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# Report A-064/2019

Accident involving a Beechcraft BE76, registration EC-INC, at La Axarquía Aerodrome (Málaga) on 25 November 2019

GOBIERNO DE ESPAÑA

MINISTERIO DE TRANSPORTES, MOVILIDAD Y AGENDA URBANA

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# Notice

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

| | |
|---|---|
| ° ' " | Sexagesimal degree(s), minute(s) and second(s) |
| ºC | Degree(s) Celsius |
| ADF | Automatic Direction-finding equipment |
| AEMET | Spain's State Meteorological Agency |
| AESA | Spain's National Aviation Safety Agency |
| ATPL | Airline Transport Pilot License |
| ATO | Approved Training Organisation |
| CAMO | Continuing Airworthiness Management Organisations |
| CPL | Commercial Pilot License |
| CPL(A) | Commercial Aircraft Pilot License |
| CRI | Class Rating Instructor |
| CRM | Crew Resource Management |
| DME | Distance Measuring Equipment |
| EASA | European Aviation Safety Agency |
| ELT | Emergency Location Transmitter |
| FAA | Federal Aviation Administration |
| FI | Flight Instructor |
| FI NIGHT | Flight Instructor Night |
| ft | Feet |
| GPS | Global Positioning System |
| h | Hours |
| HP | Horsepower |
| ILS | Instrument Landing System |
| IR (A) | Instrument Rating |
| kg | Kilogrammes |
| km | Kilometres |
| km/h | Kilometres/hour |
| kt(s) | Knot(s) |
| l , l/h | Litre(s), litre(s)/hour |
| LAPL | Light Aircraft Pilot License |
| LEAX | ICAO code for La Axarquía-Leoni Benabu Airport (Málaga) |
| m | Metre(s) |
| mm | Millimetre(s) |
| m/s | Metre(s)/second |
| $m^2$ | Metre(s) squared |
| MEP | Multi-piston engine aircraft |
| MHz | Megahertz |
| MTOW | Maximum Take-off Weight |
| N | North |
| s/n | Series number |
| W | West |
| p/n | Part number |
| PIC | Pilot-in-command |
| POH | Pilot's Operating Handbook |

| | |
|---|---|
| PPL | Private Pilot License |
| PPL(A) | Private Pilot License (aircraft) |
| ref. | Reference |
| rpm | Revolutions per minute |
| SEP | Single-piston engine aircraft |
| SOP | Standard Operating Procedures |
| TORA | Take-Off Runway Available |
| $V_c$ | Cruise speed |
| VFR | Visual Flight Rules |
| VHF | Very High Frequency (30 to 300 MHz) |
| VMC | Visual Meteorological Conditions |
| $V_{NE}$ | Never exceed speed |
| $V_{OR}$ | VHF Omnidirectional Range |
| $V_s$ | Stall speed |

# Synopsis

| | |
|---|---|
| Owner and operator: | AERODYNAMICS MÁLAGA, S.L. |
| Aircraft: | BEECHCRAFT DUCHESS BE76, EC-INC, s/n: ME-382 |
| Date and time of accident: | Monday 25 November 2019, 09:48 local time |
| Site of accident: | La Axarquía Aerodrome – Málaga (Spain) |
| Persons on board: | Three |
| Type of operation: | General Aviation - Instructor - Dual |
| Phase of flight: | Landing |
| Flight rules: | VFR |
| Date of approval: | 28 October 2020 |

## Summary of accident

On Monday 25 November 2019, the Beechcraft Duchess BE76 aircraft, registration EC-INC, made a gear-up landing on runway 30 of La Axarquía Aerodrome while performing a downwind engine failure simulation as part of a pilot licence training flight.

The crew, which comprised an instructor, an observer instructor and a student pilot, were unharmed.

The aircraft sustained significant damage.

The investigation into the event has identified as a probable cause of the accident, the lack of adherence to flight procedures

The flight instructor's failure to ensure the landing gear was extended before landing is also considered to have been a contributory factor.

The report makes three recommendations to the pilot training school regarding reinforcing its instructor training on procedures and checklists, including them separately in the ATO operations manual and developing specific checklists for instructors.

The report also includes a recommendation addressed to AESA with regards to including procedures and checklists in all training school (ATO) manuals and monitoring their appropriateness.

# 1. FACTUAL INFORMATION

## 1.1. History of the flight

On 25 November 2019, the Beechcraft Duchess BE76 aircraft, operated by AERODYNAMICS MÁLAGA, S.L., with registration EC-INC, took off from the La Axarquía Aerodrome (LEAX) at 08:15 local time to perform a visual instruction flight with three people on board, returning to the La Axarquía Aerodrome (LEAX).

