

CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE ACCIDENTES
E INCIDENTES DE
AVIACIÓN CIVIL

Report A-010/2016

Accident involving a CESSNA 172R aircraft,
registration EC-JSM,
operated by a private operator,
in Perales de Tajuña (Madrid)
on 30 March 2016



GOBIERNO
DE ESPAÑA

MINISTERIO
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SUBSECRETARÍA

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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) n° 996/2010, of the European Parliament and the Council, of 20 October 2010; Article 15 of Law 21/2003 on Air Safety and articles 1., 4. and 21.2 of Regulation 389/1998, this investigation is exclusively of a technical nature, and its objective is the prevention of future civil aviation accidents and incidents by issuing, if necessary, safety recommendations to prevent from their reoccurrence. The investigation is not pointed to establish blame or liability whatsoever, and it's not prejudging the possible decision taken by the judicial authorities. Therefore, and according to above norms and regulations, the investigation was carried out using procedures not necessarily subject to the guarantees and rights usually used for the evidences in a judicial process.

Consequently, any use of this report for purposes other than that of preventing future accidents may lead to erroneous conclusions or interpretations.

This report was originally issued in Spanish. This English translation is provided for information purposes only.

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Abbreviations

° ' "	Sexagesimal degrees, minutes and seconds
C	Degrees centigrade
AEMET	Spain's National Weather Agency
AESA	Spain's National Aviation Safety Agency
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
CIAIAC	Spain's Civil Aviation Accident and Incident Investigation Commission
cm	Centimeters
DME	Distance measuring equipment
DVOR	Doppler VOR - VHF Omnidirectional Range
EASA	European Aviation Safety Agency
FAA	Federal Aviation Administration
FAR	Federal Administration Regulations of the United States of America
FL	Flight level
ft	Feet
gr	Grams
h	Hours
hPa	Hectopascals
ICAO	International Civil Aviation Organization
Kg	Kilograms
Km	Kilometers
Km/h	Kilometers/hour
Kts	Knots
LECU	ICAO code for the Cuatro Vientos aerodrome
LELL	ICAO code for the Sabadell Airport
m	Meters
N/A	Not available
N	North
PPL(A)	Private Pilot License (Airplane)
QNH	Altimeter subscale setting to obtain elevation when on the ground
SEO	Spanish Ornithological Society
SEP	Single Engine Piston (Land) rating
TCDS	Type Certificate Data Sheet
TMA	Terminal Control Area

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UTC	Coordinated Universal Time
VFR	Visual Flight Rules
W	West

Synopsis

Owner:	Aero Club Barcelona-Sabadell
Operator:	Private ¹
Aircraft:	CESSNA 172 R, registration EC-JSM
Date and time of accident:	30 March 2016 at 14:02 ²
Site of accident:	Perales de Tajuña, Madrid
Persons onboard:	3 (1 pilot & 2 passengers), all killed
Type of flight:	General Aviation - Private
Phase of flight:	En route
Date of approval:	27 July 2016

Summary of the event:

On Wednesday, 30 March 2016, a CESSNA 172R aircraft, registration EC-JSM, impacted a griffon vulture over the town of Perales de Tajuña in Madrid.

The aircraft had taken off that morning at 11:21 from the Sabadell airport (Barcelona) and was en route to the Cuatro Vientos airport (Madrid) on a visual flight.

As the aircraft was flying over the town of Perales de Tajuña, a griffon vulture struck the left wing strut, causing the wing to detach. The aircraft immediately lost control and impacted the ground seconds later.

The impact with the ground resulted in the death of the pilot and the two passengers.

The aircraft was completely destroyed.

The investigation has determined that the accident was caused by the loss of control of the aircraft following the detachment of the left wing after impacting a griffon vulture.

¹ The pilot was a member of the Barcelona-Sabadell Aero Club.

² All times in this report are local. To obtain UTC, subtract 2 hours from local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On Wednesday, 30 March 2016, a CESSNA 172R aircraft, registration EC-JSM, took off at 11:21 from the Sabadell airport (Barcelona) on a visual flight to the Cuatro Vientos airport (Madrid). The pilot, a member of the Barcelona-Sabadell Aero Club, and the two passengers, had planned to spend part of the day in Madrid and return later that day to Sabadell.

