CIAIAC

**C**OMISIÓN DE
**I**NVESTIGACIÓN
DE **A**CCIDENTES
E **I**NCIDENTES DE
**A**VIACIÓN **C**IVIL

# Report A-063/2005

Accident involving
a Cessna 172N,
registration EC-EME,
on October 24, 2005,
in San Quirze del Vallés
(Barcelona)

MINISTERIO
DE FOMENTO

# Report

# A-063/2005

## Accident involving a Cessna 172N, registration EC-EME, on October 24, 2005, in San Quirze del Vallés (Barcelona)

MINISTERIO DE FOMENTO

SECRETARÍA GENERAL DE TRANSPORTES

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Edita: Centro de Publicaciones
Secretaría General Técnica
Ministerio de Fomento ©

NIPO: 161-07-040-9
Depósito legal: M. 47.617-2006
Imprime: Diseño Gráfico AM2000

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 63
Fax: +34 91 463 55 35

E-mail: ciaiac@fomento.es
http://www.ciaiac.es

C/ Fruela, 6
28011 Madrid (España)

# Foreword

This report is a technical document that reflects the point of view of the Civil Aviation Accident and Incident Investigation Commission (CIAIAC) regarding the circumstances of the accident and its causes and consequences.

In accordance with the provisions of Law 21/2003 and pursuant to Annex 13 of the International Civil Aviation Convention, the investigation is of exclusively a technical nature, and its objective is not the assignment of blame or liability. The investigation was carried out without having necessarily used legal evidence procedures and with no other basic aim than preventing future accidents.

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

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

# Table of contents

# Abbreviations

| | |
|---|---|
| 00 °C | Degrees centigrade |
| AENA | Aeropuertos Españoles y Navegación Aérea (Spanish Airports and Air Navigation) |
| ARP | Airport Reference Point |
| CIAIAC | Comisión de Investigación de Accidentes e Incidentes de Aviación Civil (Civil Aviation Accident and Incident Investigation Commission) |
| DGAC | Dirección General de Aviación Civil (Civil Aviation Authority) |
| ft | Feet |
| h | Hour(s) |
| in | Inch(es) |
| INM | Instituto Nacional de Meteorología (National Weather Service) |
| kg | Kilogram(s) |
| KIAS | Indicated Airspeed in knots |
| kt | Knot(s) |
| lb | Pound(s) |
| NM | Nautical Miles |
| NTSB | National Transportation Safety Board |
| UTC | Coordinated Universal Time |
| VFR | Visual Flight Rules |

# Synopsis

| | |
|---|---|
| Owner and Operator: | Aeroclub Barcelona Sabadell and Private |
| Aircraft: | Cessna 172N |
| Date and time of accident: | 24 October 2005; 16:30 h[1] |
| Place of the accident: | San Quirze del Vallés (Barcelona) |
| People aboard and injuries: | 4 (pilot and three passengers), all fatal |
| Type of flight: | General Aviation. Non-commercial. Private |
| **Date of approval:** | 31 January 2007 |

## Accident summary

Airport authorities notified the CIAIAC of the accident on the same afternoon of its occurrence. On the next day, an investigation team traveled to the accident site to start the field investigation. The NTSB (National Transportation Safety Board) of the United States was notified of the accident as the investigating organization in the aircraft's State of design and manufacture.

The aircraft took off from runway 31 of Sabadell Airport and, after traveling approximately one mile, impacted with a crane installed in a building under construction that encroached upon the airport's inner horizontal surface area.

The aircraft's climb slope was not constant and sustained during the flight. It is believed that the aircraft took off with excess weight and personnel with ample flying experience at the airport have informed that in the prevailing wind conditions on the day of the accident it is possible that downdrafts were present that could have affected the aircraft's characteristics at takeoff, though this could not be confirmed. It has therefore not been possible to accurately determine why the aircraft was at a lower altitude than it should have been in theory when it crashed into the crane.

During the course of the investigation, a safety recommendation was issued after verifying that the crane the aircraft collided against was encroaching on Sabadell Airport's aviation easements.

[1] All times given in the present report are expressed in local time. In order to obtain the UTC it is necessary to subtract 2 hours from the local time.

# 1. FACTUAL INFORMATION

## 1.1. History of the flight

OThe pilot rented the aircraft, registration number EC-EME, at the Aeroclub Barcelona Sabadell. He informed the Control Tower of his intention to fly along the coastline. The flight was expected to last 1 hour and 45 minutes. In addition to the pilot, there were three passengers aboard.