After flying for one hour and performing several practice manoeuvres, including the engine failure procedure at 3000 ft, they returned to LEAX to practise taking off, landing, and a simulated engine failure in the traffic circuit.

During the third and final take-off and landing, which involved a simulated engine failure on final, the student pilot was instructed to go through the landing checklists while the instructor communicated their position on final approach to runway 30 by radio. Moments later, the instructor realised the landing gear had not been extended. Despite making the student pilot aware of the situation, it was too late to remedy the situation. The student, therefore, continued with the approach an executed a gear-up landing.


Photograph 1: Damaged aircraft at the accident site

The aircraft landed on runway 30 at 09:48 local time, at a speed of 65 kts and with flaps not deployed. After the event, the engine controls were confirmed as being in the following positions: rich mixture, rpm control full forward for one of the engines and the other at minimum power. This configuration is coherent with the simulated engine failure. The engine temperature and pressure indicators were in the green zone.

The crew does not recall hearing any type of acoustic warning during landing. They were unharmed and exited the aircraft without assistance.

The aircraft sustained significant damage.

### 1.2. Injuries to persons

| Injuries | Crew | Passengers | Total in the aircraft | Other |
|---|---|---|---|---|
| **Fatal** | | | | |
| **Serious** | | | | |
| **Minor** | | | | |
| **None** | 3 | | 3 | |
| **TOTAL** | 3 | | 3 | |

### 1.3. Damage to the aircraft

The landing gear, propellers and the underside of the fuselage were damaged during the accident.

### 1.4. Other damage

There was no third-party damage.

### 1.5. Personnel information

## Flight Instructor

The 38-year-old Spanish pilot-in-command and flight instructor had a commercial aircraft pilot license, CPL (A), issued by Spain's National Aviation Safety Agency (AESA) on the 27/08/2007 with the following ratings:

- IR(A) instrumental flight rating valid until the 30/11/2019
- MEP and SEP ratings (land) valid until the 30/11/2019
- CRI(A) rating for MEP (land) valid until the 31/05/2022
- FI(A) rating for PPL, CPL, SEP, MEP, IR, FI, NIGHT valid until the 31/07/2021
- He had a total of 1660:20 hours of flying time, of which nineteen hours were in the type of aircraft involved in the event. He had 753:32 flight instructor hours.

In the 24 hours preceding the flight, he had flown for a total of two hours, with a pre-flight rest period of nineteen hours.

He had a valid level 4 Certificate of Linguistic Competence in English.

His class 1, 2 and LAPL medical certificates were valid until the 20/01/2020.

## Student pilot

The 30-year-old Norwegian student pilot had a private aircraft pilot license, PPL (A), issued by the FAA on the 03/04/2018 with IR(A) instrumental flight and SEP (Land) ratings.

He had a total of 175:20 hours of flying time, of which six hours were in the type of aircraft involved in the event.

His last flight was six days before the event and his last flight as PIC was on the 16/04/2018 in a PA-28 and lasted 2:20 hours.

He began his training with the ATO involved in the event on the 03/10/2018, to re-validate his FAA license. He completed eight hours of flight simulator training in two separate periods: from 03/10/2018 to 22/11/2018, and 11/09/2019 to 13/09/2019. On the 15/09/2019, he began his dual flight hours in different single-engined aircraft - the PA-28-161 and the Cessna 172RG.

In total, he flew for 31:32 hours in dual flight, two hours as co-pilot in the simulator and 3:25 hours as PIC. Of these, 28:57 hours were single-engine and 6:00 hours were multi-engine, the latter being his hours in the Beechcraft 76 aircraft and all in dual flight. Of those hours, 2:45 were with the instructor who was the PIC of the event flight.

His class 1 medical certificate was valid until 31/07//2020 and his class 2 and LAPL were valid until 31/07/2024.

## Passenger

The passenger was a 28-year-old Italian instructor observer. He had a commercial aircraft pilot license, CPL (A), issued by Spain's National Aviation Safety Agency (AESA) on the 24/09/2015 with the following ratings:

- IR(A) instrumental flight rating, valid until 31/10/2020
- MEP (Land) rating valid until the 31/10/2020
- SEP (land) rating valid until the 31/08/2021
- FI(A) rating for PPL, CPL, SEP, IR, FI, NIGHT valid until the 31/01/2020

He had a total of 1652 flight hours, thirteen of which were as PIC of the MEP aircraft involved in the event.

On the day of the event, he was preparing for a future CRI course by flying as an observing instructor in order to familiarise himself with the BE-76 aircraft and procedures.

He also had experience in C150, PA-28, C172RG, C172N and P92 aircraft.

Prior to the event flight, his last flight was in a C172N aircraft on the 19/11/2019, as PIC for a flight lasting 1:30 h.