As they were flying over the town of Perales de Tajuña, a griffon vulture struck the left wing strut, causing the wing to detach. This led to the immediate loss of control of the aircraft, which crashed into the ground a few seconds later.

The collision with the ground resulted in the death of the pilot and the two passengers.

The aircraft was completely destroyed.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	1	2	3	
Serious				
Minor				N/A
None				N/A
TOTAL	1	2	3	

1.3. Damage to aircraft

The aircraft was completely destroyed.

1.4. Other damage

There was no damage of any type, with the exception of an olive tree that was damaged by the aircraft's impact.

1.5. Personnel information

The pilot, a 27-year old Spanish national, had a private pilot license (PPL(A)) that was issued on 13 February 2013 by AESA. He also had a single-engine piston (SEP(land)) rating that was valid until 28 February 2017, and a NIGHT rating that enabled him to make nighttime visual flights.

He had a class 2 medical certificate that was valid until 18 March 2020.

On the day of the accident he had a total of 223:02 flight hours.

1.6. Aircraft information

The CESSNA 172R aircraft, registration EC-JSM and serial number 17281310, had been manufactured in 2006 and registered in the Aircraft Registry managed by Spain's National Aviation Safety Agency on 21 July 2006. The aircraft was outfitted with a LYCOMING IO-360-L2A engine.

The accident aircraft had a Certificate of Airworthiness, issued on 19 January 2012 by AESA. The Airworthiness Review Certificate had been issued by AESA on 22 December 2014. The Airworthiness Review Certificate was later extended on 7 January 2016 until 19 January 2017 by the Barcelona-Sabadell Aero Club, which was the approved Continuing Airworthiness Maintenance Organization as per Annex I (Part M), Section A, Subpart G of Regulation (EC) no. 2042/2003.

The aircraft was last inspected on 29 February 2016 during a 50-h inspection that was conducted at the Barcelona-Sabadell Aero Club, as the maintenance organization approved by AESA as per Subpart F (Part M) of Regulation (EC) no. 2042/2003. At the time of the inspection, the aircraft had 3,499:44 h and the accident occurred with the airplane having flown 3,519:37 h.

In May 2011 the aircraft sustained minor damage to its left wing, propeller and nose wheel during an incident that took place while making an unstabilized approach to the Igualada aerodrome (Barcelona). The CIAIAC conducted an investigation into that incident and published report IN-014/2011 on the event.

1.7. Meteorological information

Spain's National Weather Agency (AEMET) does not have automatic stations in Perales de Tajuña, but in light of the information from the station in Arganda del Rey (13 km away), and of radar images and adverse weather phenomena, the most likely conditions at the site of the accident were:

- Wind from the south-southwest (230°) at 30 km/h and gusting to 45 km/h.
- Good visibility on the surface. The skies were clear.
- The temperature was 23° C.
- The pressure (QNH) was 1,006 hPa.
- No significant weather phenomena.

1.8. Aids to navigation

The last radar position for the aircraft before the accident is shown below (40° 15' 19" N, 3° 21' 16" W). At that time, the aircraft was flying at an altitude of 3000 ft at a ground speed of 100 knots.

