear. It was equipped with a ROTAX 912 S3 engine and had a maximum takeoff weight (MTOW) of 580 kg and an empty weight (EW) of 398 kg. The aircraft had valid registration, airworthiness and insurance certificates, an Aircraft Station License and was based, according to its documentation, at the Casarrubios aerodrome (LEMT). It had a total of 363:54 flight hours.

The last flight recorded in the flight log had been on 25 June 2015 from the Casarrubios aerodrome to the Cuatro Vientos aerodrome. That was the same day that the aircraft was delivered to the maintenance center for its annual (100-hr) check.

[3] VLA- Very Light Aircraft, single-engine one- or two-seat aircraft with a MTOW below 750 kg and with a stall speed in a landing configuration not to exceed 45 kt.

Photograph 2. Photograph of the aircraft[4]

The aircraft had two fuel tanks, with a 49.5-liter usable capacity in each. In the ROTAX 912 S3 engine, the fuel bypasses the electric pump if it is not on and goes to the mechanical pump, which supplies the two carburetors. Any extra fuel on this aircraft goes to the left tank.

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

1.10) Fuel consumption

See table

Fuel consumption in l/h (US gal/h)	912 A/F/UL	912 S/ULS
At take-off performance	24.0 l/h (6.3 gal/h)	27.0 l/h (7.1 gal/h)
At max. continuous performance	22.6 l/h (5.6 gal/h)	25.0 l/h (6.6 gal/h)
At 75 % continuous performance	16.2 l/h (4.3 gal/h)	18.5 l/h (4.9 gal/h)
Specific consumption at max. continuous performance	285 g/kWh (0.47 lb/hph)	285 g/kWh (0.47 lb/hph)

Table 1. ROTAX fuel consumption

[4] Image taken from PlanePictures.net.

The fuel consumption at cruise power specified by TECNAM for ISA[5] atmospheric conditions, zero wind and a 600-kg MTOW are as follows:

ALTITUDE 6000 ft

Cruise pwr.	Prop. speed rpm	Manifold pres. inch HG	TAS kts	Performance hp	Fuel consum. lt/h
M.C.P.	2265	23	126	75	21,1
75%	2059	22	123	69	19,2
62,5%	1853	21	112	58	16,0

Table 2. TECNAM fuel consumption

The fuel gauges in the cockpit are of the type shown below:

Photograph 3. Cockpit fuel gauges

Based on this information, and if the ½ mark corresponds to 25 l, the second mark between 0 and ½ would correspond to ¼ full, or 12.25 l (+/- 5 l), as per the manufacturer's information.

1.7. Meteorological information

The weather information available was for the Cuatro Vientos airport, which is the closest to the accident site. Based on this information, between 08:30 and 13:30, the wind was from the south at 5.4 kt, there was good visibility on the surface, the sky was clear, the temperature was 37° C and QNH was 1015 hPa.

[5] ISA-International Standard Atmosphere- standard atmosphere at theoretical pressure and temperature conditions of air at sea level (15° C and 1013 mb).

1.8. Aids to navigation

The pilot did not use any navigational aids while landing at the Griñón airfield.

1.9. Communications

According to aircraft communications and information supplied by the ATS provider at the Cuatro Vientos aerodrome (LECU), the pilot contacted ground control at 12:42:41 and was cleared to taxi to the runway 10 holding point. QNH was 1018 and the squawk code was 0325. At 12:51:12, the pilot reported that he was at the holding point ready to take off. Ground control instructed him to hold position and to contact the control tower (local control). The pilot did so and was cleared to take off on runway 10 at 12:51:49. The wind was at 5 kt from 150º. At 12:58:43 the pilot reported clearing point W.

The communications records show that 8 minutes 49 seconds (from 12:42:41 until 12:51:30) elapsed between the pilot's initial contact with ground control until he was at the holding point and ready to take off and contacted the tower. Similarly, 7 minutes 26 seconds elapsed (from 12:51:30 until 12:58:56) between contacting the tower until the pilot signed off with the tower after going past point W and acknowledging the instruction to remain in contact with the tower.

According to the information provided by ENAIRE, there were no communications between the aircraft and ACC (DWS and WSS sectors).

Based on the flight progress strip and the ATS Log, at 12:53 aircraft EC-KQG took off normally after leaving[6] via point W. Half an hour later, the Civil Guard called to report an accident involving a light airplane, which the ARO[7] confirmed minutes later. After leaving via point W, the pilot did not contact the TWR to report anything out of the ordinary. The ARO office informed the tower that the pilot had contacted it, stating that he had been forced to make an emergency landing on the M-407 road due to thermals near the town of Griñón.