He had a valid level 5 Certificate of Linguistic Competence.

He had a class 1 medical certificate valid until 28/06/2020, and his class 2 and LAPL were valid until 28/06/2024.

## 1.6. Aircraft information

### *1.6.1. General information*

The US-made Beechcraft 76 Duchess aircraft is a twin-engine, low-wing, all-metal, T-tail monoplane trainer from the Beechcraft Musketeer line.

It has retractable tricycle landing gear and seats one pilot and three passengers.

It is equipped with two Lycoming model O-360-A1G6D engines and two-bladed constant speed propellers.

**Dimensions:**
Wingspan: 11,6 m
Length: 8,9 m
Height: 2,9 m
Wing area: 16,8 $m^2$
MTOW: 1769 kg
Empty weight: 1137 kg

**Performance:**
Never exceed speed ($V_{NE}$): 194 kt
Cruise speed ($V_c$): 154 kt
Stall speed ($V_s$): 60 kt
Ascending speed: 6,3 m/s

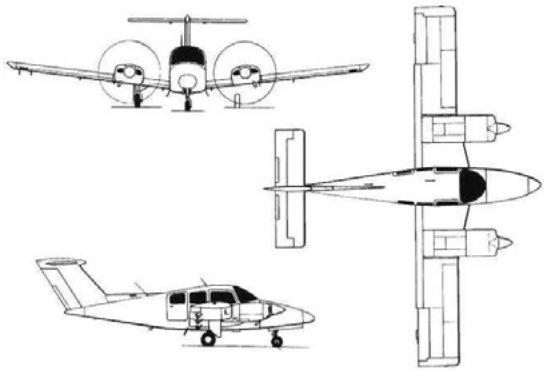


Figure 1: Beechcraft Duchess BE76

**Power plant:**
The power plant is made up of two Lycoming piston engines, model: O-360-A1G6D with s/n: RL-22298-36E and RL-409-71R, 185 HP each, air-cooled, with four horizontally opposed cylinders.

**Propellers:**
The two-bladed constant speed propellers rotate in opposite directions and are manufactured by Hartzell, model HC-M2YR-2CLEUF, s/n: FB1690B and FB1689B.

**Landing gear:**
The retractable tricycle landing gear is made from magnesium alloy and aluminium. Each landing gear leg is extended and retracted by a hydraulic actuator driven by an electric pump located at the rear of the fuselage. The landing gear can also be extended manually in an emergency.

A selector lever located on the left side of the instrument pedestal controls landing gear actuation with two positions (UP/DOWN). The lever is designed with a safety system that requires it to be pulled out to change its position.

The gear position indicator lights are located below the lever. Each gear leg has three corresponding green lights that illuminate when the leg is down and locked. Another red light illuminates when the landing gear is in transit or any other intermediate position. When the landing gear is up, all the lights are off.

The landing-gear position indicator lights are checked during the pre-flight inspection by pressing the indicator itself.

The landing gear system has an audible warning that sounds whenever the aircraft is configured for landing, but the gear is not down and locked. In other words, when the landing gear is up, but one of the throttles is pushed back, the flaps are extended beyond 16º, or both.

**Instrument panel:**
Photograph 2 shows the landing gear lever position and the indicator lights when the landing gear is down and locked in the case of the three lower green lights, and, in the case of the upper red light when it is in transit or an intermediate position.

Photograph 2: Instrument panel of the accident aircraft

*1.6.2. Maintenance information*

The aircraft was built in 1981. Its series number is: ME-382. The maintenance was carried out by a maintenance centre approved by AESA as a Continuing Airworthiness Management Organisation (CAMO) belonging to the aircraft owner.

Approved maintenance programme, ref.: P.M.A. EC-INC ed.3 rev.3 on the 24/09/2019 includes the 100-flight hour inspection of the fuselage and the 25, 50, 100 y 400-hour inspection of the engine (the 25-hour inspection after the overhaul).

At the time of the accident, the aircraft had accumulated 9496:29 hours of flight and 1062 cycles. The two engines were manufactured by Lycoming, p/n: O-360-A1G6D. Engine 1 with s/n: RL-22298-36E, and engine 2 with s/n: RL-409-71E. Engine 1 had 944:57 hours, and 653 cycles and engine 2 had 1268:24 hours and 364 cycles.

The most recent maintenance inspections before the event correspond to the following work orders:

- 0132-19 INC dated 21/10/2019: a 50-hour inspection when the aircraft had 9472:39 flight hours.
- 0129-19 INC dated 18/10/2019: a corrective action to rectify defects when the aircraft had 9469:04 flight hours.
- 0113-19 INC dated 25/09/2019: a 50/100-hour inspection when the aircraft had 9421:09 flight hours.