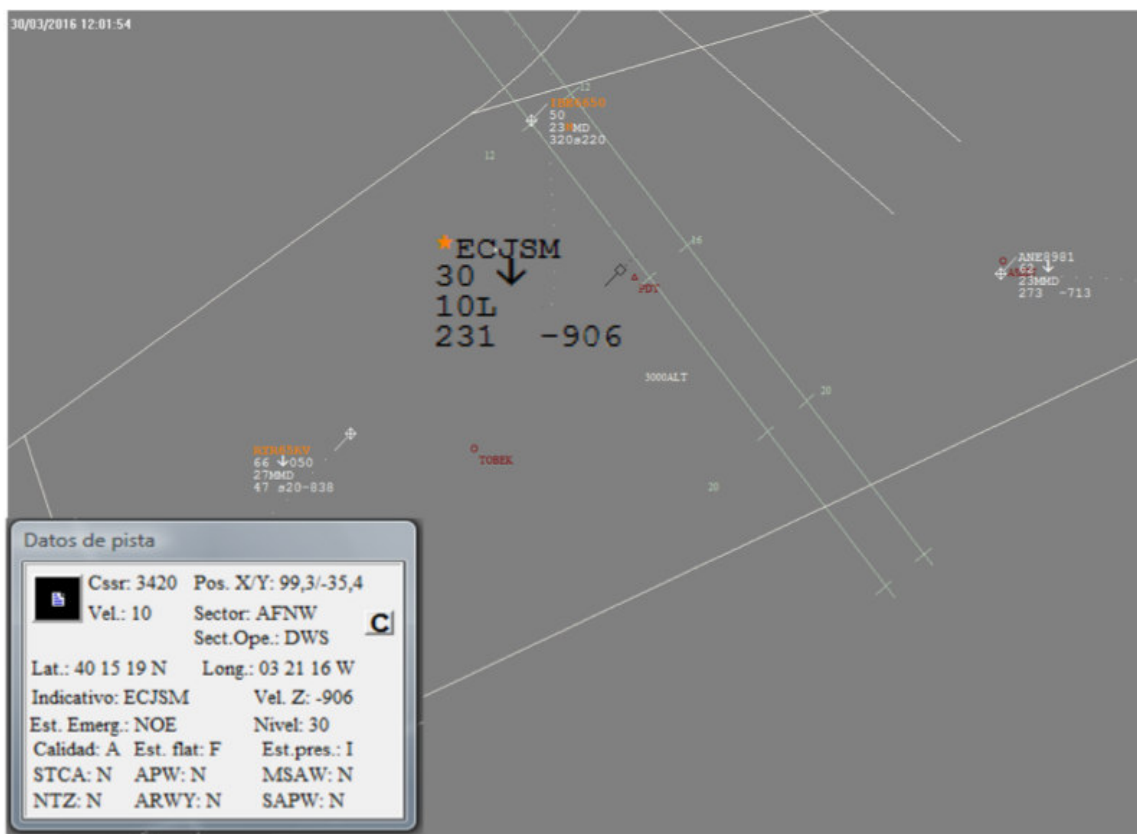


Figure 1. Last radar position of the aircraft

1.9. Communications

The communications between the pilot and ATC stations indicate that the flight was proceeding normally until the time of the accident. The last exchange took place at 13:58, when the controller instructed the pilot to proceed via visual airspace at visual altitudes, which the pilot acknowledged.

1.10. Aerodrome information

The aircraft had taken off from the Sabadell airport (Barcelona), ICAO code LELL, en route to the Cuatro Vientos airport (Madrid), ICAO code LECU.

As it was flying over the vicinity of the PDT DVOR/DME at an altitude of 3000 ft, which is the maximum altitude for visual flights in the TMAD-15 sector, it struck the griffon vulture.

TMAD-15 is a class-A sector from 3000 ft to an altitude of FL 195, and a class-C sector from FL 195 up to FL 245. Below 3000 ft, the airspace is class G and does not belong to the TMA.

The area where the accident took place is not labeled as a prohibited, restricted or hazardous area in the "VFR Procedures in the Madrid TMA" published in the AIP. It is also not identified as an area with sensitive wildlife.