The aircraft was cleared to take off from runway 31 of Sabadell Airport at 16:28. According to eyewitnesses, the aircraft's slope of climb was not uniform, exhibiting an irregular pitch angle that prevented it from maintaining a constant climb angle.

At 16:30 the aircraft impacted a crane in a building under construction that was located approximately one mile away from the airport. The crane was encroaching upon Sabadell Airport's exclusion area, and its installation had not been authorized by the Dirección General de Aviación Civil (Spain's Civil Aviation Authority). The engine and the propeller were embedded in the crane, while the rest of the aircraft fell onto the building under construction and burned.

The aircraft, with the exception of the powerplant, was completely incinerated and the occupants perished in the impact and subsequent fire.

As for the meteorological conditions, the temperature was 21 °C and the wind was at 8 kt from 260°.

The aircraft had been refueled before the flight and the tanks were full.

## 1.2. Injuries to persons

| Injuries | Crew | Passengers | Total in the aircraft | Others |
|---|---|---|---|---|
| Fatal | 1 | 3 | 4 | |
| Serious | | | | |
| Minor | | | | Not applicable |
| None | | | | Not applicable |
| TOTAL | 1 | 3 | 4 | |

## 1.3. Damage to aircraft

The aircraft impacted the crane and immediately fell on the building under construction. Witnesses working on the building testified that after the wreckage crashed to the ground, there was an explosion and a column of smoke.

Save for the powerplant components, which remained embedded in the crane, the rest of the aircraft was incinerated. The main part of the wreckage fell to the ground upside down except for the left half wing, which came to rest upright against the metallic structure that was erected in the building under construction.

### 1.4. Other damage

The jib of the crane the aircraft impacted against had to be dismantled and repaired.

Construction was halted on the building the aircraft fell on due to the fire that broke out, so as to assess the damages caused.

### 1.5. Personnel information

The pilot of the aircraft had obtained his private pilot's license on September 20, 1999. He worked as an aircraft maintenance technician. He was a member of the flight club and had kept his license in good standing since that date. He had a total of 144 h of flying time. The flights he had made since January of 2002 at the flight club had been aboard Cessna 172N aircraft and, according to flight club records, after prolonged periods without flying, he flew with an instructor. In the last three years he had flown 26 h and 9 min, all aboard Cessna aircraft.

The last two flights, on September 15, 2005 and October 10, 2005 had been without an instructor and on the same aircraft with which he had the accident. There had only been one passenger aboard for both flights.

The last flight made by the pilot with three passengers had been on May 9, 2005 on the same type of aircraft as the accident.

### 1.6. Aircraft information

The Cessna 172N aircraft, registration EC-EME, was owned by the Aeroclub Barcelona Sabadell. It was used for instruction and rented to club members.

That model of aircraft has a capacity for 4 persons: the pilot, a passenger in the front seat, and two passengers in the back. It has a maximum fuel capacity of 162.8 liters.

The aircraft had a valid airworthiness certificate and, according to the documentation available, the maintenance had been performed in compliance with the approved maintenance program.

The only modification made to the aircraft was the removal of the wheel fairing.

### 1.6.1. *Aircraft weight and balance*

By using information available in both the aircraft's flight manual and its weight and balance sheet, an estimate of the weight and position of the aircraft's center of gravity can be made.

The aircraft's maximum takeoff weight was 2,253 lb.

| | Weight (lb) | Arm (in) | Moment (lb-in/1,000) |
|---|---|---|---|
| Empty weight | 1,498 | 37.6 | 56.4 |
| Usable fuel | 258[2] | 48 | 12.4 |
| Pilot | 220[3] | 38 | 8.4 |
| Front-seat passenger | 286 | 38 | 10.9 |
| Back-seat passengers | 330 | 73 | 24 |
| Weitht and moment at take-off | 2,592 | | 112.1 |

According to the above information, the aircraft's total weight at the time of the accident was 2,592 lb, which would have put it 339 lb over the limit. These data are only approximate, however, and the takeoff weight cannot be known with certainty.

Had the aircraft's excess weight been as estimated, its moment would have been outside established limits. Figure 1.1 shows the location of the aircraft's center of gravity without fuel (Point b) and with fuel (Point a).

### 1.6.2. *Aircraft performance*

Information from the flight manual and data provided by the manufacturer were used to calculate the aircraft's climb slope.

The aircraft took off from runway 31 at Sabadell Airport and impacted with a crane located approximately one mile away from the rotation point.