The aircraft was inspected and repaired following the accident. The inspection found that all the aircraft's mechanical and other systems were operative and could not, therefore, have been a factor in the non-extension of the landing gear. The repairs consisted of work orders to replace the propellers and check the engines, identifying them as the parts to have sustained the most damage.

*1.6.3. Airworthiness status*

According to the Spanish National Aviation Safety Agency's record of active registrations, the aircraft with serial number ME-382 and registration EC-INC was registered on the 25/06/2003, with registration number 6663. The registration certificate states the aircraft's base as the Madrid-Cuatro Vientos Airport (Madrid).

According to the aircraft's logbook, it is currently owned by the Málaga pilot school.

The aircraft had Airworthiness Certificate No. 5328, issued by Spain's National Aviation Safety Agency 02/10/2019 and declaring the aircraft as a "Standard Category Aircraft".

The aircraft also had the following available authorisations:

- An aircraft station license issued by AESA on the 01/09/2015 including various pieces of equipment, among them two communications and navigation units, GPS, DME, ADE, ELT and transponder.

The aircraft had a valid insurance policy in force until the 23/01/2020.

## 1.7. Meteorological information

*1.7.1. General situation*

At low levels, the Peninsula and the Balearic Islands were between a set of storms moving through higher latitudes and a corridor of high pressure to the south. The closest depression was the extratropical transition of Tropical Storm Sebastien, which, now and extratropical depression, was in the process of intensifying into a warm seclusion. Presence of cloud streets over the south-west of the Peninsula in the post-frontal zone.

*1.7.2. Conditions at the accident site*

VMC conditions, base cloud-height 3500 ft, 15ºC, no visibility restrictions, wind speed 10 kts, direction 120.

AEMET has a thermo-pluviometric station in Vélez-Málaga, which, at the time of the accident, confirmed a temperature of 19 ºC, 62% relative humidity and no precipitation.

The remote sensing images showed a lot of cloud cover, although most of it was of medium thickness with no storm activity.

The low-level map was not predicting any significant phenomenon in the area, although it did forecast increased cloud cover in the mountainous region to the north, which would almost definitely have covered the mountain peaks at some points in the afternoon and probably caused a little turbulence.

Based on these facts, it does not appear any meteorological phenomena could have contributed to the accident.

## 1.8. Aids to navigation

Not applicable.

## 1.9. Communications

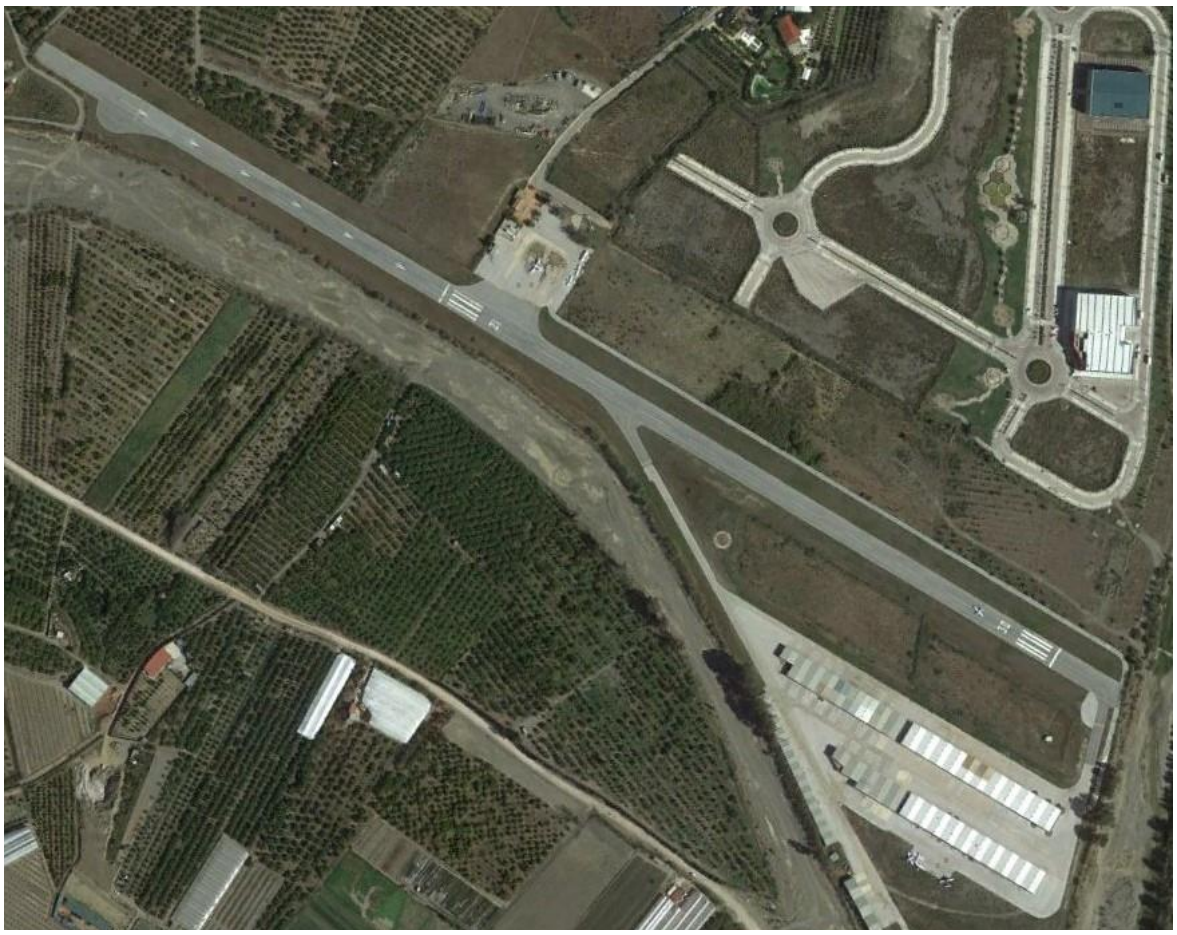
There are no records of the crew's communications via intercom and radio at the time of the event.
However, according to the instructor's statement, another aircraft in the area communicated with the event aircraft when it was on its short final, requesting it confirm its position.

