CIAIAC
Comisión de Investigación
de Accidentes e Incidentes
de Aviación Civil

TECHNICAL REPORT
A-033/2003

Accident to aircraft SOCATA TB-20 «Trinidad», registration D-EKBI, at Alto de Cobata-Sierra Salvada, Amurrio (Álava-Spain), on 27 June 2003

MINISTERIO
DE FOMENTO

Technical report

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COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

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Foreword

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

In accordance with the provisions of Law 21/2003 and Annex 13 to the Convention on International Civil Aviation, the investigation has exclusively a technical nature, without having been targeted at the declaration or assignment of blame or liability. The investigation has been 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 language. This English translation is provided for information purposes only.

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Abbreviations

00 °C	Degrees centigrade
00° 00′ 00″	Degrees, minutes and seconds
AGL	Above Ground Level
AIP	Aeronautical Information Publication, airspace
AMSL	Above Mean Sea Level
APP	Approach, Approach Control Office
ARL	Air Resources Laboratory
ARO	Air traffic services Reporting Office
ARP	Airport Reference Point
ATS	Air Traffic Services
ATZ	Aerodrome Transit Zone
CAVOK	Ceiling and Visibility OK – visibility more than 10 km
COR-I	International Radiotelephony Operator Certificate
CTR	Airport Control Zone
DME	Distance Measuring Equipment
ELT	Emergency Locator Transmitter
ENR	En route: a chapter of the AIP
FIR	Flight Information Region
FPL	Flight Plan
ft	Feet
g	Gravity acceleration
h	Hours
LT	Local Time
HF	High Frequency
hh:mm	Time expressed in hours and minutes
lbs	Pounds
ICARO	Mechanized Flight Plan system
IFR	Instrumental Flight Rules
INM	Spanish National Meteorological Institute («Instituto Nacional de Meteorología»)
km	Kilometers
kt	Knots
kW	Kilowatts
LEBB	ICAO identifier for Bilbao airport. Throughout the report LEBB refers to the Bilbao Approach Control which maintained contact with the aircraft involved in the accident
LECM	ICAO identifier for the Madrid Route Control Center
LECU	ICAO identifier for Cuatro Vientos airport
m	Metres
MTOW	Maximum Takeoff Weight
METAR	Routine Aviation Meteorological Report
Mhz	Megahertz
min	Minutes
N/A	Not applicable
NM	Nautical Mile
NOAA	National Oceanic and Atmospheric Administration
ICAO	International Civil Aviation Organization
PP	Private Pilot
QNH	Adjustment of the pressure scale so that the altimeter marks the height of the aircraft above sea level on takeoff and landing
S/N	Serial Number
SACTA	Automatic Air Traffic Control System
SAR	Search and Rescue service
SSR	Secondary Surveillance Radar
TMA	Terminal Maneuver Area
TWR	Tower, Control Tower
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules

Abbreviations

VHF	Very High Frequency (radio)
VOR	VHF omnidirectional radiobeacon
N	North
W	West
S	South
E	East
ENE	References to points on the compass
NNE	
WNW	
SW	
SE	
NE	
NW	

Synopsis

Date of approval: 26 October 2005

Summary of the accident

At 11:09 h[1] on 27th June 2003 the aircraft Socata TB-20, registration D-EKBI, took off from Madrid-Cuatro Vientos Airport with destination Bilbao Airport. According to its VFR flight plan, estimated time of arrival at Bilbao Airport was 12:44 h. Its endurance was 2.45 h.

The flight as far as the limits of the province of Bilbao progressed normally at a level of 7,300 ft and speeds of some 155 knots. The skies were slightly cloudy or clear throughout the flight at cruising level.

When close to the Cantabrian mountain range, clouds started to fill the sky with their base at 2,500 or 3,500 ft, which became stationary over the Cantabrian coast on being pushed by light NW winds. The tops of the clouds exceeded 7,000 or 8,000 ft.

At 12:11 h (some 62 minutes after takeoff) the aircraft made contact with Bilbao Approach Control, when it started its descent, at some 37 NM from its destination airport.

In the communications maintained in the subsequent five minutes, which the controller had difficulty in understanding, he realized that the aircraft's pilot was having problems maintaining visual contact with the ground. The aircraft was surrounded by clouds and descended as far as the mountainous slope, crashing into it at a height of 3,780 ft, close to Pico de Aro peak and a short distance from the mountains' northern slope.

As the aircraft did not respond to the calls from control, the rescue services were alerted whilst at the same time efforts were made to ascertain possible contacts made by the aircraft with alternative aerodromes. Once the aircraft's endurance had been exhausted, a search was undertaken by the Search and Rescue (SAR) service. Although the aircraft was equipped with an ELT radiobeacon, the clouds which covered the tops of the mountains prevented location of the wreckage and access to the site of the accident until the morning of the 28th, when the aircraft's occupants were found dead and the aircraft completely destroyed.

[1] Times are given in UTC (Co-ordinated Universal Time). UTC is two hours less than local time.

1. FACTUAL INFORMATION

1.1. History of the flight

At 11:09 h on 27th June 2003, the aircraft Socata TB-20, registration D-EKBI, took off from Madrid-Cuatro Vientos Airport with two persons of German nationality on board, with destination Bilbao Airport. The flight was private and for pleasure. The distance between both airports is some 180 NM.

The flight plan stated that the flight would be carried out under visual flight rules (VFR). Estimated flying time as far as Bilbao was 1:35 h and an endurance of 2.45 h was specified for the aircraft. This Flight Plan was presented to the Air transit services Reporting Office at Cuatro Vientos (ARO Cuatro Vientos). After takeoff, based on its real time, estimated time of arrival at Bilbao was 12:44 h and Control updated the flight plan accordingly.

At the request of the control TWR at Cuatro Vientos (LECU), after takeoff on runway 28, the aircraft contacted Control Madrid (LECM), requesting permission to ascend to a flying height of up to 6,500 ft, flying direct to Burgos from its position at that moment. LECM identified the aircraft by code «3456» with which the aircraft's transponder was responding to the TMA Madrid surveillance radars. LECU informed that there was no other traffic at those levels and that the aircraft could ascend as it preferred.

The weather was good: CAVOK in TMA Madrid and throughout the meseta as far as the province of Burgos. The aircraft took a northern course flying over Navacerrada at 7,300 ft after some 15 min of flying and reaching Burgos at 12:00 h after flying 51 min.

From Burgos the aircraft followed a magnetic course of some 20°, parallel with and some 5 NM to the east of the R-75 airway, from the Tabanera checkpoint (NEA) to that of AMTOS. The AMTOS notification point is located in the vicinity of the Angulo pass in the Cantabrian mountain range, 22 NM from VOR Bilbao. In these areas the sky was very cloudy and the terrain very mountainous, with the Araden and Salvada sierras, with peaks of some 4,000 ft.

Before reaching the latitude of AMTOS, at 12:12 h, the aircraft established radio contact with Bilbao Approach. It informed that its position was some 20 NM from the airport coming from Cuatro Vientos and that it was descending to 4,000 ft. It was identified by «3456», its transponder response code, and was informed by APP Bilbao that the runway in service was number 30 and that there was a 10 kt wind in the direction 300°, QNH 1,020 mb, and that there was other traffic approaching. APP Bilbao had no prior knowledge of this VFR flight's arrival.

In the following two and a half minutes communications were not very clear. APP tried to ascertain if it was the pilot's intention to continue the flight and hold towards the south of the airport or continue its descent to 2,000 ft.

Initially the aircraft indicated that it would proceed towards the southern side of the field, descending to 2,000 ft. APP control Bilbao asked if it was in visual contact with the terrain. The aircraft falteringly indicated that at that moment it was not in contact; that it would descend over Bilbao.

In the last communication received from the aircraft, at 12:13:47, it indicated that it was looking for a pass to descend to 2,000 ft.

The radar track of the flight which responded with «3456» was finally lost at 12:17:35.

All attempts to restore radio communications with the aircraft from fixed installations and in the form of relay from other commercial aircraft were unsuccessful. As the aircraft did not reach its destination and there was no knowledge of it in neighboring aerodromes, an emergency was declared in the successive phases of INCERFA (13:19), ALERFA (13:41) and DETRESFA (13:53).