[2] According to the information provided by the personnel who refueled the aircraft, the tanks were completely full before the flight.

[3] The weight of the pilot and passengers has been estimated based on information provided by witnesses.

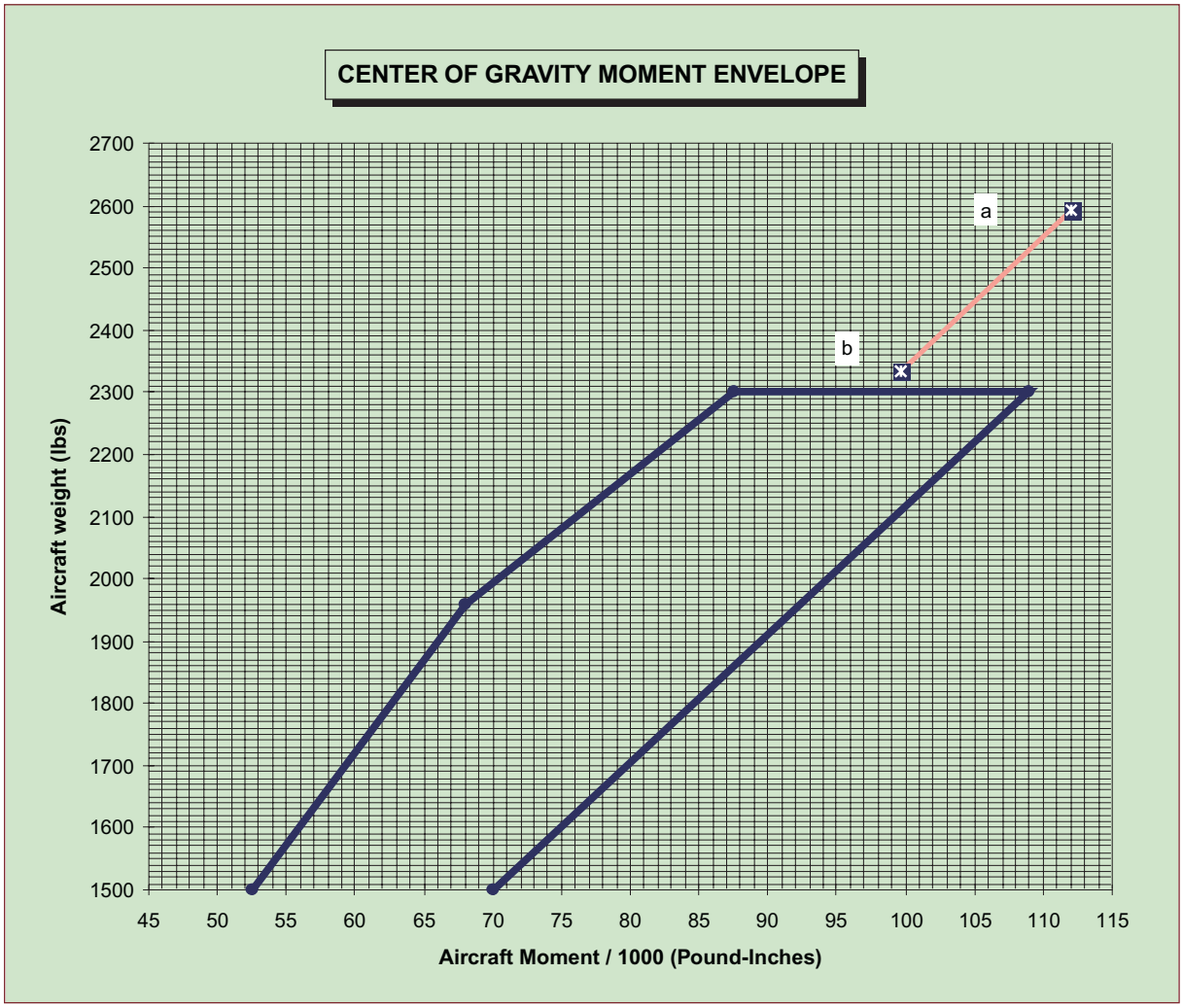


**Figure 1.1.** Center of gravity parameters

According to design specifications, for a takeoff weight of 2,253 lb (its maximum take-off weight) and a temperature of 21 °C, the aircraft should have climbed 620 ft in one mile at a speed of 73 kt.

For an excess weight condition like the one estimated for the aircraft, the ascent path would have been reduced by 160 ft per minute, according to data provided by the manufacturer. Thus, the aircraft should have climbed to 488 ft above ground.