## 1.10. Aerodrome information

The La Axarquía - Leoni Benabu Aerodrome (LEAX), is a privately owned Spanish, restricted use aerodrome with no control service, located in the municipality of Vélez-Málaga (province of Málaga). The aerodrome is owned and managed by the Real Aeroclub de Málaga, and operates on VFR flight rules only.

It has a paved 12/30 orientation runway with 20 m of width, 959 m and 637 m TORA lengths, respectively, and an elevation of 120 metres above sea level. The air communications frequency assigned is 123,500 MHz.

Its geographical coordinates are: N 36° 48´ 08´´ y O 4° 08´ 13".



Photograph 3: La Axarquía Aerodrome (Vélez-Málaga)

## 1.11. Flight recorders

The aircraft was not equipped with a flight data recorder or a cockpit voice recorder, as the aeronautical regulations in force do not require any recorders on such aircraft.

## 1.12. Wreckage and impact information

Photograph 4: General condition

The aircraft made a controlled and level landing on runway 30, aligned with the left half of the runway and with its landing gear up. It stopped a few metres from the end of the runway.

The aircraft sustained damage when, without its landing gear deployed, the lower part of the fuselage came into direct contact with the runway asphalt and eroded as it slid along it before coming to a halt. Furthermore, the propellers, which were still rotating, suffered deformations as a result of impacting the ground.

Photograph 5: Nose landing gear housing

No detached aircraft wreckage was found on the runway.

After the event, the following damages to the aircraft were identified:

Photograph 6: Main landing gear doors

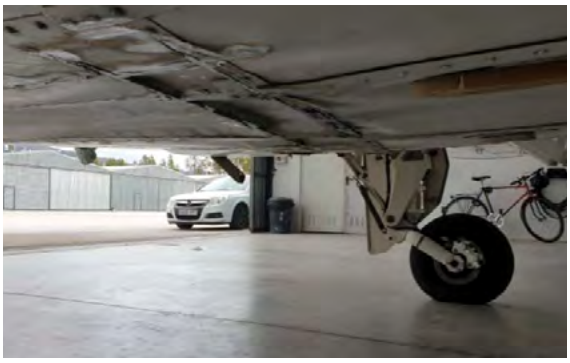
- Nose landing gear doors: significant damage.
- Main landing gear doors - deformed and eroded.
- Propellers of both engines: deformed and significantly damaged. On the right-hand propeller, one blade tip was doubled back on itself, and the other was folded forward. However, both blade tips were bent backwards on the left side, suggesting that the power being supplied by the left engine was inferior to that being supplied by the right engine.
- Lower fuselage area: underside eroded longitudinally in the direction of travel.
- Footboards: damaged at their attachment point.

Photograph 7: Right engine propeller

Photograph 8: Left engine propeller

Photograph 9, left: Footboard

Photograph 10 right: Underside of fuselaget



## 1.13. Medical and pathological information

Not applicable.

## 1.14. Fire

Not applicable.

## 1.15. Survival aspects

The aircraft cabin remained entirely in-tact and did not suffer deformations during the event. As a result, the crew were unharmed and able to exit the aircraft without assistance.

The safety seat belts were operative and functioned adequately.

