CIAIAC
Comisión de Investigación
de Accidentes e Incidentes
de Aviación Civil

TECHNICAL REPORT
A-035/1999

Accident to aircraft
Aero Vodochody L-29
«Delfin», registration
ES-YLW, on 17 July 1999
near «Monte Sayoa»,
in Baztán-Eugui
(Navarra)

MINISTERIO
DE FOMENTO

Technical report

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Accident of aircraft Aero Vodochody L-29 «Delfin», registration ES-YLW, on 14 July 1999 near «Monte Sayoa», in Baztán-Eugui (Navarra)

MINISTERIO DE FOMENTO

SECRETARÍA GENERAL DE TRANSPORTES

COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

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COMISIÓN DE INVESTIGACIÓN DE ACCIDENTES E INCIDENTES DE AVIACIÓN CIVIL

Tel.: +34 91 597 89 60
Fax: +34 91 463 55 35

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

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 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 Celsius
00° 00′ 00″	Degrees, minutes, seconds
ADF	Automatic Direction Finder
CIAIAC	«Comisión de Investigación de Accidentes e Incidentes de Aviación Civil», Air Accidents Investigation Commission of Spain
CFIT	Controlled Flight Into Terrain
GPS	Global Positioning System
hh:mm:ss	Time in hours, minutes and seconds
hPa	Hectopascal
km	Kilometres
kN	Kilonewton
lb	Pounds
m	Metres
mb	Milibars
min	Minutes
MHz	Megahertz
M.T.O.W	Maximum Takeoff Weight
N/A	Not affected
N	North
QNH	Altimeter setting by which the altimeter shows the altitude of the airport with respect to sea level at the takeoff and landing
SW	South-west
UTC	Universal Time Coordinated
VFR	Visual Fligth Rules
VHF	Very high frequency
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range
W	West

Synopsis

TThe accident was notified to the «Comision de Investigación de Accidentes e Incidentes de Aviación Civil» (CIAIAC) by the Rescue Coordination Centre (RCC) of Madrid, forwarding the information received from the «Policía Judicial» (police operating under court orders) on the same day as the wreckage of the aircraft was located.

The CIAIAC notified the accident to the equivalent investigation bodies of France, Estonia, the Czech Republic and subsequently Ukraine. The Senegalese authorities were also notified after the receipt of a request from them.

The Report analyses the characteristics and state of the aircraft, experience of the crew, meteorological conditions and flight situation at the moment of the accident, and concludes as the most probable hypothesis of its causes, taking into account the lack of communications with the aircraft, that it was a CFIT (Controlled Flight Into Terrain) type of accident caused by flying visually in the presence of descending fog banks, over unfamiliar terrain and under possible nervous tension about the fuel level, given the elapsed flying time.

1. FACTUAL INFORMATION

1.1. History of the flight

According to the Flight Plan submitted, the aircraft of make Aero Vodochody, model L-29 «Delfin», registration ES-YLW, planned for the day of the accident, 14 July 1999, to make a flight under visual flight rules (VFR) from Limoges Aerodrome (France) to Pamplona Aerodrome (Spain), via Biarritz. According to this plan, the anticipated cruising speed was 200 knots (kt), at the height corresponding to the VFR and with estimated flight duration of one hour and ten minutes and an endurance of one hour and fifty minutes. The planned take-off time was 13:00 h[1] (15:00 h local time). The leg formed part of the «ferry» flight the aircraft was making from Estonia (the origin of the flight and the State of origin of its Certificate of Airworthiness, Experimental Category) to Gambia (Africa).

According to the communications the aircraft maintained with the control tower of Limoges Aerodrome, beginning at 13:09:57 h, it took off at 13:17:30 h (13:20 as reported to Pamplona Aerodrome) with the pilot in command and a second occupant, also a pilot with aeronautical experience as a military flying instructor, who were making the said «ferry» flight, and in suitable meteorological conditions for VFR flying. From these communications, it is known that the aircraft left the Limoges zone at 13:21:52 h, in direction Biarritz.