The crane arm against which the aircraft collided was at an elevation of 667 ft and the point where the aircraft made its rotation was at an elevation of 476 ft. The aircraft therefore climbed 191 ft.

Figure 1.2 shows the theoretical slope without excess weight, the theoretical slope with excess weight and the slope actually taken by the aircraft.

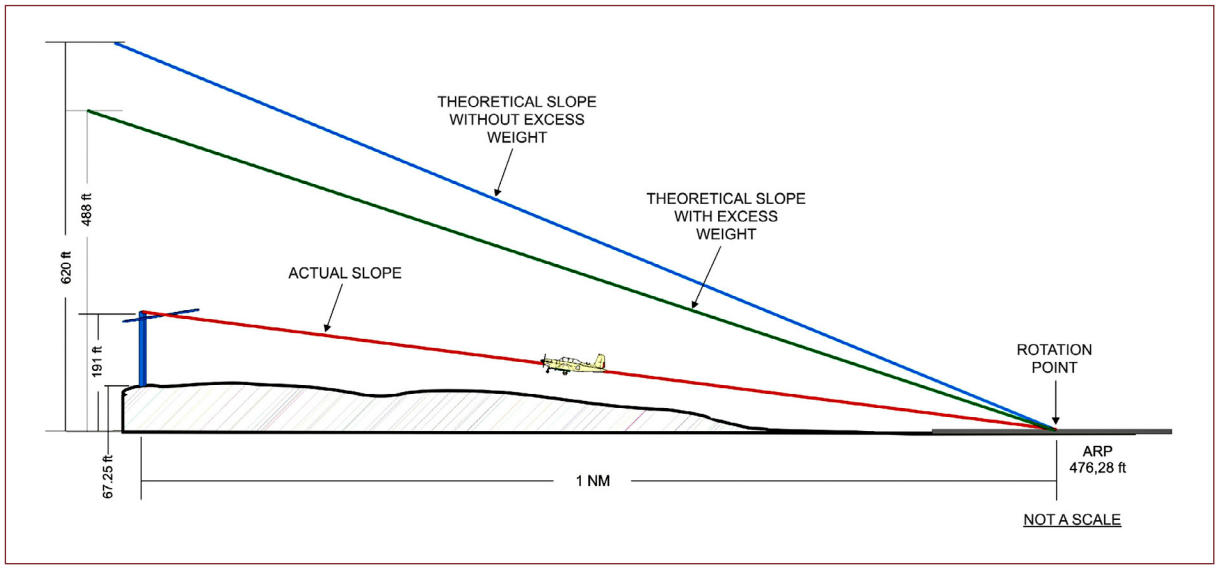


Figure 1.2. Theoretical and actual aircraft slopes

## 1.7. Communications

The aircraft contacted the Sabadell Control Tower to initiate the flight and remained on that frequency. During the takeoff and climb no communications indicative of any problems aboard the aircraft were made.

It was another aircraft tuned to the Tower's frequency that reported that aircraft EC-EME had had an accident.

## 1.8. Airport information

Sabadell Airport has an asphalt runway, 13/31. Runway 31 has a slight positive incline of 1.64% for the first half, decreasing to 1.43% for approximately another third of its length.

Sabadell Airport is an aerodrome intended for general aviation use and VFR conditions. The instruction flights given by four airplane and helicopter pilot schools account for 70% of the airport's activity. Aerial advertising and photography, air taxi and private institutional flights make up the remaining 30%.

In 2005, Sabadell Airport logged 43,814 aircraft movements.

### 1.8.1. *Sabadell Airport aviation easements*

The aviation easements at Sabadell Airport came into their current configuration in 1970. These rights-of-way include a series of exclusion areas set up in the airport and

in surrounding areas to maximize the safety of aircraft movements and to guarantee the proper operation of the aeronautical radio-electrical facilities located there.

One of these areas defined as an aerial right-of-way is the airport's inner horizontal surface area. It consists of a circle that, in the case of Sabadell Airport, has its center at a height of 45 m (147.6 ft) above the airport's reference point and a radius of 2,500 m (1.35 NM).

The part of the crane the aircraft crashed against, the lever arm, encroached on the inner horizontal surface area by 17.4 m (57 ft).