1.10. Aerodrome information

The Griñón airfield (currently closed) is located some 25 km southwest of the city of Madrid, at coordinates N 40°13'31" W 3°51'55. It is at an elevation of 2198 ft. It has one 434-m long runway in a 12/30 orientation (see Figure 4). The accident aircraft landed on runway 30.

[6] LECU traffic pattern and tower frequency.

[7] ARO (Air Traffic Services Reporting Office) at the LECU aerodrome.

Photograph 4. Aerial view of the Griñón airfield

The aircraft had departed from the Cuatro Vientos aerodrome (LECU), which is at an elevation of 2293 ft. On the day of the accident, it had one asphalt runway in a 10/28 orientation[8] . The runway in service and used to take off was 10. The flight plan showed Casarrubios (LEMT) as the destination aerodrome, with an estimated flight time of 20 minutes. The photograph below shows the geographical location of the three airfields and of point W, where the pilot last contacted ATC.

[8] Its current orientation is 09/27.

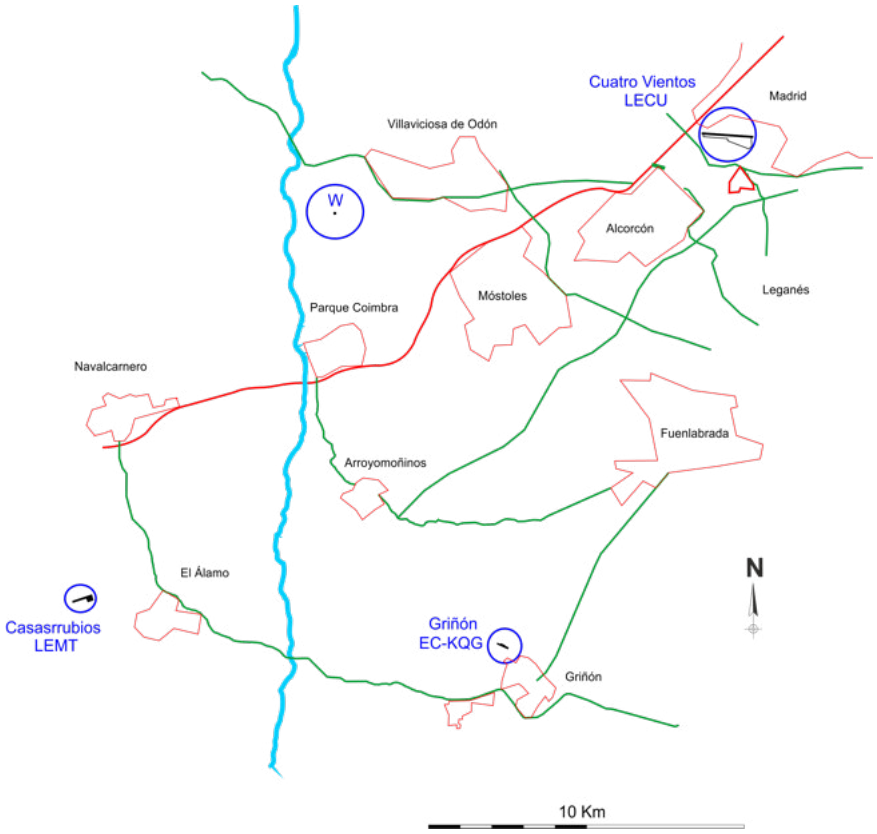


Figure 1. Locations of LECU, point W, LEMT and airfield

The straight-line distance from the threshold at the Cuatro Vientos aerodrome and reporting point W is 7.21 NM, and between point W and the threshold at the Griñón airfield runway it is 8 NM.

The aerodromes on which the pilot had landed using the accident aircraft were Cuatro Vientos (LECU), Casarrubios (LEMT) and Trebujena (LETJ), whose runways are 1500, 900 and 1200 m long, respectively.

1.11. Flight recorders

The aircraft was not equipped with flight recorders, nor was it required to be. Based on ENAIRE radar data, the aircraft's radar return appeared on the screen for a few minutes after takeoff, from 12:53:44 until 12:59:04 UTC.

1.12. Wreckage and impact information

The investigation team reported to the accident site immediately. The aircraft was overturned on the side of the road, behind the guard rail with the tail assembly

resting on the rail. The nosewheel was caught on the perimeter fence, between the ditch and the embankment at the side of the road. The tip of one of the propeller blades was also caught on the fence. There were two notches on it and it was cut halfway along its length. The other blade was intact. The flaps were deployed about 30º (halfway between the takeoff (15º) and landing (40º) flaps positions). The Hobbs meter reading was close to 44.6.