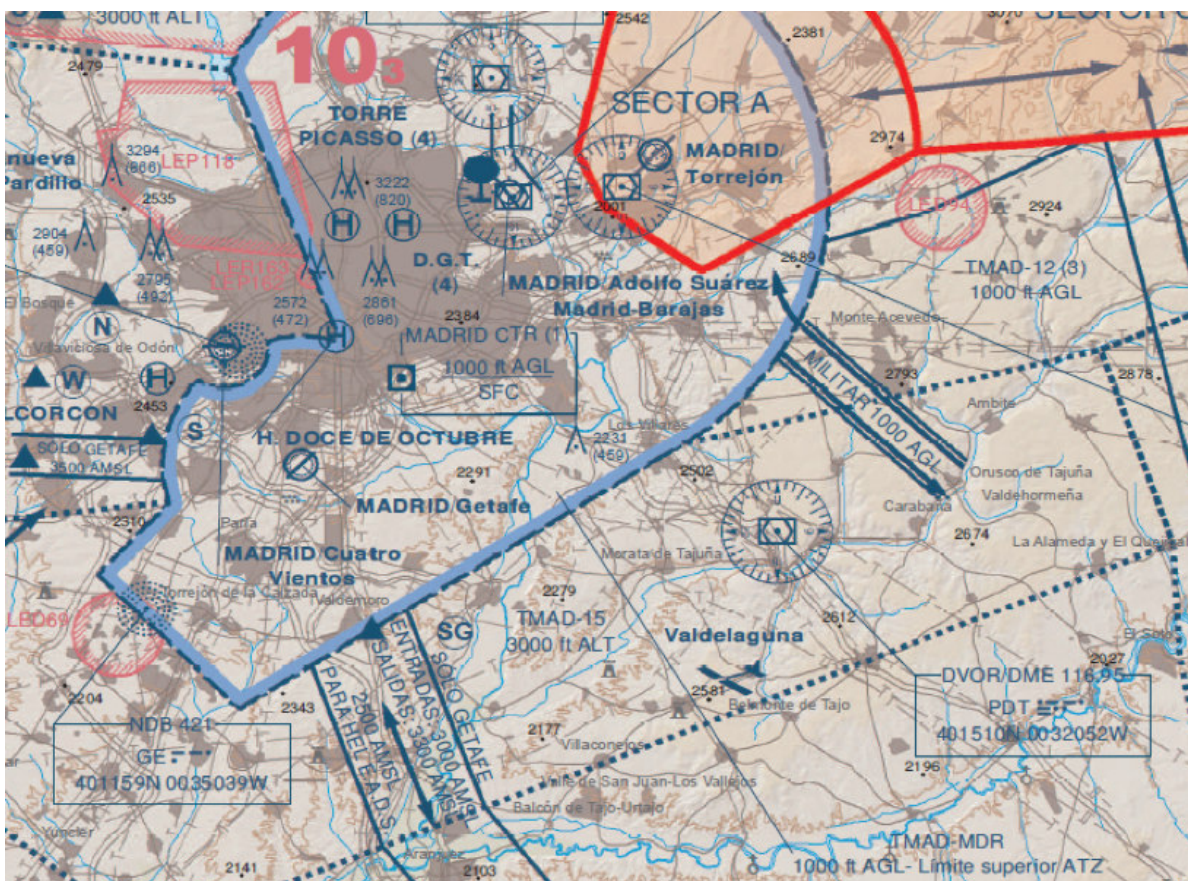


Figure 2. Segment of the VFR traffic chart for the Madrid TMA

1.11. Flight recorders

Not applicable.

1.12. Wreckage and impact information

The aircraft was completely destroyed. The aircraft wreckage was found in two areas. The debris from the left wing was found at coordinates 40° 15' 42.6" N, 3° 20' 36.7" W. The remains of the vulture were some 100 m north of this location. The rest of the aircraft was found at coordinates 40° 15' 35.3" N, 3° 20' 49.1" W, next to an olive tree that stopped the aircraft's motion. The figure below shows both of these areas:

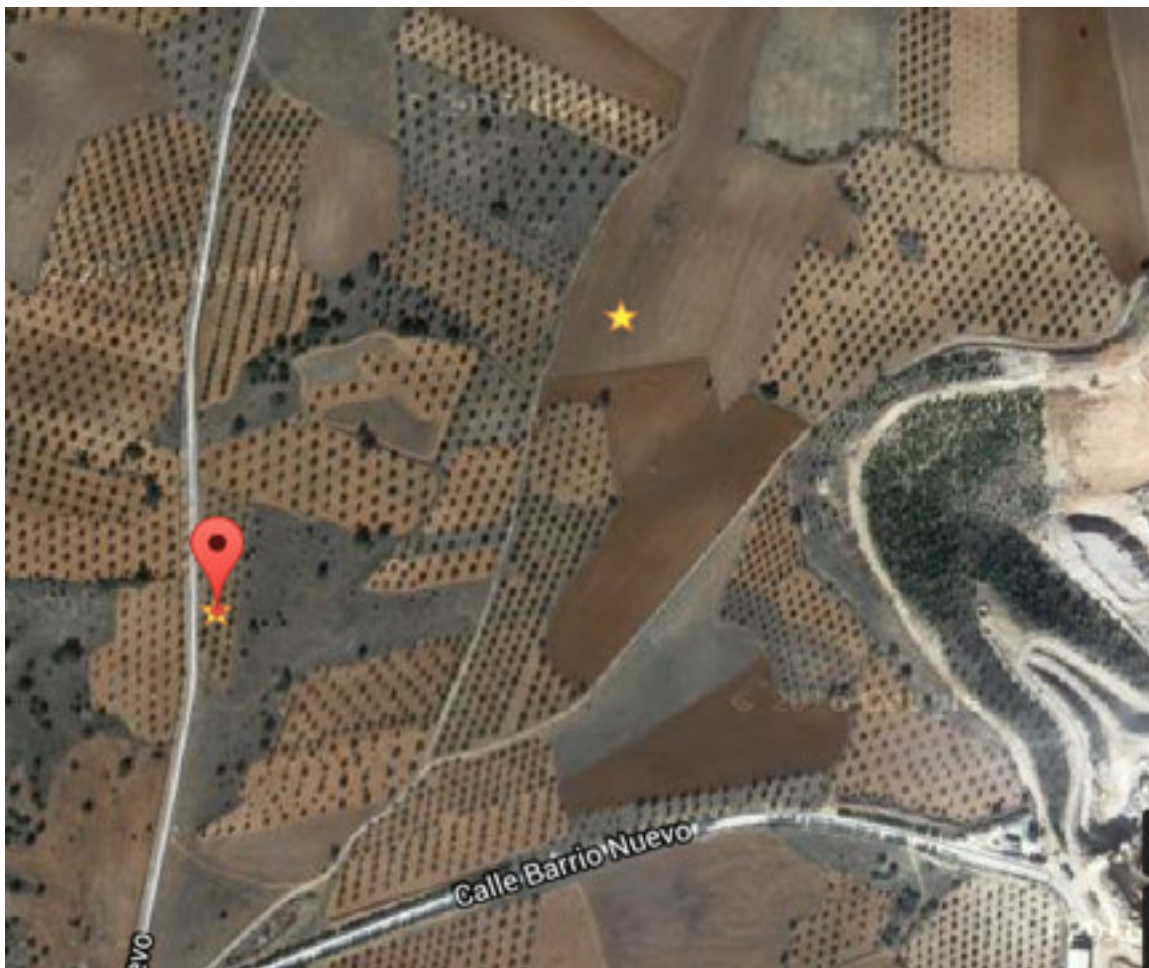


Figure 3. Location of the left wing (right star) and the main wreckage (left star)

The photographs below show the condition of the left wing, with the photograph on the right showing the point where the griffon vulture severed the strut.



Figure 4. Left wing and strut

1.13. Medical and pathological information

There is no evidence based on the autopsy results that the pilot's actions were hampered by any physiological factors or disabilities.

1.14. Fire

A fire did not break out after the aircraft crashed into the ground.

1.15. Survival aspects

Due to the nature of the accident, all three of the aircraft's occupants were killed on impact.

1.16. Tests and research

1.16.1. Statement by an eyewitness who was pruning olive trees

The eyewitness stated that at approximately 14:00 he was pruning some olive trees when he saw an airplane approach the area, flying normally at a high altitude and without making any type of strange noises. He then saw the small airplane lose altitude rapidly, and that a wing, which he thought to be the left wing, detached from the aircraft. The airplane fell with the nose tilted slightly left and crashed in an area with several olive trees. He heard a loud noise when the accident took place and after witnessing the event, immediately reported it to emergency services.

Several Civil Guard units and a firefighting truck responded to the scene.

1.17. Organizational and management information

The airplane belonged to the Barcelona-Sabadell Aero Club, of which the pilot was a member. This flying club, which is based in the Sabadell airport, is the largest in Spain with over 1000 members and a fleet of over 40 aircraft, which may be used by the club's members.