### 1.8.2. *Downdraft phenomenon at Sabadell Airport*

During the investigation into the accident, personnel from the Barcelona-Sabadell flight club, including instructors and other pilots with considerable experience, noted that during conditions of variable crosswinds from 200°-270°, moderate intensity downdrafts can occur which can affect aircraft taking off from runway 31, which is on the leeward side of the hills located to the left of the path.

AENA and DGAC sources at Sabadell Airport also reported that the existence of downdrafts was common knowledge among the flight personnel working there. There was no written record of such events, however.

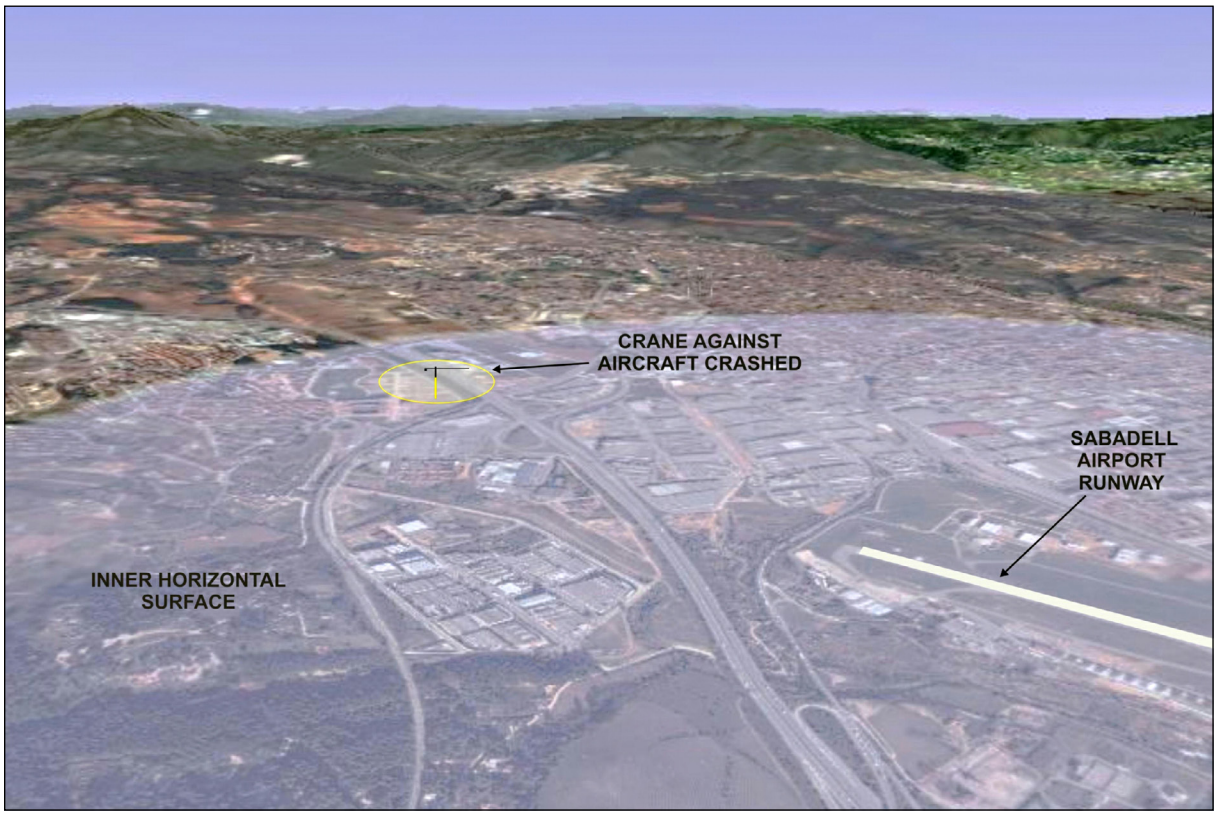


**Figure 1.3.** Inner horizontal surface

The INM started providing the airport with weather information in the summer of 2006, and has no historical data on wind patterns at the airport.

### 1.8.3. *Aircraft movements in the moments leading up to and following the event*

The airport logged the departure of aircraft EC-EME at 16:28 h. At 16:27 a Diamond DA-20 had taken off and at 16:13 h a Tecnam P-2002. After the accident aircraft, a Piper PA-30 took off at 16:33 and at 17:00 h another Cessna 172. None of these aircraft reported to ATC encountering downdrafts that caused problems during the climb.

## 1.9. Wreckage and impact information

The aircraft impacted a crane used for building construction. The crane was located at the work site on Dolors Monserda Vidal street, numbers 22-24. Its height above ground was 36.5 m. It consisted of two arms, one horizontal and the other vertical, both having a grid pattern of steel tubing painted in a blue color. The horizontal arm was 35 m above the ground and had a steel grating platform that could travel the entire length of the arm.