SAR aircraft and helicopters, in co-ordination with Civil Guard ground patrols and SOS DEIAK, participated in the search and rescue. At 15:30 h one of the aircraft involved in the search picked up a signal from the ELT emergency radiobeacon carried by the aircraft but the clouds and mist in the area prevented the site of the accident being located and accessed in the afternoon of the 27th. At first light on the 28th, 04:55 h, an SAR helicopter located and landed next to the aircraft wreckage and the two dead occupants.

Possibly the first person to arrive at the site was a shepherd looking for a lost sheep, which he found dead a few metres away from the aircraft wreckage and passengers.

The impact occurred on the southern slope of Sierra Salvada, Alto de Cobata heights, in the Salmanton district of the municipality of Amurrio, in the province of Alava, in an area with coordinates 43° 01' N/03° 07' W and an approximate altitude of 1,150 m. (3,780 ft), some 20 NM (37 km) from Bilbao airport, at the southern limit of its TMA. The impact point was one km from the Cantabrian mountain range's northern slope.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	1	1	2	
Serious				
Minor				Not applicable
None				Not applicable
TOTAL	1	1	2	

1.3. Damage to aircraft

The aircraft was completely destroyed and the wreckage scattered in the area.

1.4. Other damage

The aircraft's left wing struck a sheep which died as a result of the impact.

1.5. Personnel information

1.5.1. *Pilot*

Age/sex:	58 years/Male
Nationality:	German
License:	— Category: Private Pilot — Number: 273 NWMS — First issued: 19-05-1969 — Renewed: 18-12-2002 — Validity: 30-12-2004
Ratings:	— International radiotelephony operator certificate — Single piston engine. Maximum Takeoff Weight (MTOW) up to 2,000 kg — Visual flight (VFR)
Flying hours:	1,420:08 h

1.6. Aircraft information

1.6.1. *Aircraft identification*

Make:	Socata – Groupe Aeroespatiale
Model:	TB-20 «Trinidad»
Serial number:	355
Year of manufacture:	1983
Registration:	D-EKBI
MTOW:	1,400 kg
Owner:	Private

The aircraft was equipped with IFR navigation equipment, ATC transponder with height notification and ELT (Emergency Locator Transmitter) radiobeacon.

This model can reach horizontal speeds of 180 kt with 85% power.

Stall speed, with flaps open, is 59 kt.

1.6.2. *Airworthiness certificate*

Number:	L 18093
Type:	Private
Date issued:	04-12-2001
Expiry date:	November 2003

1.6.3. *Maintenance log*

1.6.3.1. Airframe

Total flight hours:	3,400:27 h
Last inspection:	29-11-2002
Hours since last inspection:	44:27 h

1.6.3.2. Engine-propeller unit

Make:	Lycoming
Model:	IO-540-C4D5D
Power:	177 kW-28 in.Hg-2,400 U/min
Serial number:	L-21094-48 A
Total hours:	1,103:37 h
Hours since last inspection:	44:27 h
Propeller:	Hartzell HC-C2YK-1BF/F 8477-4
Serial number:	CH-26647
Hours since last inspection:	44:27 h

1.7. Meteorological information

1.7.1. *Situation and general forecast over the Iberian Peninsula*

On 27th June 2003 the Instituto Nacional de Meteorología informed of a general situation characterized by an anticyclone over the Azores which extended from the west over the Iberian Peninsula, with very low activity. Relative low pressures in the western part of the Peninsula accentuated the instability in the region. Tramontana winds in the gulf of Leon.

The Instituto Nacional de Meteorología forecast for the first few hours of the day in the Basque Country very cloudy skies with the opening of clear patches towards mid-day; showers or slight occasional rainfall most probably in the early morning and late evening on the coast; morning mists. Slight winds, predominantly with a northerly component.

1.7.2. *General aviation forecast*

The forecast made by the Instituto Nacional de Meteorología for low-level flights for the interval 09:00-15:00 h on 27th June 2003 for the northern half of FIR Madrid was as follows:

Very cloudy sky with cloud base between 2,500 and 3,500 ft and tops between 7,000 and 8,000 ft to the north of 43° N:

Temperatures and winds forecast for Madrid and Santander:

Madrid

Level (FL)	Wind direction (°)	Wind (kt)	Temperature (°C)
020	301	2	28
050	291	2	19

Santander

Level (FL)	Wind direction (°)	Wind (kt)	Temperature (°C)
020	036	14	13
050	010	8	10

Data obtained from maps for the Basque Country for 12:00 h

Altitude (m)	Wind direction (°)	Wind (kt)	Temperature (°C)
1,040	020	10	15
1,520	040	10	12

1.7.3. *Routine Aviation Meteorological Reports*

The METAR aviation meteorological reports of the conditions observed in the aerodromes and at different times were as follows:

METAR Madrid

— 11:00 UTC: Wind 250° and 6 kt, CAVOK, temperature 28 °C and pressure of 1,016 hPa.

METAR Burgos

— 11:00 UTC: Wind 070° and 14 kt, CAVOK, temperature 22 °C and pressure of 1,022 hPa.
— 12:00 UTC: Wind 080° and 14 kt, visibility 10 km or more, scattered clouds at 3,000 ft and cloudy at 18,000 ft, temperature 23 °C and pressure of 1,020 hPa.

METAR Bilbao

— 11:00 UTC: Wind 300° and 7 knots, visibility 6,000 m, scattered clouds at 2,000 ft and cloudy at 4,000 ft, temperature 22 °C and pressure of 1,020 hPa.
— 11:30 UTC: Wind 310° and 7 knots, visibility 6,000 m, scattered clouds at 2,000 ft and cloudy sky at 4,000 ft, temperature 21 °C and pressure of 1,020 hPa.
— 12:00 UTC: Wind 300° and 6 knots, visibility 7,000 m, scattered clouds at 2,000 ft and cloudy sky at 3,300 ft, temperature 21 °C and pressure of 1,020 hPa.

1.8. Communications

During the operation of flight D-EKBI on 27th June 2003 numerous communications were established between the aircraft and the fixed stations of LECU (Cuatro Vientos Tower), LECM (Control Madrid) and LEBB (Bilbao Approach), which are summarized in this section and reproduced in Appendix B in the language in which they were held (with English translation of the Spanish in brackets).

The relevant co-ordination telephone communications between different control services are also included.

Statements of the controllers and persons who intervened in the communications are included in this section.

1.8.1. *Communication aircraft-TWR Cuatro Vientos (D-EKBI – LECU). Frequency 118.70 Mhz*

The records correspond to the time interval from 11:05 to 11:14 h.

The content of the communications relates to making contact, identification, meteorological information, and permission to take off from runway 28 and to ascend to 6,500 ft. The log concludes with the transfer of control to Control Centre Madrid (LECM).

In these communications, LECU (TWR Cuatro Vientos) did not communicate to D-EKBI the SSR code allocated by the SACTA system to the aircraft's flight plan.

1.8.2. *Communication aircraft-Control Centre Madrid (D-EKBI – LECM). Frequency 127.10 Mhz*

The recording encompasses the time period from 11:14:33 to 11:15:10 h. Listening in continued until 11:45:00 but there are no recordings in this last interval.

The aircraft (D-EKBI) communicated to Control Centre Madrid (LECM) its position at that moment and details of its Flight Plan from Cuatro Vientos to Bilbao. The Centre requested confirmation from the aircraft that its transponder code was «3456». The aircraft responded that its code was «3 4 '4' 6». Control Madrid did not notice the slight error, nor did it request the aircraft to respond with the code allocated by SACTA. At the same time, LECM provided general information that there was no other traffic at those levels and gave permission to ascend to its flight level at its discretion.

1.8.3. *Communication aircraft-Bilbao Approach (D-EKBI – LEBB). Frequency 120.70 Mhz*

These communications commenced at 12:11:00 and continued until 12:13:55 h.

The aircraft established first contact with the Bilbao airport approach control airport and gave its position as some 20 NM to the south of the airport at 12:12 h.

LEBB, which had not been informed of the flight's existence, confirmed radar contact with code «3456» and provided routine information on the runway in use, wind, QNH and that there was other traffic approaching Bilbao. Although transmission from the aircraft is deficient, it can be understood that it was flying through clouds and that it had no visual contact with the terrain.