Photograph 5. Propeller after the accident

The right fuel tank was selected in the cockpit. The electric fuel pump was not on. Once the aircraft was placed on its landing gear, the levels in the left and rights tanks were checked. Visually, there was not much fuel in the tanks. When measured with a dipstick, it hardly left a mark on it. The right carburetor (as seen looking forward) was checked, because it was directly accessible through the engine cover. There was some fuel in it, but less than what would be considered normal. The three drains, one in each wing and a third in the filter underneath the engine, were closed and tight. Several samples were removed at the accident site. The right tank yielded practically nothing and the left tank yielded 20 cl. None of the samples showed signs of contaminants or impurities. A few drops fell from the engine drain. There were no marks in the surrounding terrain indicative of a significant loss of fuel, save for a small stain under the left wing near the tank vent. There was also no typical smell of gasoline.

The tracks left on the runway during the landing were measured and confirmed to start some 120 m before the end of the runway (see Appendix A).

It was not possible to determine if the engine behaved strangely at some point in the flight, though it is not thought that it stopped completely since it would have been at idle during the final phase of the landing.

1.13. Medical and pathological information

The pilot suffered bruises, skin abrasions and both cervical and dorsal spine injuries, requiring a collar to immobilize the neck.

1.14. Fire

There was no fire.

1.15. Survival aspects

After the accident, the pilot unbuckled his safety harness and broke the right side of the acrylic ceiling, climbing out under his own power.

1.16. Tests and research

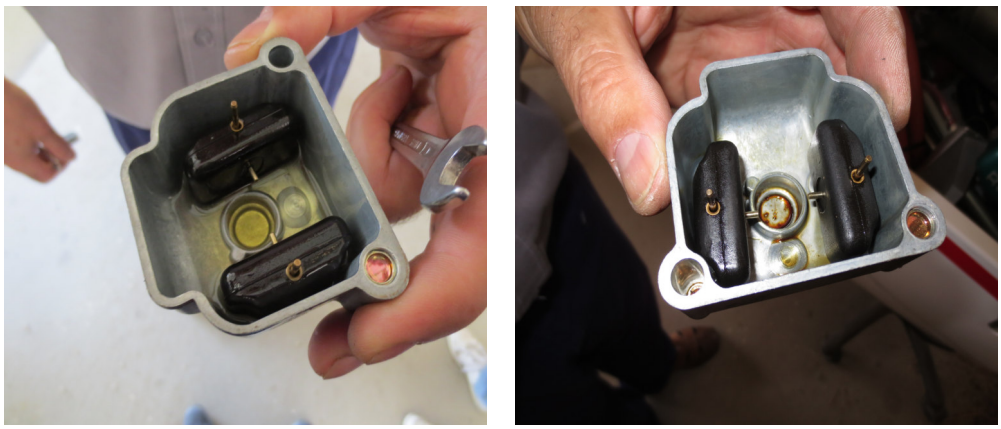
1.16.1 Inspection of the aircraft in the hangar

The aircraft was stored in the hangar at the Griñón airfield, where it was subsequently subjected to a more exhaustive inspection, as were its engine and components.

The fuel tanks were inspected once more to search for possible leaks. Both tanks were empty. The three drains (from which the fuel samples had been drawn ad the accident site) were still closed, as were the access plugs to the tanks. Since the tank in the left wing was deformed (see photograph 7), the inside of the wing was checked visually with a flashlight to ensure that the damage had not reached the wall separating the tank and the rest of the wing. The vents and overflows at the wingtips were in good condition with no obstructions.

Photograph 6. Inspection of the aircraft in the hangar

The fuel system was inspected. Both pumps were in good condition and had fuel. The left carburetor (as seen looking forward) had some fuel. The right carburetor did not have any fuel and it had deposits. The right carburetor is the one that was inspected during the field inspection, at which time it had some fuel, meaning it probably evaporated during that inspection.



Photograph 7. Left (LH) and right (RH) carburetors

Any overflow fuel in this aircraft is sent to the left tank. In this case the pilot had the right tank selected, meaning that all the overflow fuel filled the left tank, where investigators found about 20 cl of fuel.

1.16.2. Calculations of the fuel consumption

According to the information given by TECNAM, the consumption at power 75% would be 19,2 l/h in cruise conditions, with zero wind, ISA atmosphere and density altitude of 5000 ft. The 75% in cruise power has been calculated taking into consideration the turbulence and the changeable atmosphere conditions. This percentage is considered necessary to maintain the same performances as a 60%[9] power with stable atmosphere.

The consumptions for the ROTAX 912 S3 engine, according to the manufacturer's documentation, are the following:

- Take off- 27 l/h
- máx. continuous - 25 l/h
- 75%- 18,5 l/h

This information is considered to be more detailed by flight phases, so it will be used for calculations later exposed in the report.