The aircraft communicated with the control tower of Biarritz Aerodrome confirming height 2,300 ft and destination direct to Pamplona, at 14:10:12 h. The last communication with this control tower was six minutes later to sign off, setting a southward direction and setting mode C of the transponder to 1260, in accordance with the tower's instructions.

When the safety period terminated without news of the aircraft, and after confirming that it had not landed at the alternative aerodrome nor at any of the nearby ones, the three alert phases were declared and the search for the aircraft began, the wreckage being located at around 09:30 h (local time) the following day in a mountainous area near the Monte Sayoa, following the statements of several witnesses who heard the noise of the engine, some of them having even seen the aircraft amid the fog. All of them coincided in stating that the aircraft was flying very low, too low according to some.

The accident occurred when, flying too low, as mentioned, the aircraft scraped the tops of several trees at a height of around 15 m, continued its descent, cutting the trunks of a number of trees, and finally colliding with the ground, forming a crater of some 6

[1] All the times of the report are UTC times unless otherwise noted. It is necessary to add 2 h to obtain local time in the place of the accident.

per 3 m. The aircraft was completely destroyed, its wreckage scattered around an area of over 300 square metres, and the two crew members were fatally injured, hanging from their parachutes but lying on the ground. The parachutes were hanging from the branches of the trees.

The accident occurred at an elevation of 1,410 m at around 14:30 h in a mountainous area of difficult access by land and air, and in an east-west flight direction.

1.2. Injuries to persons

Injuries	Fatal	Serious	Minor/none
Crew	2		
Passengers			
Others			

1.3. Damage to aircraft

As a consequence of the impact with the trees and the ground, the aircraft was totally destroyed.

1.4. Other damage

No fire was caused following the accident, and consequently the only appreciable damage was to the beech trees which were affected and the crater formed in the ground. The damage is not considered significant.

1.5. Personnel information

1.5.1. *Pilot in command*

Age/Sex:	43 years/Male
Nationality:	French and Senegalese
Licence:	USA Airline Transport Pilot Licence, n° 2336248, validated by Estonian Civil Aviation Licence n° 1419 for operating on board aircraft of this nationality, with expiry date 9 October 1999
Ratings:	Those of the USA licence, that is: — Single-engine and multi-engine landplanes — Commercial Privileges

	Note: The Estonian Civil Aviation Authorities do not differentiate in their qualifications whether the aircraft uses jet or turboprop engines
Medical check:	09-04-1999. Valid for 6 months
Flying experience:	Updated information not available. 2,907 hours until 31-08-1994

1.5.2. *Second occupant*

The following are the data corresponding to the passenger, who was a military flying instructor.

Age/Sex:	43 years/Male
Nationality:	Ukrainian
Licence:	Civil Aviation Pilot Licence n° 040314, printed on the former USSR format but issued by the Ukrainian authorities on 25-05-93, validated by Estonian Civil Aviation Licence n° 1416 for operating on board aircraft of this nationality and with expiry date 25 February 2000
Qualifications:	Those of the Ukrainian licence
	Note: The Estonian Civil Aviation Authorities do not differentiate in their qualifications whether the aircraft uses jet or turboprop engines
Flying experience:	4,730 hours up to 2 June 1999, of which 4,110 hours were on the L-29 type

As a flight instructor of this aircraft, he was used to be seated on the rear seat of the cockpit. He also had maintenance experience with this type of aircraft.

On the other hand, according to the information received, he was not fluent enough in English to cope with the radio communications.

1.6. Aircraft information

The aircraft L-29 «Delfin», manufactured by the Czech firm Aero Vodochody and the first prototype of which flew in April 1959, was the winning model in the contest held in 1961 to select the basic/advanced trainer to replace piston-engine models in the Warsaw Pact countries. A total of almost 3,600 aircraft were manufactured until production terminated in 1974.

The aircraft is a single jet-engined model with a straight middle wing, with zero dihedron in the central zone and 3° in the outer wings, fuselage of circular cross-section, double seat in tandem and T tail, powered by the M701 engine, also of Czech manufacture, limited to 1,960 lb of thrust with air intake incorporated into each half-wing root.