12:12:27	LEBB	«... And for your information there are several arrivals, approach for runway three zero»
12:12:53	LEBB	«delta eco kilo bravo india, do you prefer to hold south of the field or descend down to 2,000 ft»

12:13:02	D-EKBI	«To the south of the field descending to 2,000 ft»
12:13:07	LEBB	«delta bravo india, are you in contact with the terrain?»
12:13:14	D-EKBI	«Not at the moment... but hold... overhead...»
12:13:18	LEBB	«delta bravo india, repeat please»
12:13:21	D-EKBI	«... Without contact with the terrain at this moment... descending over Bilbao...»
.....		
12:13:47	D-EKBI	«... we are looking for a pass to descend to two thousand»

At 12:27:14 LEBB asked an Iberia flight to act as relay with D-EKBI, but without success.

1.8.4. *Communication Bilbao Approach–Control Madrid (LEBB – LECM)*

Between the hours of 12:30:23 and 12:41:05 telephone communication is established in which LEBB asked LECM if D-EKBI had passed and LECM responded in the negative.

Referring to the aircraft, the indications were: «difficult to hear – it appears and disappears in the radar – very low – now I can't see it – there is quite a lot of cloud – unintelligible – no reply».

At 12:30:50 LECM communicated to LEBB that they had not received communications from the aircraft and that they did not have its Flight Plan activated.

LEBB replied that they had activated the flight plan on receiving the initial call from the aircraft.

In the subsequent communications there is mutual confirmation that latterly they had received no replies from D-EKBI.

1.8.5. *Statement of the Bilbao approach controller*

The controller who maintained radio contact with D-EKBI stated that communications were very deficient and practically inaudible. He had no prior knowledge of the flight's arrival and did not know that traffic's real intentions. He understood that its intentions were to fly over the field and he communicated routine data to it. «Given the meteorological conditions on that day I stressed that he should check that he was in visual contact with the terrain.»

1.8.6. *Statement of the Bilbao control tower supervisor*

Of the statements made by the Bilbao tower supervisor, the following should be highlighted:

— Broadcasting in frequency 120.7 is from an antenna situated at the tip of mount Sollube, which considerably improves its range.
— There was no record of the aircraft's flight plan in the tower or its real departure time from its airport of origin.
— It may be that the time estimated by the SACTA, based on flight plan data, did not coincide with the real time, with the aircraft arriving earlier than its estimated time of arrival.
— Worth noting is the fact that the SSR code to which the aircraft responded (3456) did not coincide with that allocated by the SACTA (5127).

He also added that there was no evidence of malfunctions in any of the airport's radio aid equipment.

— Communications with the aircraft involved in the accident were limited and not very intelligible for the controller.
— The conclusion can be reached that the aircraft received the tower well, which may have been due to its greater broadcasting power and the antenna's optimum location.

1.9. Aerodrome information

Bilbao airport, with ICAO identifier LEBB, has geographical coordinates N 43° 18' 03"/ W 002° 54' 38". Its height above sea level is 42 m (138 ft).

Its TMA is classified as class D airspace. It is open to commercial traffic and accepts IFR and VFR operations. It has a polygonal shaped ground plan with its southern limit on parallel 43°, which is the latitude of the AMTOS checkpoint. The lower limit in height of its TMA is 300 m AGL-ASML.

The control area (CTR) consists of a circle with a 7 NM radius centered on the VOR/DME with two quadrangular extensions in the approach areas (see Figure A-5 in Appendix A).

The aerodrome's transit zone (ATZ) is a circle centered on the airport reference point (ARP), with an 8 km radius.

The aircraft taxi areas and runways are situated in a rectangular-shaped valley with a WNW/ESE orientation, which is closed at its ESE end by hills with an elevation of some 1,000 ft and is open to the sea at its WNW end at the mouth of the river Nervion. Two sierras form the valley to the NE and SW with peaks of up to 1,500 ft, which are separated by a distance of some 6 km. The runways, with magnetic orientations 12-30 and 10-28, have lengths of 2,000 m and 2,600 m, respectively.

Towards the S, SE and SW there are other mountains with heights of 2,500 ft at a distance of 8 NM from the airport. The mountain heights are higher the further south they are situated, reaching more than 4,000 ft at some 20 NM from the airport.

The mountains favor the formation of stationary cloud masses from the NW.

1.10. Wreckage and impact information

1.10.1. *Orography and topography of the area*

The accident occurred at the top of the Cantabrian coast or mountains. The Cantabrian mountain range makes up the coastal valleys' southern limit, forming a wall some 1,200 m high in that area.

The mountains' south-facing slopes gently descend to the river Ebro valley. The terrain rises up again towards the south at the Oña sierra and La Bureba moors in the Castillian meseta.

The impact occurred on the southern slope of Sierra Salvada, Alto de Cobata heights, in the Salmanton district of the municipality of Amurrio, in the province of Alava, with coordinates 43° 01' N/03° 07' W and an approximate altitude of 1,150 m (3,780 ft), some

20 NM (37 km) from Bilbao airport. The highest point in the profile is the Aro peak of 1,185 m, at a distance of 2 km on a NW course. Below these points the slope descends to the Ayala valley at lower levels. (See the terrain's profile in Figure A-2 and general orographic and detailed topographical maps in Figures A-1 and A-3 of Appendix A.)

The terrain's gradient at the point of impact in a S-N direction is some 22° upwards and the terrain is very stony with scrub and grazing land.

The point of impact is at the southern limit of TMA Bilbao and one km from the mountains' northern side (see photographs in Figures A-6 and A-7 of Appendix A).

1.10.2. *Site and marks of the impact*

The marks of the aircraft's impact and dragging along the mountain slope show a south-north direction. A first crash of the aircraft's underbelly, which churned up the terrain and tore off the nose assembly doors, followed by minor bumps in which parts of the flight controls, stirrups and structure, nose assembly, etc. on both sides of the aircraft came off, could be observed. During dragging and up to the final impact the aircraft traveled 47 m and ascended 18 m up the mountain slope.

In one of the impacts the left wing struck a sheep and killed it. At the end of the run, the main aircraft wreckage, which crashed violently against slightly jutting out rock masses, was located grouped together. The wings came away from the fuselage and the cabin disintegrated. There was no explosion or fire to scatter the wreckage, but the engine, propeller, instrument panels and other wreckage were projected some 10 m forwards. Some items, such as the stand-by compass, were picked up 40 m beyond the main wreckage. The bodies of the two occupants were also thrown out beyond the main wreckage at distances of 7 m and 17 m. (See sketch of the wreckage in Figure C-1 of Appendix C.)

The symmetrical dragging 40 m up the side of the mountain suggests that in its final flight the aircraft had its wings level and was flying upwards parallel to the terrain.

The area of the first impact, slightly churned up, the marks of the skidding and the loose wreckage scattered about in the area can be seen in the sketch in Figure C-1 of Appendix C and in photograph A-7. The main wreckage grouped together at the end of the run can be seen in the photograph in Figure C-2).

1.10.3. *Inspection of the wreckage*

The propeller which came off the aircraft showed bending of the blades which is typical of propellers in an impact whilst turning and with power (Figures C-3 of Appendix C).

The tachometer on the instrument panel was seized indicating 2,000 rpm.

The breakages on the wings were symmetrical (see photograph in Figure C-2).

1.11. Aids to navigation

1.11.1. *Electronic aids to navigation based on the ground*

There is no evidence of possible anomalies in the working of the airport's navigation aids during the flight of D-EKBI. Although the flight plan was visual, the aircraft was well equipped with instruments to know its position. However, the pilot did not have IFR rating.

1.11.2. *Navigation tracking carried out by the aircraft*

The radar tracks of the surveillance radars (SSR[1]) allow the complete route flown by the aircraft from takeoff at Cuatro Vientos up to the few moments prior to impact to be known. At all times the aircraft responded to the secondary surveillance radar with code «3456». Figure A-4 in Appendix A shows the route followed, the main points of which are indicated in the following table:

UTC	Height (ft)	Profile	Speed (kt)	Position
11:10:15	3,000		92	In the air after takeoff in Cuatro Vientos
11:10:15	3,200	Ascent	108	Goes round Madrid by the W
11:22:40	7,200		148	Passes Guadarrama to the E of Cotos
11:39:10	7,300		155	
12:00:35	7,300		158	Reaches Burgos, takes NNE course
12:15:55	5,900	Descent	145	Descending before AMTOS *
12:16:15	5,800	Descent	148	Crosses airway H-210 near AMTOS
12:16:40	5,600		148	Takes course further to the N
12:16:50				Radar track is lost
12:17:10	4,900		138	
12:17:20	4,800	Descent	169	
12:17:35	4,800		169	Last radar position. Exceeds latitude of AMTOS

* AMTOS is a notification point at the crossing of airways R-75 and H-210 with coordinates: 43° 0.0' N/003° 13.16' W, in the proximity of the Angulo pass in the Cantabrian mountain range.