Taking into consideration all the communication records since the pilot's initial contact with the taxiing control service until he signed off with TWR at point W, they lasted 16 minutes and 15 seconds. The distance between point W and the threshold of the runway at the Griñón airfield is 8 NM, similar to the one between threshold of runway 10 and point W (7,21 NM), meaning that the flight time should have been at least similar to that of the first segment (7 minutes and 26 seconds), furthermore with a headwind (from the south). In light of all this information, the total flight time would have been approximately 23 minutes and 41 seconds, to which we would have to add the time that elapsed between the engine start-up and when the pilot contacted ground control, and the time used to make the approach and landing, which gives a total time of 28 minutes. This coincides with the closing of the flight plan by the ARO. Probably after the pilot's phone call, the landing took place at 13:10. Using conservative calculations, and assuming that the aircraft did not climb above 3000 ft (as restricted by the Gefate CTR) and proceeded directly to Griñón without performing any maneuver, the following calculations have been established:

[9] CTR- Controlled Traffic Region-Control zone, space associated to an aerodrome whose aim is to protect entances and wayouts.

PHASE OF FLIGHT	TIME	FUEL
Taxiing[10]	10 min	2 l
Take off	2 min	0,9 l
Initial climb	4 min (máx. cont.)	1,66 l
Straight and levelled cruise	12 min (75%)	3,7 l
TOTAL	**28 min**	**8,26 l**

Which means that the flight time would have been 28 minutes and the fuel consumption 8,26 l.

1.17. Organizational and management information

N/A.

1.18. Additional information

1.18.1 Statement from the pilot

The pilot stated that the aircraft was at the Cuatro Vientos aerodrome to undergo its annual (100-hr) inspection. He was planning to fly it to the Casarrubios aerodrome on a test flight, the results of which he would report to the maintenance center. It was very hot that day and although he had planned to leave early, at about 10:30, he was delayed by paperwork at the maintenance center and did not leave until about 12:50. The pilot stated that he refueled the emptier wing tank from two 5-liter jugs, one of which was not full. He estimates, therefore, that he added about 8 liters, and based on the fuel gauges, there was about 15 l in that wing tank (25 l between the two tanks). He did the engine test with the emptier tank and took off with the fuller tank. He decided to go south, an area that he was familiar with and where he anticipated less traffic, to do the test flight. The engine temperature was a little over the green arc (in his opinion this occurred while climbing as part of the test flight and because of the ambient heat). The pilot explained that along the way, the aircraft was subjected to heavy turbulence and the cockpit was getting very hot. He felt dizzy, and although he was fine physically, psychologically he felt a need to land as soon as possible, feeling apprehensive about the possibility of suffering a heatstroke. He did not know how much traffic he would find at the Casarrubios aerodrome, and since the aircraft could land on a 250-m runway and he was familiar with the Griñón airfield (he had kept a ULM

[10] Including the engine test, calculating an average consumption of 12 l/h which corresponds to a performance of a 30%.

in a hangar there and knew the airfield had a 420-m long runway), he decided to divert to that airfield, intending to resume the flight to Casarrubios late in the afternoon when it cooled down.

The thermals made it difficult to maintain the aircraft's speed. The windsock showed the wind was from around 270º. The pilot emphasized that the flight was under control at all times. He did a good approach and he was going to land on the first third of the runway. He had takeoff flaps set and a little more, but he noticed that he was going too fast, due to, as he stated, the high density altitude caused by the high temperature. He then decided to go around, but as he started the procedure the aircraft sank. He considered his two options, namely proceeding with the go-around or cutting the engine and braking. He settled on the latter, thinking it would be better to land. According to the pilot's statement, the engine did not stop. Only the temperature parameter was above the green zone due to the heat. He increased power before reducing it when he decided to continue with the landing. He knew he was going to come close to the end of the runway so he did skidding maneuvers during the landing run to reduce the braking distance. In the end, however, the aircraft overran the runway by just a few meters, where the terrain sloped down to the M-407 road. He was wearing the four-point safety harness and it was tight. He had a hammer and a knife with him. After the impact the pilot unbuckled the harness (though he did not remember how), turned off the master switch, broke the glass and exited under his own power.

As concerns the fuel, the pilot was adamant that he had managed the fuel correctly, stating the following:

- He had checked the two tanks visually before leaving and saw a fuel level that was in agreement with the gauge readings. The gauges are not exact, but once he and the other owner completely drained the tanks and then slowly added fuel while they compared the fuel gauges, and they found no inconsistencies in the indications. As a result of this he trusted the fuel gauge readings.
- He then added fuel to one of the tanks (right) from two 5-liter jugs, one of them full and the other nearly full, meaning there would have been about 8 liters in total.
- Based on the fuel gauges, he calculated there was approximately 25 liters between both tanks[11].
- Every time the pilot flew the aircraft he took a photograph of the Hobbs meter, which read 44.3. The meter read 44.6 after the accident (as stated by the co-owner), meaning that the flight lasted a total of 18 minutes.