1.18. Additional information

1.18.1. Bird activity charts

The bird activity chart below was taken from the Aeronautical Information Publication (AIP) and shows the main vulture breeding colonies year-round.

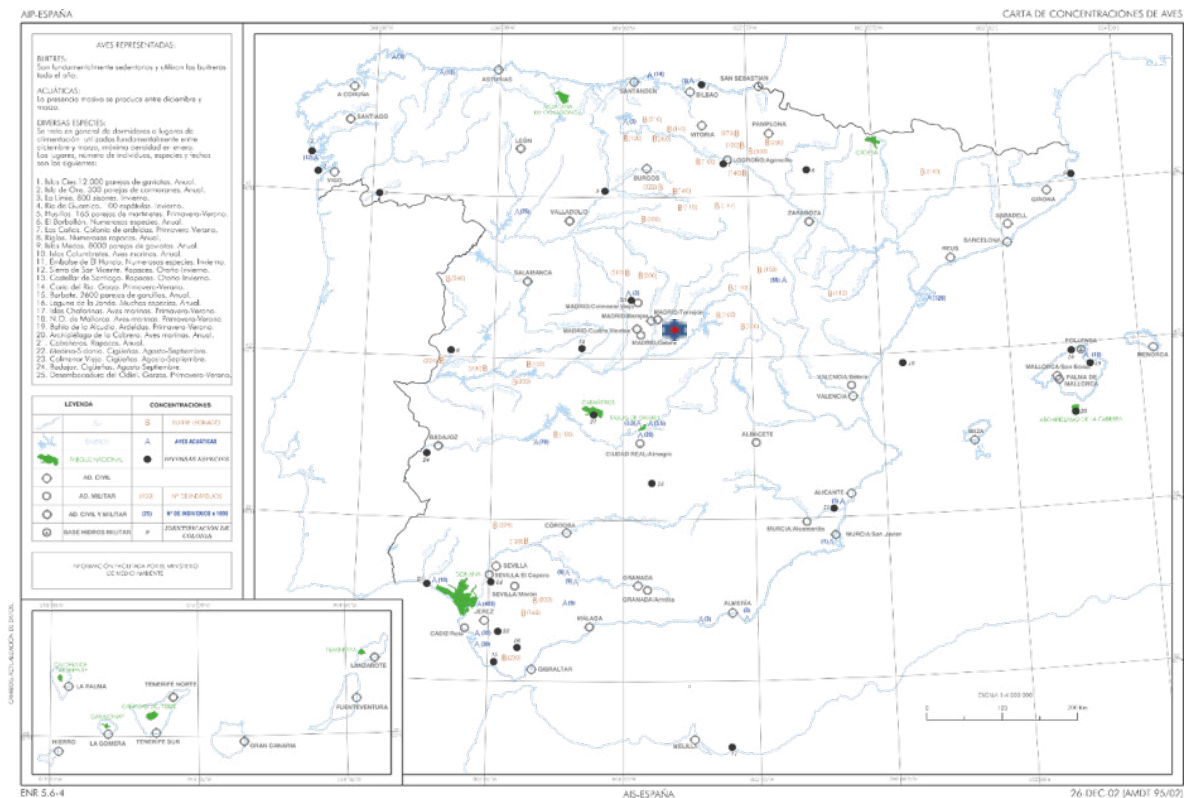


Figure 5. Bird activity chart

The red star on the AIP bird activity chart shows the location of the accident site, which is not identified as an area of bird activity.

1.18.2. Information on the griffon vulture

The website of the Spanish Ornithological Society (SEO) contains the following information. The griffon vulture (*gyps fulvus*) is a large bird of prey that can range from 90 to 100 cm in length, 230 and 265 cm in wingspan and 6 to 9 kg in weight for adult specimens.

The vulture that impacted the accident aircraft was an adult weighing over 6.4 kg³.

The griffon vulture tends to glide rather than fly. It can reach altitudes of 1,800 to 3,500 meters above sea level, though on certain days they can reach as high as 6,000 meters above sea level.