[1] The available APP/TWR Bilbao radar signal is not valid for providing control service. It is only used as supplementary information.

1.12. Medical and pathological information

The report of the autopsy carried out on the bodies of the aircraft's two occupants establishes in its conclusions as the cause of death open cranio-encephalic trauma with extensive loss of brain mass.

The time of death is estimated as 15:00 h (local time) on 27th June 2003.

1.13. Fire

There was no fire.

1.14. Survival aspects

As from 13:17 h the corresponding alert phases were activated and towards 15:45 h an SAR aircraft located the emergency beacon (ELT), with an intensive search on foot being commenced immediately in the area. Due to the foggy weather conditions the wreckage was not located during the afternoon of the 27th and at sunset the search was suspended. The following morning, with visibility restored, a shepherd who was looking for a lost sheep found the aircraft wreckage and the passengers' dead bodies.

According to the medical report, there was no probability of survival. The death of both occupants was almost instantaneous.

1.15. Tests and research

1.15.1. *Speed calculations*

At 11:09 the aircraft took off from Cuatro Vientos and its radar track was lost at 12:17, after it had covered 160 NM. A real mean speed of 141 knots can be estimated.

The mean speed forecast in the flight plan was 114 kt, as the aircraft planned to cover the 180 NM which separate Bilbao from Cuatro Vientos in 95 min.

During the 100 seconds which elapsed between 12:15:55 and 12:17:35 the aircraft descended from 5,900 ft to 4,800 ft, according to the radar surveillance data; this gives a mean descent speed of some 660 ft/min.

1.15.2. *Radar positions of the aircraft*

At 12:12 h, in the first communications with APP Bilbao, the aircraft's radar position was some 37 NM from VOR-DME Bilbao instead of the 20 NM announced by D-EKBI.

The point of impact's elevation is 1,150 m (3,780 ft). From these last points, recorded by radar, the aircraft had to descend some 1,000 ft until it located the ground, which would involve one more minute of flying and some 2.5 NM more of distance covered.

1.16. Organizational and management information

1.16.1. *Flight plan routing*

Spanish regulations published in the AIP Spain (ENR 1.11-1) establish that all aircraft having to fly within controlled airspace must complete a flight plan, which is processed in the airports' ARO (Air traffic services Reporting Office). These offices are responsible for routing FPL messages to the ARO and TWR of destination and alternative aerodromes and the affected ATS units. The ICARO automated system currently receives the flight plan information and completes it with any pertinent information that may be generated such as, for example, allocation of the on-board transponder SSR equipment response codes.

This information is updated with real takeoff time and flight progress data.

In the control posts the system generates files of the forecast flights ten minutes prior to the forecast time of entry in the TMA or corresponding control zone. The files are activated and placed in sequence when contact is established with the aircraft.

In the case of flight D-EKBI, the file was generated at 12:32 h on 27/06 and also indicated, apart from its origin, Cuatro Vientos, and estimated time of arrival, 12:44, at Bilbao, transponder code «5127».

1.16.2. *Flight plan observance*

Air Traffic Regulations (ATR 2.3.6.2. and ATR 2.3.6.2.2.) establish that all controlled flight aircraft must follow the updated flight plan. It also requires the corresponding office of the air transit services to be notified of any variations equal to or greater than 5% in the real aerodynamic speed. Similarly, it requires that, if the forecast time of arrival at the destination aerodrome is erroneous by more than 3 minutes, the aircraft must notify the corresponding control office as quickly as possible.

1.16.3. *Applicable visual flight rules*

The flight was planned as VFR and, consequently, the visual flight rules contained in Annex II to the ICAO and ATR (Air Traffic Regulations) applied to it.

In controlled airspace (airspace classes B, C, D and E), visual flight rules require the pilot to maintain a distance from clouds of 1.5 km in the horizontal plane and 300 m in the vertical plane and that its visibility is greater than 5,000 m.

In uncontrolled airspace (classes F and G), a visibility of more than 5,000 m is also required, in addition to lack of clouds and a view of the surface when flying below 3,000 ft AGL or AMSL. If the flight is conducted above 3,000 ft AGL or AMSL, visual contact with the surface is not required but a vertical separation of 300 m from clouds is required.

VFR flights must not be carried out at a height of less than 150 m (500 ft) AGL or AMSL except when this is necessary for takeoff or landing (ENR 1.2-4).

2. ANALYSIS

2.1. Flight preparation

Details of how the flight was prepared and the pilot's level of knowledge of the route and the destination airport's airspace are not known. Neither is there any knowledge of the degree of attention paid by the pilot to the meteorological forecasts and reports available on the morning of 27th June 2003. Nevertheless, it is known that the flight plan was properly prepared and processed in accordance with prevailing procedures, with the flight's forecast commencement time being 11:15 h.

A flying time of 1.35 h was estimated to cover the 180 NM long Cuatro Vientos Bilbao route, involving a mean speed of some 114 kt. The Socata TB-20 Trinidad is capable of maintaining cruising speeds in excess of 180 kt, although with high power and heavy fuel consumption. The forecast flying time of 1.35 h may have been influenced by the forecast of a light upwind, the possibility of some holds required by ATS and the choice of speeds corresponding to moderate fuel consumption.

2.2. Execution of the flight

Slightly in advance of the flight plan, the aircraft commenced takeoff on runway 28 at 11:09 h. The weather was good in TMA Madrid and throughout the northern meseta, with clear or slightly cloudy skies as far as the limits of the province of Burgos.

At the levels at which the aircraft was flying, 7,300 ft, there was no other traffic and so the aircraft flew a northerly course without delays direct to Burgos, where it arrived after 51 min of flight, reaching speeds of almost 160 kt.

Commencing the second leg of the flight from Burgos to Bilbao, the aircraft took a NNE course, flying over the high terrain of the La Bureba moors at a height of 800 m, sierra de Oña, with 1,200 m elevations in the Iberian mountain system, and the Ebro valley. Then the route went over the Araden sierra, entering the Cantabrian mountain range, at 40-50 NM from its destination. The flying altitude, until then some 7,300 ft, and the skies with flew clouds, allowed the path to be well above the highest elevations in the terrain, of some 4,000 ft (see the flight path in Figures A-1, A-2 and A-3).

With Bilbao being at sea level, the D-EKBI had to descend 7,300 ft and it commenced this descent when a little less than half an hour from its destination. There were still some 4,000 ft high mountains in front of the aircraft before crossing the Cantabrian coast and afterwards there were some 2,500 ft peaks between the valleys in the Basque Country.

At the same time, the clouds started to thicken which, pushed by the light NW winds, became stationary in front of the Cantabrian mountain range. Two visual flight strate-

gies were open to the pilot: either to fly above the clouds until a little before Llodio, entry point S from the south in the visual procedures, and then descend through a gap in the clouds or not to lose contact with the terrain, descending before the cloud front and, maintaining a height of 500 ft above the terrain and below the clouds, reach point S before entering the CTR with control's permission.

The first option entails the difficulty of finding wide gaps in which to descend whilst being horizontally separated from the clouds and allowing observed navigation whilst approaching the CTR. A second difficulty is the height of the tops of the clouds, which cannot invade IFR traffic levels. On the day of the accident, with cloud ceilings at 7,000 ft and 8,000 ft and with skies at times very cloudy, this option was probably not possible although it may have seemed that it was being suggested by the controller when he asked to know the aircraft's intentions: «delta eco kilo bravo india, do you prefer to hold south of the field or descend down to 2,000 ft». That is, to maintain the flying height and descend on point S, as opposed to the alternative of continuing the descent to 2,000 ft at that very moment. If the aircraft's intention was to land in Bilbao it would have to hold over point S; if its intention was to cross the TMA with destination another aerodrome it would have to descend to 2,000 ft so as not to affect approaching IFR traffic.