[11] 10 in the left and 15 in the right.

- Between warming up the engine, checking in with the tower and taxiing to runway 10, he figured some 10 minutes had elapsed, meaning the actual flight time after takeoff would have been no more than 10 minutes.
- He taxied on the tank that read 10 liters[12], which would not have consumed much fuel idling over ten minutes.
- The other tank, to which he had added about 8 liters and had about 15 liters in total, was the one he used to take off[13].
- If he was in the air for just 10 minutes running off a tank to which he had added 8 liters and which now had 15 liters of fuel, and if the aircraft consumed 14-15 liters per hour at 60%, which is the average power at which he ran the engine, the flight should have used 2.5 liters. Thus, even if the tank had been empty and he had only added those 8 liters, there should have been more than enough fuel. He thus thought it physically impossible that he could have run out of fuel.
- He also recalled how the people who were at the crash site (including the local police) warned him not to approach because they smelled gasoline, which was spilling out.
- The pilot reasoned that the remaining fuel spilled while the aircraft was upside down and then when it was turned over.

After the period of comments of this report the pilot persevered that he did not agree with the lack of fuel stating that he had checked with a mechanic and expert in the aircraft that, being the aircraft upside down, it could spill some fuel. According to his opinion the porosity of the field would have absorbed part of the fuel and the rest would have evaporated due to the temperature (40º). He also stated that he had talked to the policemen from Griñón again who had confirmed him that fuel was coming out from the wings when they arrived to the site of the accident.

1.18.2 Statement from the maintenance technician

The maintenance technician who inspected the aircraft before takeoff reported that the fuel gauges read slightly above 0. The pilot refueled the aircraft with about 10 liters of fuel he was carrying in two jugs.

[12] Left.

[13] Right.

1.18.3 Statement from the local police

The local police officer who first reported to the scene stated that two officers went to the accident site, and that there were already people at the site who had been driving on the M-407 road and who had stopped. The officers asked the bystanders about the pilot and they pointed him out to the officers. At that point the pilot was talking on the phone. They asked him how he was and he said he was fine and asked them if they could find his glasses in the cockpit because he could not see well without them. The officer got his eyeglasses and he could see how fuel was dripping from one of the wingtips, staining the ground underneath. He noted this to the pilot who told him not to worry, that there was not much fuel.

1.18.4. Density altitude

Since the pilot mentioned a high density altitude as a reason for his decision to land at the Griñón airfield, this concept is explained next.

Density altitude is the altitude at which a given air density would exist on a day with standard atmospheric conditions (ISA). The density altitude determines the aircraft's performance and behavior, since it affects lift and drag, engine performance and propeller efficiency. Basically, the higher the temperature, the less pressure (higher altitude), meaning a lower density, which degrades performance.

Based on the performance tables of the aircraft manufacturer, a pressure altitude[14] of 2269 ft (elevation of LECU) and a temperature of 37º would yield a density altitude of 5000 ft.

The density altitude also affects landing performance. According to the manufacturer's specifications, the temperature-corrected landing run[15] on this aircraft, for an outside air temperature similar to that present on the day of the accident, at the 2000 ft pressure altitude of the airfield, was 148 m, and the landing distance[16] was 334 m.

1.19. Useful or effective investigation techniques

N/A.

[14] The altitude corresponding to a specific pressure at standard atmospheric conditions.

[15] The landing run is the distance between the touchdown point and the stopping point.

[16] The landing distance is the distance needed to come to a complete stop after crossing the threshold at 50 ft.

2. ANALYSIS

2.1. General

The aircraft was owned by the pilot and another partner. The two had agreed to sell the aircraft and had taken it to the Cuatro Vientos aerodrome (LECU) for its annual (100-hr) inspection in preparation for the sale. On the day of the accident, the pilot had planned to pick up the aircraft and take it to the Casarrubios aerodrome (LEMT), where the transaction would take place. He had planned to leave early, at about 10:00, to avoid the high temperatures and turbulence, since it was a June morning and it was hot. But the paperwork with the maintenance center was delayed and he ended up leaving at about 13:00. The aircraft remained on the parking stand during this delay. The estimated duration of the flight was 20 minutes. The pilot loaded fuel from two jugs he had taken with him and he took off from the Cuatro Vientos aerodrome at 12:53 (as recorded on the flight progress strip). A few minutes into the flight the pilot began to feel hot and, fearing he would succumb to a heatstroke, he decided to land at the Griñón airfield (which has a 420-m long runway) because he knew the airfield (he had hangared a ULM there). He would continue the flight to Casarrubios in the evening when it was cooler. As shown on his license, the pilot's place of residence was in the town of Griñón.