Figure 6. Griffon vulture that caused the accident

In 2008 the SEO published the study “El buitre leonado en España. Población reproductora en 2008 y método de censo” [The griffon vulture in Spain. Breeding population in 2008 and census method]. At the time its population was estimated at between 91,000 and 95,000 birds and 1,560 colonies were identified. The map below, taken from this study, shows the distribution of the griffon vulture in Spain:

³ It was not possible to find all of the vulture’s body; specifically, the lower left extremity and the left wing could not be found. The remains that were found weighed 6,400 gr.

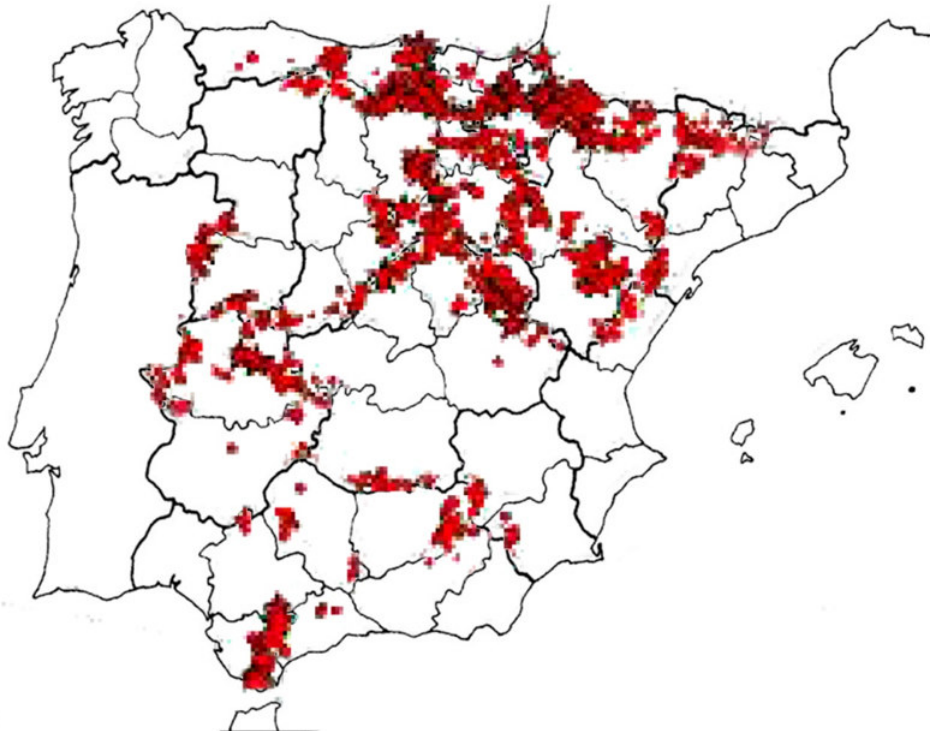


Figure 7. Distribution of the griffon vulture in Spain

In the province of Madrid, the vulture colonies are located in the Guadarrama Mountains, concentrated in two areas. The main one is centered around La Pedriza de Manzanares, with the other one being between El Escorial and the San Juan Reservoir. Regardless of the locations of the colonies, we must bear in mind that a griffon vulture is capable of flying hundreds of kilometers in one day.

1.18.3. Certification requirements for the CESSNA 172 R aircraft

The CESSNA 172 R aircraft has an EASA.IM.A.051 type certificate that refers to the FAA TCDS 3A12 type certificate as the basis for its certification. The FAA TCDS 3A12 type certificate specifies that the aircraft was certified as per the FAR23 regulation, Amendments 1 through 6, not including certain requirements in the FAR23 regulation. The airworthiness categories are "Normal" and "Semi-acrobatic".

The FAR23 regulation, Amendments 1 through 6 for the normal and semi-acrobatic categories, do not require aircraft to be certified for a bird strike. Subsequently, Amendment 23-49 of FAR23, in Section 23.775, did require that commuter aircraft have a windshield and support structures that could withstand the impact from a two-pound bird.