With cloud ceilings between 2,500 ft and 3,500 ft, the second option would only be possible, and with limited probabilities, for a pilot very familiar with the terrain. Indeed, if in the Angulo or Orduña mountain passes to the W and E of the aircraft's route the ceilings were at 3,500 m and the passes' elevation in the region of 2,700 ft, there would have been an 800 ft layer with good visibility in which the aircraft could have traveled with a 500 ft separation from the ground and below the clouds, just before entering the TMA. After entering the TMA (class D airspace), the ground's mean level would have descended suddenly whilst maintaining the cloud ceiling height, permitting the vertical separation of 500 ft from the ground and 1,000 ft from the clouds in order to comply with the regulations.

In the aircraft's communications with APP Bilbao, the difficulties being encountered can be observed. The pilot did not have good visual contact with the terrain; he did not know whether to descend on Bilbao or not and expressed his anxiety about finding a pass through which to descend to 2,000 ft. If he was referring to a clearing or pass between the clouds for the descent such a pass did not exist because he had not yet flown over the mountains. If he was looking for a pass between the mountains, the fact is that he was heading straight for an area between the Angulo and Orduña mountain passes where elevations are the highest.

Although it seems highly unlikely, it is possible that the pilot was disorientated, believing himself to be nearer Bilbao. After having erroneously given his position at 20 NM from Bilbao five minutes early, he might have believed that he was 10 NM away. In this case, it is surprising that he maintained a high speed in the final minutes of the flight.

At the same time, although the pilot did not have an IFR rating, the steadiness in the maintenance of courses, as shown by the flight's radar track, leads to the impression that navigation was not purely observed navigation. The flight was undoubtedly supported by some type of electronic aid. A typical observed navigation following land communication routes would probably have led him to the Orduña mountain pass.

It is true that in the final minutes the speed was high: the last radar data indicate some 169 kt and descent speeds in the region of 660 ft/min can be assumed. These speeds in conditions with poor visibility may have reduced the pilot's response time to unexpected obstructions and reduce the aircraft's capacity in its obstacle evasion maneuvers.

2.3. Control and communications aspects

Communications between the aircraft and APP Bilbao were difficult. It may be that these difficulties only existed in the aircraft-APP direction. The mountains between the aircraft and reception in Bilbao may have interfered with this transmission whereas broadcasting from APP, with greater power, from the mount Sollube antenna, may have been picked up clearly by the aircraft, which never asked for a communication to be repeated.

Radar coverage was also lost in the last few moments, possibly due to the low flying height. However, the radar track is continuous throughout the route prior to the accident. In this connection it should be noted that when the aircraft gave its position at 20 NM from Bilbao in its first communication with APP and is identified by its transponder code «3456», its position on the controller's screen was more to the south of the AMTOS checkpoint, approximately 37 NM from Bilbao. The controller, who was handling other IFR approach traffic, was unable to correct the pilot's error inasmuch as his notifications prevailed over the surveillance radar supplementary information.[2]

In connection with the «3456» transponder code used, it should be noted that, although not the «5127» allocated by the ICARO and SACTA mechanized systems, it was the code with which the aircraft was positively identified in both TMA Madrid and Bilbao.

Another anomaly in the flight's tracking was the lack of the file corresponding to that flight in APP Bilbao. The controller immediately activated a flight plan in order to take it into account. It is true that the aircraft entered TMA Bilbao perhaps 15 minutes early. This may have been due to greater aerodynamic speed or a possible downwind instead of the forecast upwind. As required by the ACR, the aircraft's pilot should have notified Control Madrid of the gain in its estimated time of arrival at TMA Bilbao and the airport because when it passed over Burgos the mean speeds developed exceeded those envisaged in the flight plan.

[2] In this analysis it is considered that the radar information was correct, after comparing the radar tracks with the recorded communications and taking into account the point of impact.

These malfunctions probably did not have a decisive effect on the accident but at the same time they may have given rise to more communications than were necessary and to corrective actions on the controller's part, thereby increasing the workload in the flight cockpit, which was involved in the difficulty of flying among clouds, and of the controller who was attending to other approaching IFR traffic.

For this reason it is considered advisable to recommend the strict use of SSR transponder codes.

2.4. Impact and search and rescue activities

The last echoes of the radar from D-EKBI were received at 12:17:35 when it was crossing 4,800 ft. The aircraft descended a further 1,000 ft before crashing into the terrain. The flight prior to the impact was rectilinear with level wings and, although the pilot managed to bring the aircraft up almost parallel to the mountain slope, he was unable to avoid its heavy impact against the mountain. The engine was operating with quite a lot of power, although not maximum. The speed was high, as confirmed by the dragging for almost 47 m until the final impact and the breakage and detachment of wings, engine and propeller and the disintegration of the cockpit. The high speed and sudden appearance of the ground probably prevented an increase in the aircraft's power which would have enabled it to ascend and separate itself from the slope. A lower flying speed would have given the pilot a few more seconds in which to manoeuvre its escape and the aircraft would have offered less inertia for inverting its descending path.

There is no evidence of a fault in the aircraft's engine or its systems.

The search activities in the hours following the accident confirm the existence of low clouds in the area, which prevented the wreckage's location in spite of the intensive search by air and land and the ELT radiobeacon's broadcast on the same day as the accident. The dead bodies were found and rescued the following morning.

3. CONCLUSIONS

3.1. Findings

— The pilot held a flying license and was rated for this type of flight.
— The aircraft had a valid airworthiness certificate and maintenance logs.
— The start of the flight and its progress as far as the province of Burgos was in clear skies with light winds.
— At the limits of the province of Alava clouds were stationed against the Cantabrian mountain range, covering its heights.
— Before entering TMA Bilbao, when 37 NM from its destination, the aircraft established contact with APP and erroneously gave its position as 20 NM to the south.
— APP had no prior knowledge of the arrival of this VFR flight. The flight reached TMA Bilbao some 15 min before its estimated time of arrival.
— Technically difficult communications were established for Control to identify and clarify the flight's intentions.
— The aircraft found itself surrounded by clouds just before entering TMA Bilbao.
— It lost clear visual contact with the terrain and communicated that it was looking for a pass to descend to 2,000 ft.
— At 12:17:35 h APP stopped receiving communications from the aircraft and lost its radar track with code «3456» which identified it. The code allocated by the systems to flight D-EKBI was «5127».
— SAR was alerted and search operations were commenced in the early hours of the afternoon.
— Owing to the clouds and fog which covered the mountains it was not possible to locate the wreckage until the following morning.
— The aircraft crashed flying with level wings, in ascending flight almost parallel to the slope with a northerly course.
— The point of impact's elevation is 1,150 m (3,780 ft).
— The occupants died instantaneously due to the fatal injuries suffered in the impact.
— There is no evidence to suggest that there were prior mechanical or functional faults in the aircraft.

3.2. Causes

The main cause of the accident was the lack of visibility and the IMC conditions when the VFR flight entered an area of clouds over high mountain terrain. It lost contact with the ground and continued its descent at high speed. Possibly the pilot was not familiar with the surroundings and was not carrying out careful, observed navigation.

Various circumstances coincided at the scene of the accident, such as deficient communications and lack of knowledge on the part of the Bilbao approach control center (APP Bilbao) of the imminent arrival of the aircraft at TMA Bilbao. There was no communication from the aircraft reporting its earlier arrival at Bilbao with respect to its estimated time in the flight plan.

4. SAFETY RECOMMENDATIONS

REC 44/05. The recommendation is made to AENA that in the rendering of air transit services, the SSR response codes allocated by the mechanized systems in use should be communicated to the aircraft.