In addition to the crane the aircraft impacted, two other cranes with similar characteristics were in use nearby.

The aircraft collided with the crane and broke apart into two main sections, the powerplant, which remained lodged in the crane, and the rest of the aircraft which fell atop the building under construction and was consumed by fire.

The impact stopped the aircraft completely. When the propeller blades struck the crane it brought the engine to an abrupt halt, causing it to wrap itself around the crane, in particular around the steel grating platform. This resulted in the aircraft detaching from the powerplant with a counter-clockwise motion.

During the fall, the aircraft turned 180° before crashing upside down into the building under construction. The wreckage was confined to an area of 12 $m^2$ and the left half wing was in a vertical position, leaning against the metal structure that had been erected during the building's construction.

The nose wheel and a portion of the engine cover detached during the fall. The wheel came to rest against a safety net and the engine cover was found at the base of the building. Neither showed any signs of fire damage.

Figure 1.4. Photo of the powerplant stuck in the crane structure

## 1.10. Medical and pathological information

The occupants died from multiple traumas and the subsequent incineration.

Toxicological analyses did not indicate any impairment on the part of the pilot which may have affected his abilities.

## 1.11. Fire

According to eyewitness statements, when the aircraft impacted the building under construction, there was an explosion which resulted in a fire. Therefore, the fire was subsequent to the impact, as confirmed by the fact that there were no signs of fire either on the powerplant components or on the parts of the aircraft which were thrown clear of the main wreckage, namely the nose wheel and part of the engine cover.

## 1.12. Tests and research

Once recovered, an inspection of the powerplant components was performed. The aircraft was equipped with a Lycoming O-320-H2AD engine.

The engine damages matched those found on the crane where it had lodged itself, the most noticeable being those on the underside, where the exhaust is located. One of the two propeller blades was twisted around the metallic mesh that was used as a walkway atop the crane arm.

The engine accessories, the lubrication, fuel, air intake and ignition systems and the state of the main components (combustion chambers, cylinders, connecting rods/crankshaft) were all checked.

The inspections did not reveal any internal mechanical anomalies which may have led to a loss of engine power or an engine malfunction. The brakes and damage noted were completely consistent with the nature of the impact.

## 1.13. Additional information

### 1.13.1. *Eyewitness statements*

An eyewitness with flying experience who was at the airport at the time of the accident observed the aircraft's trajectory. He reported a longer-than-usual takeoff run, followed by an irregular path in which it appeared as though the aircraft was not climbing steadily, but rather pitching up and down.

This same eyewitness did not note any unusual sounds coming from the aircraft's engine indicative of a malfunction. He stated that the flaps were up during takeoff.

Another eyewitness, this one working on the building under construction where the aircraft eventually came to rest, said that the aircraft was flying unusually low and that it was having difficulty gaining altitude since the aircraft would raise its nose and climb a few meters, only to quickly drop again.

### 1.13.2. *Climb phase techniques*

The climb is a basic maneuver during which the right combination of thrust and speed result in the airplane climbing, as long as the available thrust is greater than required.

With maximum engine thrust, there is a specific speed which yields the best climb slope, which corresponds to a given attack angle. An increase in the angle of attack above the

optimum might result in a momentary increase in the aircraft's altitude in exchange for a lower speed. The resulting equilibrium situation would exhibit a lower than maximum climb slope due to a speed different from the optimum. In addition, the more behind the center of gravity position is, the more reduced the aircraft stability is, so the aircfraft control is made more difficult.

Another aspect to consider is that during the climb, the nose attitude leads to reduced horizontal visibility from the pilot's point of view and increases the drag of the aircraft.

The initial climb after takeoff with a Cessna 172 at Sabadell is normally done by giving the airplane a certain speed, according to the instructions received or the pilot's experience. This speed should match that specified in the aircraft's flight manual, which states in Section 4, normal procedures, that takeoffs are performed with 0º of flaps, maximum power and a speed between 70 and 80 KIAS. If a maximum rate of climb is desired with maximum weight at sea level, a speed of 73 kt should be used (Section 5 of the flight manual, Performance).

### 1.13.3. *Regulations on aviation easements*

The areas, building sites and facilities surrounding airports and aids to navigation are subject to rights-of-way so as to guarantee the safety of aircraft movements.