Moreover, the aircraft manufacturer stated that the wing on the Cessna 172 is attached to the fuselage with a single bolt each at the front and rear spars. The

strut joins the midpoint of the front spar to the underside of the fuselage. Without the strut, the wing rotates about the points where it attaches to the fuselage and the loads placed on the wing cannot be absorbed by the fuselage. Therefore, if the strut breaks, it will cause a catastrophic failure that will result in the loss of the aircraft.

The manufacturer reported that it had not conducted any impact testing on the strut.

1.19. Useful or effective investigation techniques

Not applicable.

2. ANALYSIS

2.1. General

On Wednesday, 30 March 2016, a CESSNA 172R aircraft, registration EC-JSM, took off at 11:21 from the Sabadell airport (Barcelona) on a visual flight to the Cuatro Vientos airport (Madrid).

As it was flying over the town of Perales de Tajuña (Madrid), the strut on the aircraft's left wing impacted the left wing of a griffon vulture.

At the time of the accident the aircraft was flying at an altitude of 3000 ft, according to the radar return, which is the maximum altitude allowed for visual flights in the airspace where it was located. Considering the elevation of the terrain at the accident site (approximately 759 m or 2490 ft), this means the aircraft was 510 ft above ground level.

2.2. Analysis of the impact with the griffon vulture

On impact, the left wing strut broke, as did the left wing and the lower left extremities of the vulture. It was thus a frontal impact between the two. At the time of the accident, the radar return showed that the aircraft's ground speed was 100 kt. This translates into a kinetic energy on impact of over 8,323 joules, not taking into account the air speed or the speed of the vulture.

To put the magnitude of an impact with this kinetic energy in perspective, consider that the current EASA certification specifications for normal, semi-acrobatic, acrobatic and commuter aircraft (CS-23) only require commuter aircraft to be able to withstand a bird strike that imparts a kinetic energy ranging from a few joules to 5,566 joules in case of the Fairchild SA-227.

Therefore, normal, semi-acrobatic, acrobatic and commuter aircraft are not certified to withstand impacts with a kinetic energy as high as the one involved in this accident.

2.3. Analysis of the pilot's actions

It is not known if the pilot sighted the vulture and attempted some kind of evasive maneuver or if the collision took place without the pilot noticing the bird's presence

3. CONCLUSIONS

3.1. Findings

- The pilot had a valid license and medical certificate.
- The aircraft's documentation was in order and it was airworthy.
- The weather conditions were not limiting to visual flight.
- The pilot, in his communications with various ATC stations, did not report any type of technical problem with the aircraft during the flight.
- The area where the accident took place is not identified on the bird activity chart published in the AIP as a breeding colony for griffon vultures.
- The wing on a CESSNA 172 is not required to withstand a bird strike, as per its certification specifications.

3.2. Causes/Contributing factors

The investigation has determined that this accident occurred when the pilot lost control of the aircraft following the detachment of the left wing as the result of striking a griffon vulture.

4. SAFETY RECOMMENDATIONS

In 2016, there have been four accidents, three of them fatal, involving bird strikes with griffon vultures. In the first three, the strike with the vulture caused significant structural damage and the loss of control of the aircraft, resulting in an inevitable violent impact against the ground. In the fourth accident, the pilot, who was not seriously injured, was able to land.

The first accident took place on 16 January 2016, when a SOCATA TB-20 aircraft struck an adult griffon vulture while flying over the Serranía de Cuenca Natural Park.

The second accident was the one investigated in this report.

The third accident occurred on 19 May 2016 when a Robin DR-400-180 struck an adult griffon vulture while flying over the town of Arbizu (Navarre).

The fourth accident took place on 7 July 2016, when a glider struck a vulture head-on as it was making a climbing turn in an updraft, northeast of the town of Sabiñánigo, Huesca.

It is essential that when preparing a flight, updated and detailed information be available on areas where birds gather and on the migratory routes of the larger bird species. As a result, the following recommendation is issued:

REC 58/16: It is recommended that ENAIRE update the bird activity chart and the migration route charts for larger bird species published in the AIP dated 26 December 2002, to reflect the current distribution of colonies of vultures and other birds that are suitable for inclusion in said chart, and their migratory routes.