APPENDICES

APPENDIX A

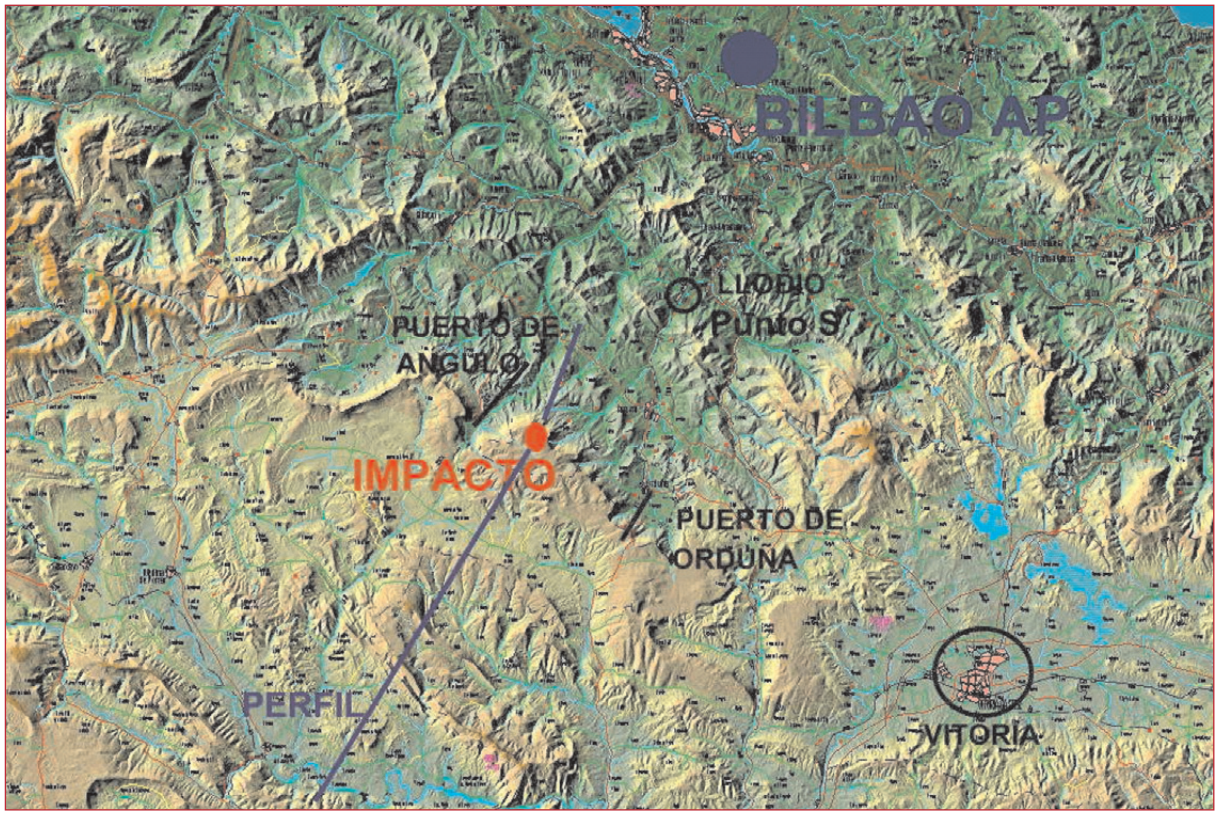

Figure A-1. *Orographic map of the area indicating the line corresponding to the terrain's profile shown in Figure A-2*