## 1.16. Tests and research

*1.16.1. Statements*

*1.16.1.1. Instructor's statement*

On the day of the event, the instructor/pilot-in-command was conducting an instruction flight with two people on board.

They took off at 08:15 local time from the Axarquía Aerodrome to proceed with the MEP/VFR training course. On the way back to the aerodrome, the instructor told the student they would simulate a downwind leg engine failure and land on runway 30. According to the instructor's testimony, as he reduced thrust to the left engine, the student began the procedure to control the plane, making the appropriate checks and initiating the turn towards base followed by the final approach to runway 30 with a simulated engine failure.

The instructor reports that at approximately 500 feet and with the aircraft already aligned on the final, he asked the student to repeat the last final-approach checklist. The student proceeded to read it aloud, checking the position of the flaps for landing, the mixture control levers, forward propellers, the landing gear-down position, and confirming the approach speed was above the blue line on the anemometer.

According to the instructor's statement, he visually checked all the items on the list except for the green landing gear indicators, because the student's arm on the thrust lever and the checklist strapped to his leg obscured them from his view.

The instructor claims that, at that point, they were additionally distracted by having to answer a radio communication from another aircraft in the area and confirm their position on short final. The added distraction meant he did not visually check if the landing gear was down until just seconds before landing, when, according to his statement, on realising the landing-gear indicator lights were not green, he immediately alerted the student to tell him the landing gear was up. Faced with this situation, the student panicked and was unable to react, landing with the gear-up. The friction produced as the propellers and fuselage dragged along the runway brought the aircraft to a stop within a few metres.

After securing it, the three uninjured crew members evacuated the aircraft unassisted and, according to the instructor, the company's maintenance personnel arrived at the scene in less than two minutes. A truck crane was immediately called to remove the aircraft from the runway. It lifted it and extended and locked the landing gear legs without issue so that it could be towed to the company's maintenance hangar.

*1.16.1.2. Student pilot's statement*

In his statement, the student says he carried out the preflight inspection together with the observing pilot and the instructor, with whom, according to the student, he had not flown before. The result of the inspection was satisfactory.

They took off, and the lesson proceeded without incident. On the way back to the aerodrome, they practised different manoeuvres and reviewed the necessary procedures for the final check. According to the student, after executing two landings and take-offs, the next landing was the first he had performed with a simulated engine failure. He focused on, what for him, was the unfamiliar feeling of landing a twin-engined aircraft with only one engine and, in his words, it all went well except for the fact that he didn't realise the landing gear wasn't down. As neither of the two instructors spotted the problem, he was forced to make a gear-up landing but, according to his statement, he controlled the aircraft safely ensuring the crew escaped unharmed.

*1.16.1.3. Passenger's statement*

He arrived at the aerodrome at 08:00 local time, intending to board the event flight as an observer to familiarise himself with the aircraft and its procedures for a future CRI course.

According to his statement, they flew for one hour practising the engine failure procedure at 3000 ft and subsequently returning to the aerodrome to practise take-offs and landings and simulate an engine failure in the traffic circuit. During the third and final landing and take-off, they simulated an engine failure on approach. The student was instructed to lower the landing gear. At this point, the instructor made a radio communication to indicate their position on final approach to runway 30. A few seconds later, they asked him to carry out the final cockpit checks.

According to the observing instructor, the student made the final check saying that the gear was down, without realising, the three green lights that confirm the gear is down and locked were not illuminated. At the very last minute, the instructor/pilot in command realised the landing gear was still up and alerted the student who didn't understand what he was being told and continued with the approach. A few seconds later, they were already touching down without landing gear, and it was too late for the instructor to remedy the situation.

*1.16.2. Related reports/communications*

*1.16.2.1. ATO risk assessment*

The ATO reported the event and conducted a risk analysis of the training flight that classified the aircraft's gear-up landing as tolerable.

The risk analysis was carried out according to the risk matrix defined in section 6.8.2 of the ATO *Management Manual*, which placed the hazard in the "Technical" group, as a risk related to the school's operations. The likelihood of occurrence was classified as a remote possibility, although the potentially severe consequences for both passengers and aircraft meant it was classed as an extremely serious incident. Although the event was classified as "tolerable", the ATO decided mitigating actions were necessary.

The mitigating actions deemed necessary were as follows:

- make improvements to training both at a technical level and with regard to CRM between the student and the instructor in the cockpit.
- ensure the Head of Teaching supervises the simulator sessions to ensure procedures are being followed correctly and that communication in the cockpit is adequate.
- conduct an internal training session for all instructors of aircraft with retractable landing gear to review procedures.
- reinforce the habit of checking the gear-down lights are on, underlining the fact that reading the aircraft checklist alone is not sufficient and that a final gear-down check should be performed on the short final before landing, with this last "Double Visual Check" involving both student and instructor confirming the lights are on during the corresponding procedure.