Aviation easements in Spain are regulated by Decree 584, instituted in 1972. The aviation easements defined therein are of three types. The so-called aerodrome rights-of-way consist of specific areas and surfaces, denominated takeoff climb, approach, transition, conic, external and inner horizontal, and an obstacle-free zone. Their physical and geometric characteristics are specifically defined. Spaces subject to these rights-of-way can adopt one or more of the following measures: restrict the creation of new obstacles, eliminate existing ones or mark them.

The regulation also states that no new obstacles can surpass the height limits established for surfaces within the right-of-way, with two exceptions: when the object is screened off by another existing object or when a determination is made, following an aviation impact study, that the object would not compromise the safety of aircraft operations.

The 1972 law gave the then Air Ministry the power to determine which obstacles or facilities had to be demolished or modified in areas subject to rights-of-way, the mandate to inspect and monitor those areas, the demolition of obstacles in violation of said rights-of-way and the adoption of resolutions so that other State institutions, such as provincial and municipal authorities, might authorize new construction, facilities or plantations in those areas.

Currently, the successor to the Air Ministry in matters related to civil aviation is the Ministerio de Fomento (Ministry for Development). Within this Ministry are the Dirección General de Aviación Civil (DGAC), the aviation authority, and the public organization Aeropuertos Españoles y Navegación Aérea (AENA), charged with managing and supplying airport and aerial navigation services. The distribution of responsibilities concerning aviation easements between the DGAC and AENA was set out in regulations subsequent to the 1972 decree.

### 1.13.4. *Aviation impact reports for the construction of new structures in the area subject to Sabadell Airport's easements*

As mentioned above, the 1972 decree stipulated that in order to authorize construction, facilities or plantations in spaces and areas established as aviation easements areas, it is necessary to obtain permission from the then Air, now Transport and Public Works, Ministry.

To this end it has been verified that in the permits filed with the DGAC for new construction in areas affected by Sabadell Airport's rights-of-way, there was no mention of the crane against which the aircraft collided.

It has also been confirmed that permits for the installation of a crane in a building next to the crash site, first for one 27 m high, and then for another of a lesser height, 24 m, were denied by the DGAC as this equipment would have encroached on the inner horizontal surface area.

# 2. ANALYSIS

## 2.1. Analysis of the aircraft's flight path

Although it cannot be known for certain, it is likely that the aircraft took off from Sabadell Airport with excess weight, in which case it would not have been able to attain the maximum theoretical climb attitude for the conditions present on the day of the accident. Still, it should have been able to achieve a climb angle more than sufficient enough to have gained altitude without major difficulties under normal circumstances. In spite of that, when it collided against the crane, it was 297 ft (about 100 m) below where it should have been even with the excess weight.

The aircraft's takeoff run was longer than normal, and then it had difficulty climbing, according to an eyewitness account. Eyewitnesses who saw the slope climb followed by the airplane confirmed that the aircraft would gain altitude, only to lose it immediately, which agrees with the variations in the aircraft's attitude as it tried to gain altitude by any means possible.

No technical problems have been identified in the powerplant components inspected which may have resulted in diminished performance during the climb. The rest of the aircraft was completely destroyed and incinerated. Eyewitnesses reported that the engine sound seemed normal. Excepting a possible temporary engine malfunction which could not be identified later, it is difficult to explain the performance degradation experienced by the aircraft, unless the flying technique used during the climb was incorrect or meteorological factors arose which affected the aircraft for most of its climb slope.

A combination of excess weight, downdraft conditions during the climb, and aircraft pitch variations as the pilot tried to climb in these conditions, could explain the eyewitness accounts and the events of the accident.

The pilot, who had 144 flying hours, did not inform by radio of problems of any type during the 1.5-km covered after takeoff, and in the end was unable to avoid the crane, possibly because he did not see it. The horizontal field of view from the pilot's position would have been considerably reduced had the airplane been in a nose-up attitude.

## 2.2. Downdraft phenomenon at Sabadell Airport

During the accident investigation several people with flying experience, others with experience in air traffic control at the airport, and also within DGAC, stated that the existence of downdrafts at the end of runway 31 was common knowledge. There was no written or formal evidence in airport, control tower, DGAC or Instituto Nacional de Meteorología (National Weather Service) records of such a phenomenon, although it had apparently been observed for quite some time.