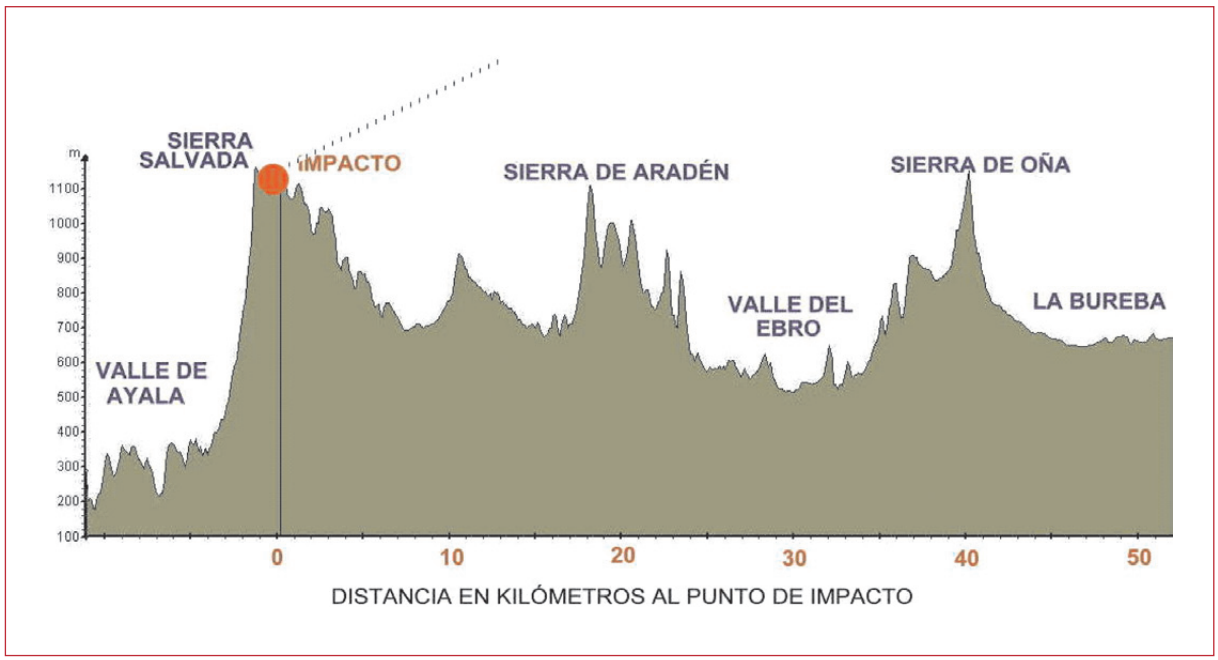

Figure A-2. *Profile of the terrain on the route followed by the aircraft*

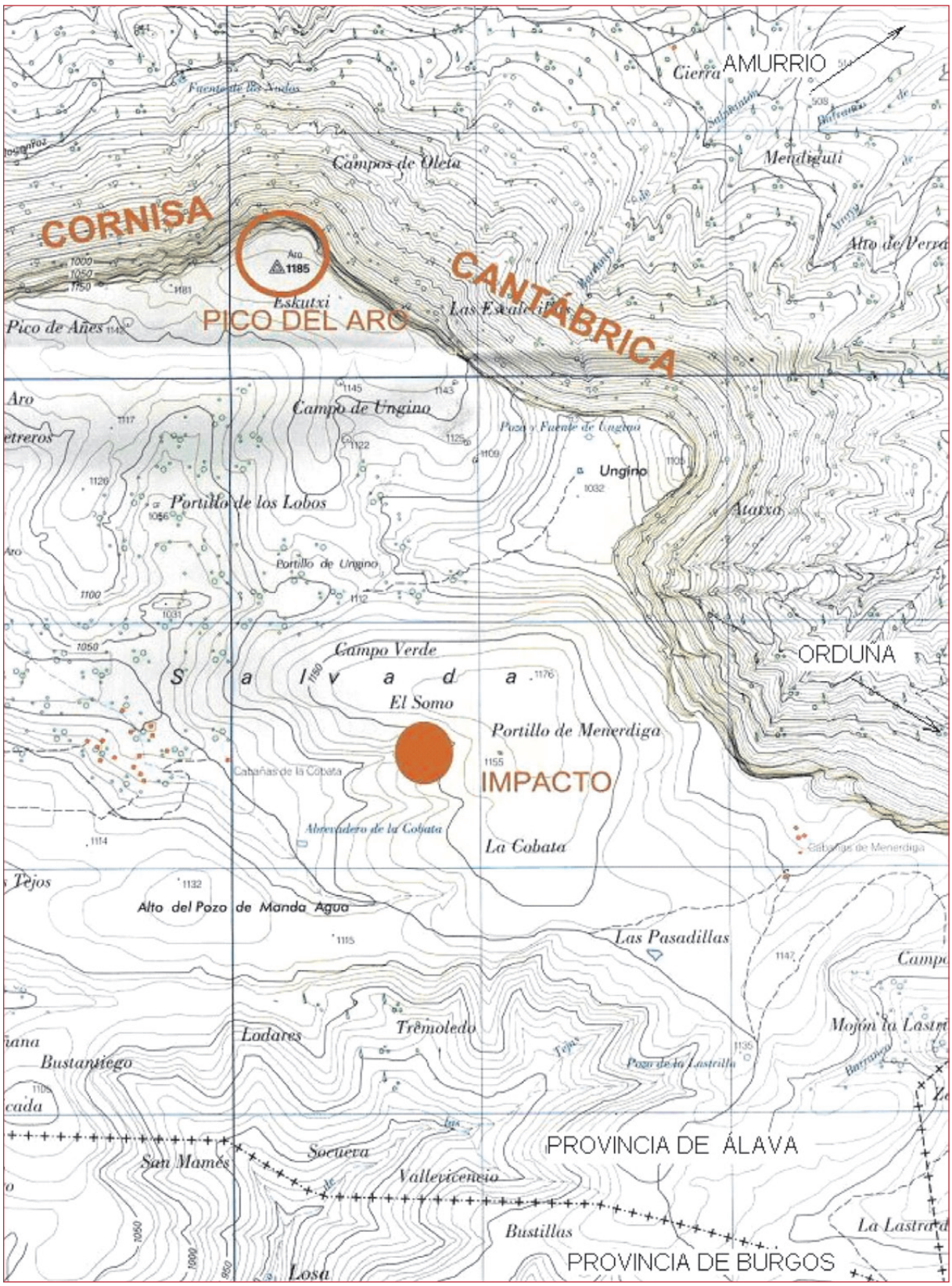

Figure A-3. *Detailed map of the site of the accident. 1 km graticule*

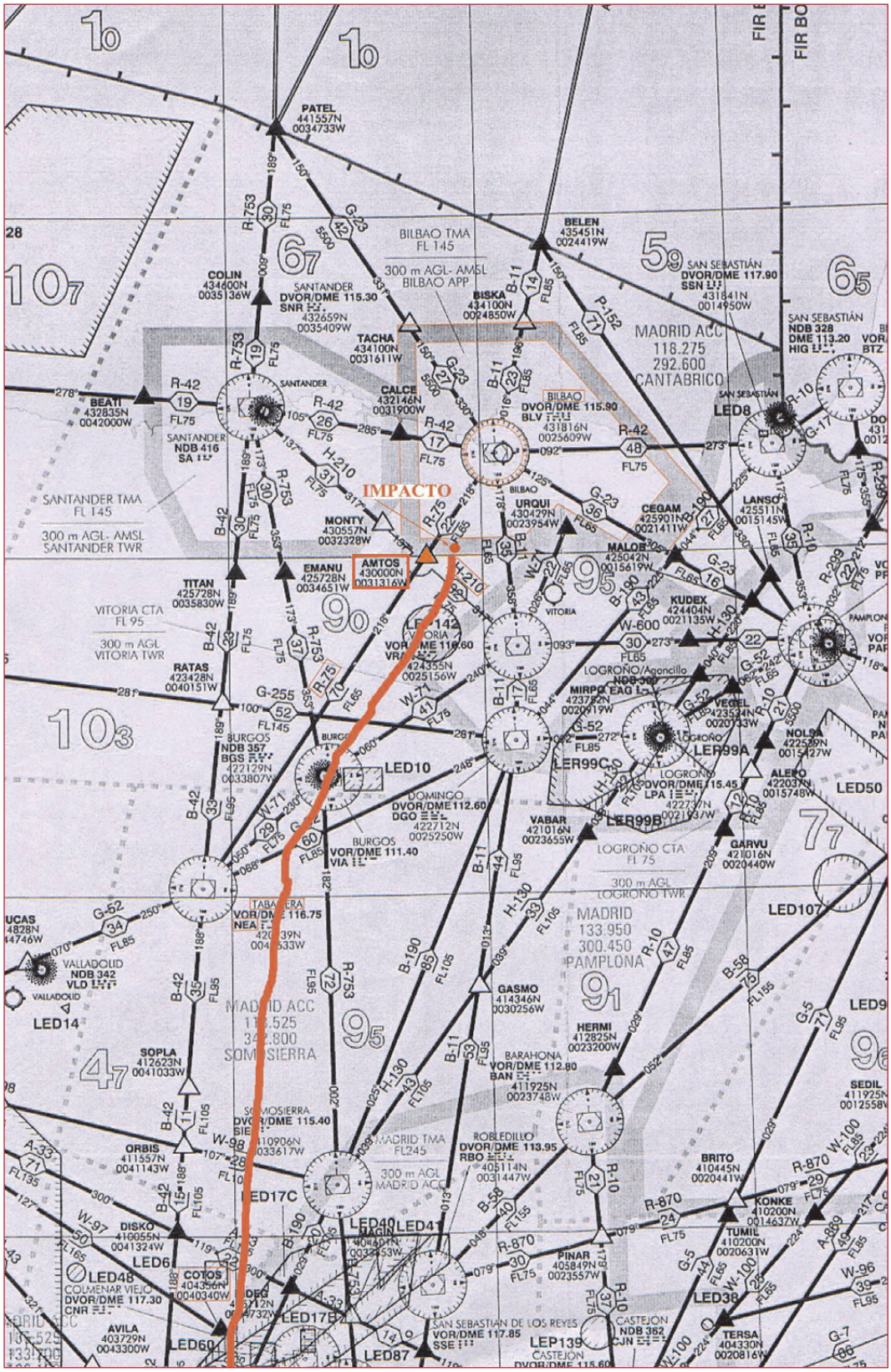

Figure A-4. *Representation of the route of D-EKBI on the air navigation chart*

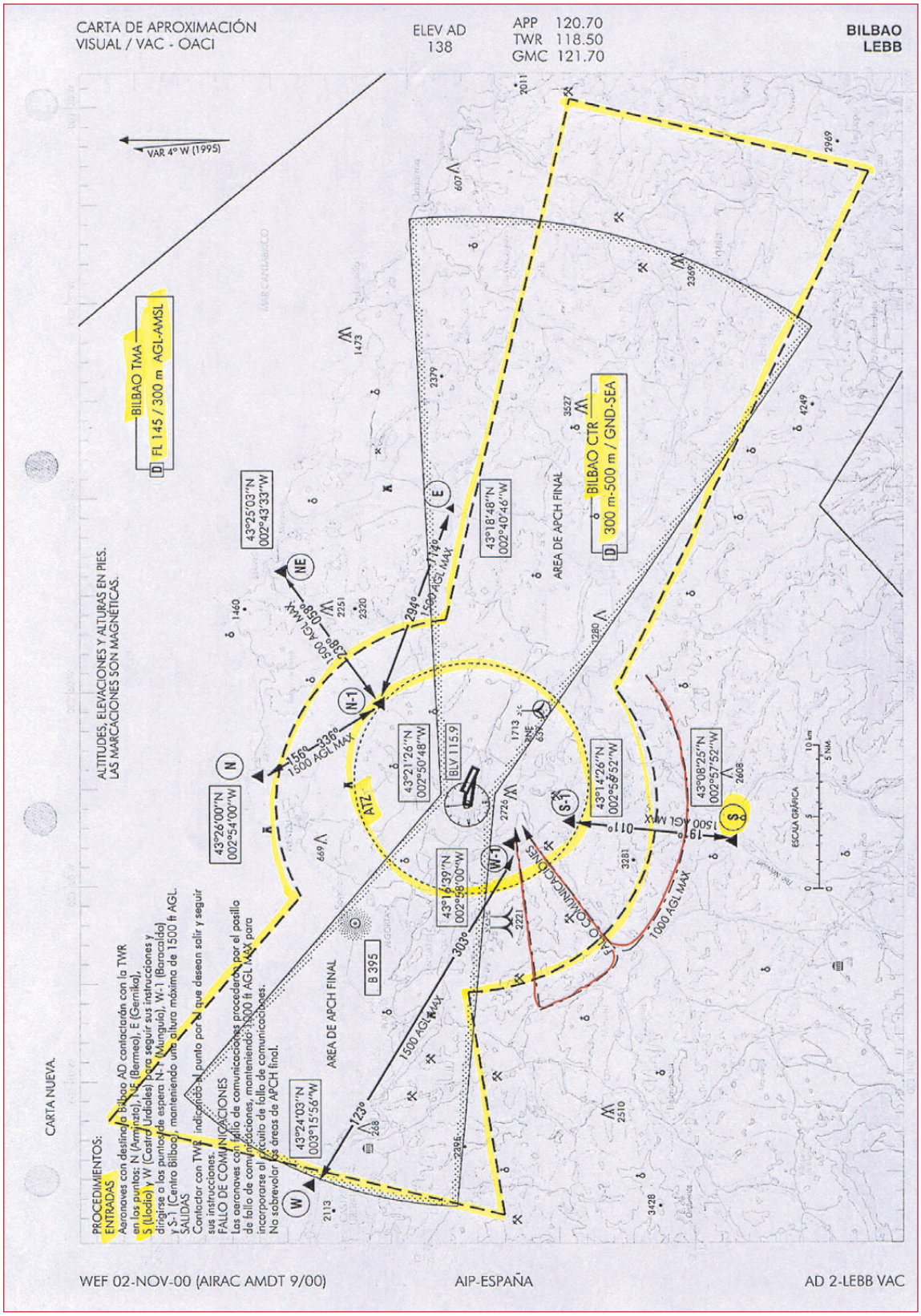

Figure A-5. *Bilbao Airport visual approach chart*

Figure A-6. *General view of the site of the accident with an indication of the impact point and the flight's probable path before the accident*