During the landing the pilot stated that he tried to touch down on the first third of the runway, but he was going too fast and when he tried to go around, the aircraft "sank". He ended up landing about halfway down the runway and the aircraft taxied to the end of the runway, overshooting it and impacting the perimeter fence separating the airfield from the road. The aircraft flipped over and stopped on an embankment alongside the M-407 road.

2.2. Results of the aircraft inspections.

The pilot stated that the people who were at the accident site (including the local police) told him not to approach the aircraft because it smelled of gasoline, which was spilling out of it. The local police officer stated that the pilot asked him to retrieve his eyeglasses from the cockpit, and that when he did so, he was able to see fuel dripping from one of the wingtips. When he told the pilot this, the pilot said not to worry, that there was little fuel onboard.

The investigation team reported immediately to the accident site. There, it saw that there was no fuel in the wing tanks and little evidence of a fuel spill, save for a small stain underneath the left wing, near the tank vent. There was none of the characteristic fuel smell. Once the aircraft was righted, the investigators inspected the fuel levels in the left and right tanks (visually and with a dipstick). They did not see much fuel inside. This was confirmed with the dipstick, which barely had any

fuel on it. They checked for potential leaks. All three fuel drains (one in each wing and one in the filter underneath the engine) were closed tight. The access plugs on the tanks were also closed. The vents and overflows on the wingtips were in good condition with no obstructions. The fuel tank selected in the cockpit was the right tank. The electric fuel pump was not on. The investigators then proceeded to draw samples. They got almost no fuel from the right tank and about 20 cl from the left tank. No contaminants were visible in either sample. The overflow fuel in this aircraft is routed to the left tank. In this case the pilot had selected the right tank, meaning that all the overflow fuel went to the left tank, which was found with more fuel in it. Only a few drops fell from the engine drain. Since the tank in the left wing was deformed, it was checked visually using a flashlight. A subsequent inspection of the inside of this wing revealed that the damage had not affected the wall separating the tank and the rest of the wing, meaning no fuel had been lost from that tank.

The fuel system was inspected during a subsequent inspection. Both fuel pumps were in good condition and they had fuel. The left carburetor (as seen looking forward) had some fuel. The right carburetor had no fuel and some deposits. This is the tank that had been checked during the field inspection, when some fuel was found inside it, meaning that the fuel probably evaporated following that inspection. In both cases, the amount of fuel present was lower than would be considered normal.

Investigators could not determine if the engine stopped due to fuel starvation.

2.3. Fuel management and calculation

The pilot stated that he added approximately 8 l to one of the tanks (right). Based on the fuel gauges, he figured that there was about 25 l in the two tanks combined (10 in the left and 15 in the right). He trusted the readings on the gauges. The maintenance technician who had last seen the aircraft before takeoff reported that the gauges were slightly above 0.

The communications records show that 16 minutes 15 seconds elapsed between the pilot's initial contact with ground control until he signed off with the tower at point W. He still had the segment to Griñón left. The distance between point W and the threshold of the runway at the Griñón airfield is 8 NM, similar to the distance between the threshold of runway 10 and point W (7.21 NM), meaning that the flight time should have been similar to that of the first segment (7 minutes 26 seconds). The aircraft had a headwind (from the south) during the flight. In light of all this information, the total flight time would have been approximately 23 minutes 41 seconds, to which we would have to add the time that elapsed between

engine start-up and when the pilot contacted ground control and the time used to make the approach and landing. An average time of 28 minutes was used to calculate the fuel consumption, in agreement with the closing of the flight plan by the ARO. Using these conservative calculations, and assuming the aircraft did not climb above 3000 ft (restricted by the Getafe CTR) and proceeded directly to Griñón, the aircraft would have used 8.26 l of fuel.

The Hobbs meter reading indicates that the engine was running for around 18 minutes. During this time period, the pilot thought that the fuel used while taxiing (10 minutes) was negligible, and assuming a 10-minute flight time and an average consumption of 14-15 liters/hour (at 60%), the total fuel used would have been 2.5 l. These figures show that the parameters used by the pilot to calculate fuel consumption were significantly below those specified by the manufacturer. Furthermore, the engine run time (associated with the Hobbs meter) estimated based on the communications and the flight to Griñón are not compatible with the 18 minutes shown by the Hobbs meter.

After the period of comments the pilot persevered that he did not agree with the lack of fuel stating that this would have been lost being the aircraft upside down, part of it being absorbed by the field and the other being evaporated due to high temperatures.