Eyewitnesses who provided accounts of the event believed that the intensity of downdrafts could have influenced an aircraft's climb consistent with what was observed with the Cessna 172 EC-EME. Were that the case, these downdrafts must have affected the aircraft for most of its climb. There is no record, however, of said phenomenon affecting another aircraft which had taken off a minute earlier or one which took off five minutes after EC-EME. In this end it is considered that this factor has not had relevant influence in the accident.

## 2.3. Analysis of the encroachment upon the aviation easements

The highest point on the crane the aircraft crashed into encroached 18.9 m into the airport's inner horizontal surface area, and, specifically, the crane's arm encroached 17.4 m.

The crane's presence was obviously key to the occurrence of the event, as was the fact that said crane encroached upon a space that is expressly delimited so as to ensure the safety of aircraft movements in airports and surrounding areas. At the moment of impact, the aircraft was flying above the airport's exclusion area.

Available information points to cases of existing right-of-way violations of various types. In some cases structures have been built without the knowledge of airport authorities or service providers, as was the case in this accident. In other cases, builders have gone ahead with construction after the competent authorities had denied the building permit.

It is reasonable to assume that the situation regarding the rights-of-way at Sabadell Airport could be expanded to include other airports, resulting in the possibility of undetected obstacles, in which case their impact on aircraft operations has not been assessed, as stipulated by the International Civil Aviation Organization for cases of aviation easement encumbrances. It is advisable, therefore, to review the actual right-of-way conditions affecting airports and to take appropriate measures if the evaluation poses previously unknown risks.

# 3. CONCLUSION

## 3.1. Findings

— The pilot in command had a valid pilot's license and medical certificate.
— The aircraft had a valid airworthiness certificate and had passed all required inspections.
— The aircraft was occupied by the pilot and three passengers.
— The aircraft may have had excess weight, though it is impossible to verify this. The excess weight is estimated to have been 339 lb (154 kg).
— No powerplant system malfunctions were detected in the post-accident inspection.
— The climb after take-off was slower than expected, even assuming an excess weight of 339 lb. The pilot did not inform by radio of any problems with the aircraft.
— Accounts from personnel with ample flying experience at that airport suggest that in variable conditions with crosswinds from 200°-270°, moderate intensity downdrafts can occur and affect aircraft taking off on runway 31, this trajectory being on the leeward side of hills located to the left of the runway.
— Other aircraft taking off shortly before and after did not report downdraft conditions.
— The aircraft impacted a crane that encroached upon Sabadell Airport's inner horizontal surface area and fell on a building under construction.
— There was no permit authorizing the installation of the crane against which the aircraft collided.
— A request for the installation of another crane located next to the one involved in the accident had been denied.
— At the moment of impact with the crane, the aircraft was above the inner horizontal area's exclusion zone at Sabadell Airport.

## 3.2. Causes

No positive determination has been made of why the aircraft was at a lower altitude than it theoretically should have had at that point in the flight, causing it to impact a crane that was encroaching on the airport's inner horizontal area.

# 4. SAFETY RECOMMENDATIONS

## 4.1. Previously issued recommendations

After the accident took place and in light of the evidence indicating aviation easement violations, not only at Sabadell Airport but in other airports as well, the following safety recommendation was issued on November 25, 2005:

**REC 35/05.** It is recommended that the Ministry of Transports and Public Works:

Check for the presence of possible obstacles at general use airports which may affect aviation easements.

Place measures in effect so as to guarantee the safety of operations by eliminating, reducing or informing users of the risks found as a result of the evaluation of areas affected by airport rights-of-way.

The Ministry of Transport and Public Works accepted this recommendation and has revealed the measures it will take. The proposed actions include, on the one hand, a review of the situation involving exclusion areas protected by aviation easements so as to identify undetected obstacles and their impact on the safety of aircraft operations, and on the other to ensure that rights-of-way have been taken into account in affected urban planning projects throughout Spain.

These measures, which are currently being adopted, are considered satisfactory by the CIAIAC.

## 4.2. Other actions initiated

In light of the data revealed following the accident on the state of the rights-of-way at Sabadell Airport, the DGAC (Civil Aviation Authority) instated initiatives which complement those implemented by the Ministry of Transports and Public Works as a result of safety recommendation 35/2005. These initiatives basically include a proposal to modify the current regulations on aviation easements, changes that take into account the evolution experienced by Spain's administrative and territorial structures since the appearance of the current laws in the 1970s. The changes also attempt to improve the mechanisms designed to control, monitor and evaluate obstacles.

These measures are deemed adequate to the resolution of other structural deficiencies noted in the investigation. As such, no new recommendations are considered necessary.