The organisation also notified us of its intention to hold the internal training course for all retractable landing gear aircraft instructors no later than two weeks after the event, in order to specifically review procedures and the use of checklists in this type of aircraft.

The internal ATO evaluation concluded that although the event was an isolated event caused by a chain of errors on the part of both the student and the instructor (ultimately responsible), in future, the organisation would place more emphasis on safety, procedural standardisation and adequate situational awareness during training flights.

*1.16.3. Tests/Inspections*

We evaluated the crew's statements, the overhaul and subsequent repair of the aircraft by the ATO maintenance centre, and analyses of similar events to define lines of investigation for the event.

A. The crew's statements clearly point to human error as a factor in the event; specifically, the chain of procedural and checklist errors made by both the student pilot and the instructor, and the general lack of situational awareness during a training flight.

B. The maintenance overhaul carried out by an authorised maintenance centre confirms the aircraft had a fully functional landing gear alert and warning system, and that both the indicators and the gear itself were operating correctly.

## 1.17. Information about the training organisation

The organisation had a certificate of approval as an approved training organisation (ATO), issued by Spain's National Aviation Safety Agency (EASA) on the 30/05/2013, which allowed them to offer courses for the CPL, PPL, MCC, CRI, ATPL, FI, IR and SEP, MEP and night flight ratings.

The ATO uses the *pilot's operating handbook* (POH) published by the manufacturer as its source of information on the aircraft's operation. It then adapts this information to include it in its "Standard Operating Procedures (SOP)". The checklists defined by the POH are included in part B of the organisation's *Operating Manuals*.

Within the SOP's, the before-landing procedures are as follows:

1. Safety seat belts and harnesses secured. Seat backs in the upright position
2. Fuel selectors - check ON position
3. Auxiliary fuel pump - ON position
4. Mixture control - FULL RICH position
5. Carburettor heater - FULL ON or FULL OFF position as required
6. Cowl flaps – as required
7. Landing gear – DOWN position, maximum speed 140 kts
8. Landing and taxi lights: as required.
9. Wing Flaps – FULL DOWN position, maximum speed 110 kts
10. Airspeed – establish approach speed for landing
11. Propellers – HIGH RPM position

The "landing with an inoperative engine" procedure, which is included in the emergency procedures, is as follows:

On final approach and when an airfield is close and reachable:

1. Landing gear – DOWN position
2. Airspeed – 85 kts
3. Power – as required
4. If you are sure a go-around is not an option, flaps – FULL DOWN position
5. Land normally

## 1.18. Additional information

Not applicable.

## 1.19. Useful or effective investigation techniques

Not applicable.

# 2. ANALYSIS

## 2.1. Analysis of the meteorological conditions

The meteorological conditions in the area of Axarquía Airport (Málaga) around the time of the event (09:48 local time) were suitable for the flight, and no unexpected adverse conditions that could have contributed to the accident were registered.

## 2.2. Operational analysis

The lesson affected by the event had proceeded normally, although the briefing was held during the flight. After performing various manoeuvres, including a simulated an engine failure at 3000 ft, the aircraft joined the traffic circuit to land on runway 30. The instructor decided to repeat the engine outage simulation on the downwind leg, giving the student time to compensate for the yaw and follow the engine failure procedure.

The "before landing" list, which includes deploying the landing gear, is always checked on the downwind leg and, in this case, the simulated engine failure meant they also had to go through the "landing with an inoperative engine" list. This final list specifies that when the aircraft is on the final approach, and the landing is assured, pilots must lower the landing gear, maintain a speed of 85 kts and adjust thrust as required. They must also go through any points in the "before landing" list not included in the "landing with an inoperative engine" list.

There are two different final lists: one used as standard and another to be used in an emergency.

According to the testimonies provided by the crew, the landing gear remained in the UP position because the pilot forgot to move the landing gear lever to DOWN.

Pilot training typically involves repeatedly practising different manoeuvres with different aircraft configurations, particularly in the airfield circuit, as was the case in this event.

According to the crew's statements, the student did not follow the procedures despite the instructor requesting he go through the list. In his statement, the student himself indicated that it was the first time he had practised landing with an inoperative engine. Therefore, it is entirely possible that the inexperienced student was distracted by the challenge of controlling the aircraft and did not actuate the landing gear extension lever.

According to his statement, the instructor could not see if the three green gear-down lights had come on. Firstly, because their position on the instrument panel meant they were obscured by the student's arm and secondly because just as he was going to check them, he was distracted by a communication from traffic joining the circuit, which meant he was concentrating on confirming their position by radio.