To this respect this Commission keeps on reaffirming its hypothesis, mainly based on the evidences obtained in the accident site (shortly after it had occurred), on fuel calculation estimations and on statements from the witnesses.

2.4. Landing operation at the Griñón airfield.

According to the aircraft's manufacturer's performance table, a pressure altitude of 2269 ft (elevation of LECU) and a temperature of 37º would yield a density altitude of 5000 ft, more than twice the pressure altitude. With such a difference, the aircraft's performance and behavior would have been significantly affected, as would the engine's performance and behavior. Similarly, the landing distance would have been increased by these atmospheric conditions. According to the manufacturer's specifications, the landing run for this aircraft with an outside air temperature similar to that on the day of the accident and at 2000 ft is 148 m, with a landing distance of 334 m.

The runway at the Griñón airfield is 434 m long, 100 m longer than the landing distance required. The marks left on the runway during the landing run were measured and verified to start some 120 m from the end of the runway, meaning that the aircraft landed 314 m down the runway, that is, in the final third. The

minimum landing run specified by the manufacturer, and the distance that the aircraft should have traveled, is 148 m. The aircraft only had 120 m before it ran out of runway.

The pilot had limited experience on that aircraft (7:36 h). He had started flying on it on 9 May 2015, less than two months before the accident. The aerodromes at which he had landed with it (Cuatro Vientos (LECU), Casarrubios (LEMT) and Trebujena (LETJ)) had runways between 900 and 1500 m in length, far greater than the 434-m long runway at the airfield where the pilot landed on the day of the accident.

The aircraft had taken off from runway 10 at Cuatro Vientos (LECU). The wind was from the south. The runway used to land at Griñón was 30, meaning the aircraft landed with a tailwind. According to the pilot's statement, the speed during the approach was higher than that specified by the manufacturer. Both of these factors contributed to increasing the already tight landing distance.

3. CONCLUSIONS

3.1. Findings

An analysis of all the information available yielded the following findings:

- The aircraft's documentation was valid and in force.
- The pilot's documentation was valid and in force.
- The pilot had limited experience (7:36 h) on the accident aircraft type.
- According to his statement, the pilot decided to divert to the Griñón airfield because of the high temperatures he encountered during the flight.
- The pilot's place of residence, as noted on his license, was in the town of Griñón.
- The pilot did not have experience landing this aircraft type on runways as short as the one in the Griñón airfield.
- The pilot landed on a runway that was 434 m long.
- The landing distance for the altitude and temperature conditions present was 334 m.
- The distance traveled by the aircraft before running out of runway was 120 m.
- According to the manufacturer, the distance needed for the landing run under those altitude and temperature conditions would have been 148 m.
- The pilot took off from runway 10 at the Cuatro Vientos aerodrome (LECU) with the wind from 150º.
- The pilot landed on runway 30 at the Griñón airfield. There were southerly winds in the area.
- The landing was thus conducted downwind, which increased the landing distance.
- The temperature was 37º, which also increased the landing distance.
- The pilot stated that he did the approach at a higher speed due to the temperature, which increased the landing distance.
- According to the Hobbs meter, the flight lasted 18 minutes (from engine start-up).

- According to ATC communications (from engine start-up and establishing contact with ground control), the minimum flight time had to be 16 minutes and 15 seconds to point W.
- Point W is located 8 NM from the threshold of the Griñón runway, which required an additional 7 minutes 26 seconds of flight time.
- The total time based on these calculations would have been at least 23 minutes 41 seconds, not including the time between engine start and contact with ground control.
- Assuming a 28-minute flight (end of the flight plan), the fuel consumed would have been 8.26 l.
- The pilot added about 8 l to the right tank. According to his statement, there should have been 25 l in total.
- The mechanic who last checked the aircraft before delivery stated that the gauges read slightly above 0 before the aircraft was refueled.
- During the inspection immediately after the accident, no fuel was found in the tanks.
- There was no compelling evidence that fuel was spilled at the accident site.
- The carburetors and pumps had fuel, but less than usual.
- Investigators were unable to determine if the engine stopped due to fuel starvation.

3.2. Causes

The investigation concluded that the accident occurred as a result of an improperly executed approach and landing maneuver by the pilot at an airfield other than the destination aerodrome specified in the flight plan, with a runway much shorter than those normally used by the pilot.

Contributing to the accident was the shortage of fuel in the tanks due to improper flight planning, the high temperature and turbulent conditions associated with atmospheric instability and the stress and concern generated by these two factors. The fuel tanks were practically empty, which was to be expected considering the amount of fuel added and the fuel consumed during the flight. It was not possible to determine if the engine exhibited any unusual behavior due to fuel starvation, not necessarily an engine stoppage but other behavior that could have alerted the pilot and that, along with the other contributing factors, drove him to divert from his planned flight path and land at the Griñón airfield, near his place of residence.