Figure A-7. *View of the point of impact in the direction of the flight, S-N*

APPENDIX B

Transcription of communications between the aircraft and Bilbao Airport in frequency VHF 120.7 Mhz

Time	Station	Communication
12:11:07	D-EKBI	Bilbao, This is delta, eco, kilo, bravo, india.
12:11:15	APP	Two zero mike, continue descend flight level one four zero.
12:11:22	20M	One, four zero, two zero mike.
12:11:40	D-EKBI	Bilbao approach, this is delta, eco...
12:11:46	APP	Station calling, say full call sign again. Please.
12:11:50	D-EKBI	It is, this is delta, eco, kilo, bravo, India.
12.11:56	APP	Delta, eco, kilo, bravo, India, muy buenas, Bilbao Approach, go ahead.
12:11:59	D-EKBI	VFR flight from Cuatro Vientos to your field. Twenty miles from your field, descending to four thousand feet,... IFR(¿?)
12:12:15	APP	Delta, eco, kilo, bravo, india, squak three four five six, confirm squak three four five six?
12:12:23	D-EKBI	Squaking three four five six, that is correct
12:12:27	APP	Delta, eco, kilo, bravo, india, roger. Runway in use in Bilbao is three zero, wind three zero zero, ten knots, QNH one zero, two zero. And for your information there are several arrivals, approach for runway three zero.
12:12:44	D-EKBI	... Three zero and the...
12:12:53	APP	Delta, eco, kilo, bravo, india, do you prefer to hold south of the field or descend down to two thousand feet.
12:13:02	D-EKBI	South of the field descending two thousand feet.
12:13:07	APP	Delta bravo india, in contact with the ground?
12:13:14	D-EKBI	Not by the moment... But hold... overhead...
12:13:18	APP	Delta bravo india, say again, please.
12:13:21	D-EKBI	... Not ground contact by the moment... descend over Bilbao...
12:13:33	APP	Delta bravo india, do you confirm proceding to San Sebastian?
12:13:47	D-EKBI	... we are looking for a pass to descend to two thousand.
12:13:55	APP	Delta bravo india, do you confirm your intentions?
12:14:04	D-EKBI	.....
12:23:38	APP	Delta bravo india, Bilbao.
12:23:52	APP	Delta bravo india, Bilbao.
12:25:37	IBE1455	Bilbao, buenas tardes, Iberia uno cuatro cinco cinco, librando... (Bilbao, good afternoon, Iberia one four five five, releasing...)
12:25:46	APP	Iberia uno cuatro cinco cinco, muy buenas, continúe ascenso... (Iberia one four five five, good afternoon, continue ascent...)

Time	Station	Communication
12:25:50	IBE1455	Ascenso... (Ascent)
12:27:08	APP	Iberia uno cuatro cinco cinco, Bilbao (Iberia one four five five, Bilbao).
12:27:12	IBE1455	Adelante para Iberia uno cuatro cinco cinco (Go ahead for Iberia one four five five).
12:27:14	APP	Uno cuatro cinco cinco sí, podría hacer de relay para delta, eco, kilo, bravo, india, simplemente llamarle, a ver si le recibe (One four five five yes, could you relay for delta, eco, kilo, bravo, india, just call to see if he receives you).
12:27:31	IBE1455	Delta eco kilo bravo india, from beria one four five five.

APPENDIX C

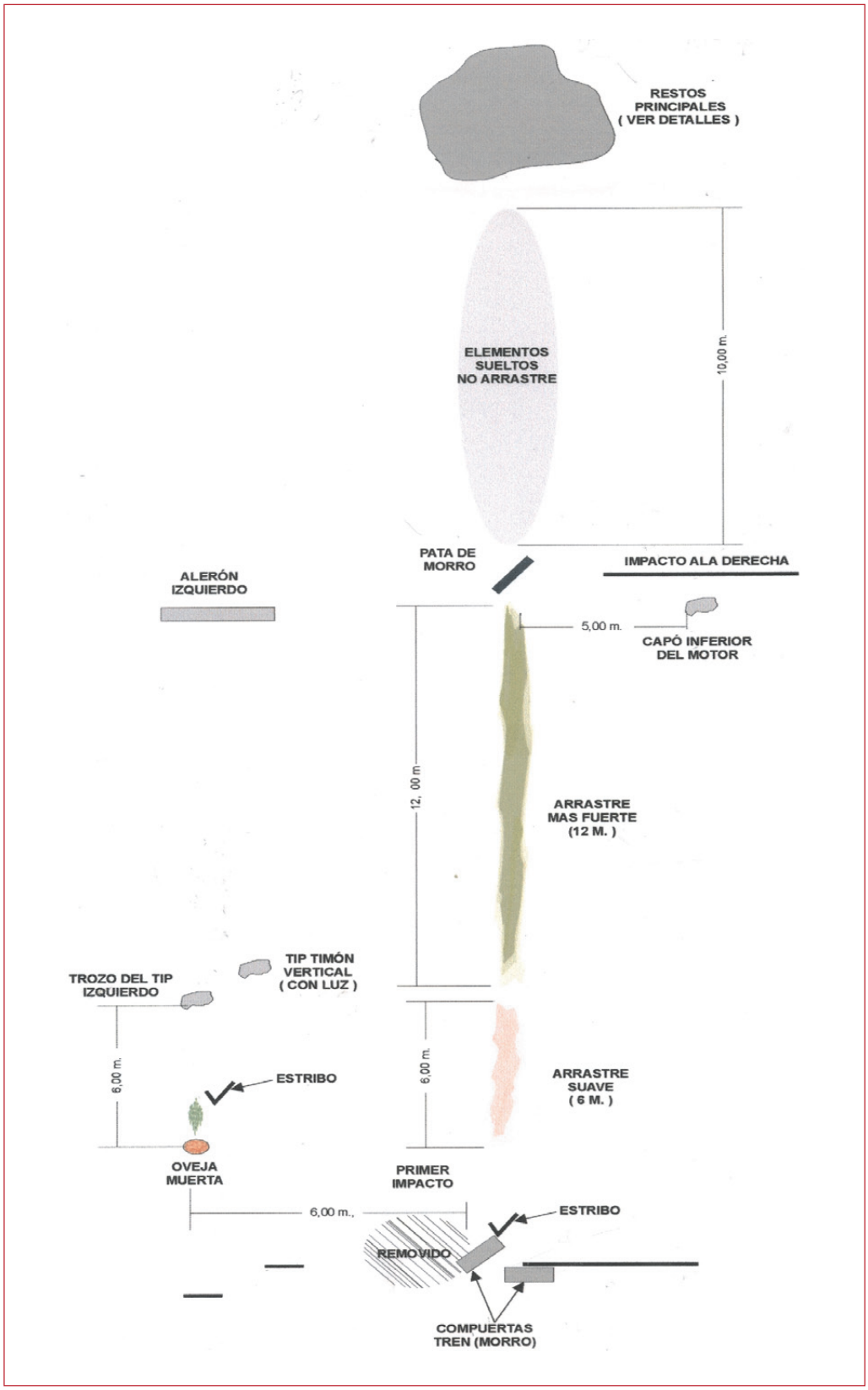

Figure C-1. *Distribution of wreckage*

Figure C-2. *Main group of wreckage in aerial view*

Figure C-3. *Detached engine and propeller*