As the pilot-in-command, the instructor was overly focused on the radio and neglected to verify the correct execution of all items on the checklist. Having checked that the student had completed the other points on the list, he assumed the landing gear indicators were lit and that the lever was in the DOWN position. When he returned his attention to the cockpit, he noticed that the green lights were not on and immediately realised the student had not lowered the gear. He urged him to go-around but the student, was focused on the engine outage and landing, did not know how to react and, instead, completed his planned manoeuvre and landed on the runway with the gear up.

It also appears the crew did not pay attention to the audible landing-gear position warning, despite the fact that it must have sounded because the gear was up and one of the thrust levers was in the idle position.

In conclusion, it can be assumed the student failed to deploy the landing gear due to a procedural error, which occurred because he was entirely focused on controlling the aircraft during his first simulated landing with an inoperative engine, and neglected to carry out all the items on the "before landing" and "landing with an inoperative engine" checklists. Furthermore, the instructor, who was ultimately in charge of the flight, did not check the landing gear's position and, therefore, failed to supervise the manoeuvre properly.

### 2.3. Analysis of the aircraft's maintenance

The maintenance carried out the aircraft was in order. A post-event inspection of the aircraft found the landing gear system, including the alarm, warning systems, were operational, and working correctly; hence our conclusion that they did not contribute to the event.

The inspection did not reveal any mechanical or non-mechanical breakdown or failure that could have impeded the landing gear's correct operation.

There is nothing to suggest the audible gear-up alert did not sound.

### 2.4. Analysis of the organisation and management

As per its *Safety Management Manual*, the school carried out an analysis of the event. The risk matrix used classified the event as "Tolerable", considering the probability of occurrence to be remote. However, because of the potentially severe consequences for both passengers and aircraft, mitigating actions were deemed necessary. Their analysis is deemed to be satisfactory.

The fact that the organisation itself identified the reinforcement of training, both at a technical level and with regard to the CRM between student and instructor in the

cockpit, as a corrective measure, underlines the need for the school to make improvements to its training on these aspects. The school must also make improvements to the procedural training provided for instructors of aircraft with retractable landing gear.

Specifically, as a result of their analysis, the school has decided to reinforce the habit of checking the gear-down lights are on. They will also underline the fact that reading the aircraft checklist alone is insufficient, and that a final gear-down check should be performed on the short final before landing, with this last "Double Visual Check" involving both student and instructor confirming the lights are on during the corresponding procedure.

# 3. CONCLUSIONS

## 3.1. Findings

- The aircraft was maintained by an AESA-approved Continuing Airworthiness Management Organisation (CAMO) belonging to the owner of the aircraft.
- The aircraft had an airworthiness certificate valid for the flight.
- There were no limiting meteorological conditions for visual flight.
- Analysis of the aircraft wreckage confirmed the landing gear system and its cockpit warning and indication systems were not affected by any failure or malfunction. It also established that the left engine had less power than the right engine.
- The investigation has revealed that the landing gear was not deployed by default of actuation of the landing gear lever on the instrument panel to the DOWN position.
- The damage to the aircraft is consistent with the testimonies of those involved in the event.
- The crew were unharmed and evacuated the aircraft without assistance.

## 3.2. Causes/contributing factors

The investigation into the event has identified as a probable cause of the accident, the lack of adherence to flight procedures

The flight instructor's failure to ensure the landing gear was extended before landing is also considered to have been a contributory factor.

## 4. OPERATIONAL SAFETY RECOMMENDATIONS

During the investigation, the training organisation reported its intention to implement corrective measures following the event. These measures included providing a training course for all instructors of aircraft with retractable landing gear, to be held no later than two weeks after the event. The course was to focus, specifically, on procedures and the use of checklists in this type of aircraft. It would also emphasise the need to make a "Double Visual Check", which should involve both the instructor and the student checking the indicator lights, confirming they are illuminated, and, therefore, both establishing that the landing gear is down and locked in preparation for landing.

The organisation will confirm the implementation of these measures to the Commission.

REC 48/20: It is recommended that AERODYNAMICS MÁLAGA, S.L., should reinforce and improve its instructor training to ensure procedures are followed and checklists are used correctly, with particular emphasis on those relating to abnormal procedures and emergencies.

REC 49/20: it is recommended that AERODYNAMICS MÁLAGA, S.L., should establish specific emergency checklists for instruction which should include all the actions necessary to provide training on emergency management, given the possibility of a genuine emergency occurring during training flights.

REC 50/20: It is recommended that AERODYNAMICS MÁLAGA, S.L., should include procedures and checklists separately in the training school's (ATO) operating manuals.

REC 51/20: It is recommended that AESA should ensure the inclusion of procedures and checklists specific for instruction in all training school (ATO) manuals and monitor their appropriateness.