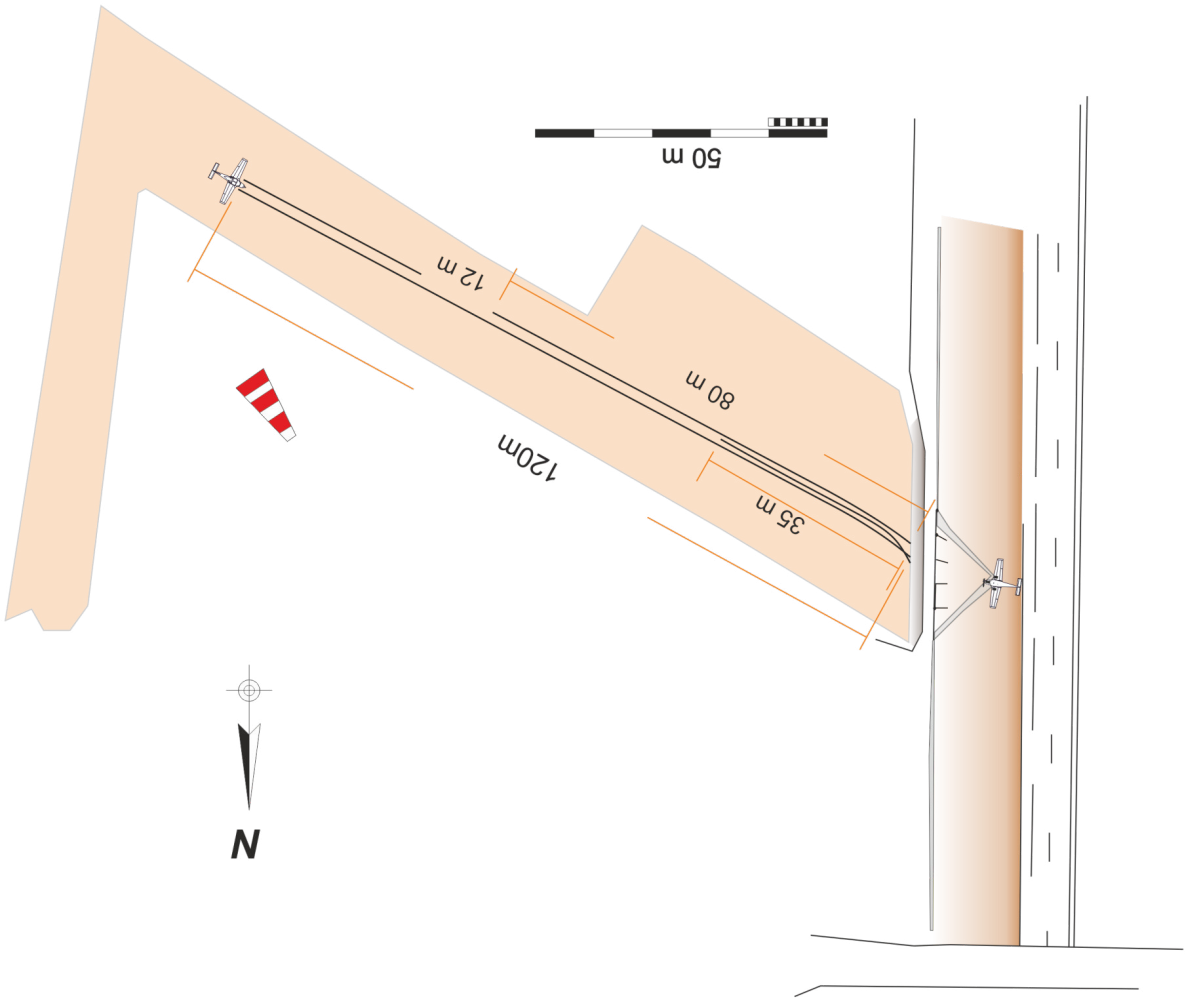
4. SAFETY RECOMMENDATIONS

The accident is deemed to have occurred due to poor flight planning which resulted in an improper maneuver and in incorrectly planned fuel consumption.

Poor flight planning in terms of the estimated fuel consumption and the choice of alternate aerodrome gave rise to an improperly executed approach and landing maneuver. The investigation determined that there is documentation from the manufacturers that addresses both of these factors, as a result of which no safety recommendations are issued in this regard.

APPENDIX A

PATH TAKEN ON THE GROUND AND MARKS LEFT


50 m
12 m
80 m
120m
35 m
N