According to the information available, the principal characteristics of the model of interest for this report are:

— Wingspan: 10.29 m
— Total length: 10.81 m
— Height of the horizontal tail: 3.13 m
— Wing area: 19.80 m^2
— Empty weight: 2,280 kg
— Normal take-off weight: 3,280 kg
— Service ceiling: 36,100 feet (11,000 m)
— Maximum speed at sea level: 332 kt (615 km/h)
— Stall speed with flaps up: 87 kt (160 km/h)
— Endurance without external tanks: 1 h 47 min (at 247 kt and 16,400 ft)

1.6.1. *Aircraft identification*

Manufacturer:	Aero Vodochody
Model:	L-29 «Delfin»
Serial number:	993447
Registration:	ES-YLW
M.T.O.W.:	3,540 kg, with external tanks
Proprietor:	Castle Oil Ltd.
Operator:	OÛ Dolphin Aero

1.6.2. *Certificate of airworthiness*

Number:	1764 of the Civil Aviation Administration of Estonia
Type:	Restricted (Category: Experimental)
Issuance date:	04-06-1999 (Renewed 23-06-1999)
Expiry date:	23-09-1999

It was only authorized to fly under VMC conditions and, according to its certificate, it was only authorized to fly in Estonia, and needed specific permits to fly in other States. There is no evidence that it had any of those permits for the flight it was carrying out.

1.6.3. *Maintenance log*

Total flight hours:	3,028:52, as of 28-05-1999
Total flight cycles:	6,485, as of 28-05-1999
Hours since last gral. inspection:	719
Cycles since last gral. inspection:	1,209
Date of last annual inspection	26-6-1999
Hours since last annual inspection:	Less than 10

The aircraft was purchased by the Estonian company OÛ Dolfin Aero in May 1998. After that date the necessary actions were performed, on the ground and in flight, to renew the Certificate of Airworthiness, which was obtained on 4-06-1999 with a restricted nature (Category: Experimental) after the inspection of the aircraft with a favourable results by the Technical Division of the Estonian Civil Aviation Authority.

1.6.4. *Engine*

Manufacturer:	Motorlet [2]
Model:	M701 VC-150 or S-50 [2]
Thrust:	8.72 kN (1,960 lb) [2]
Serial number:	MC63072
Total hours:	2,047, as of 28-05-1999
Hours since last annual inspection:	278, as of 28-05-1999
Last inspection:	The note marked (*) in the previous section is applicable

1.6.5. *Avionics*

The aircraft had the following navigation and communications equipment:

[2] General information available.

— Radio RTL-11.
— Automatic Direction Finder (ADF) ARK 9.
— Radio-altimeter RV-UM, with metric scale.
— Transponder.

Additionally, the crew carried on board the following portable equipment:

— Portable radio, probably, ICOM.
— Receptor GPS GARMIN 100, with additional electrical supply from the aircraft, at the rear cockpit seat.
— Receptor GPS MARK (model unknown), at the forward cockpit seat.

1.7. Meteorological information

According to a report by the National Meteorological Institute (NMI), no meteorological data is available on the place where the accident occurred. However, there is no knowledge of any electrical discharge or precipitation in the zone. As a general situation, the NMI reports low pressures over the south-west of the Iberian Peninsula and the Balearic Islands and an anticyclone of 1,028 hPa over the Azores which caused cloudy skies in the extreme north of the Peninsula.

This situation of presence of clouds and fog over the zone in the afternoon of the accident was confirmed to the «Policía Judicial» by all of the people who were in the area on that afternoon and stated that they had heard and even seen the aircraft amid the fog.

1.8. Communications

It is known that the aircraft maintained communications, and the corresponding transcripts were available, with the control towers of the aerodromes of Limoges (between 13:09:44 h and 13:22:.07 h) and Biarritz (between 14:10:00 and 14:16:12 h).

The first contact began with loud whistling and background noises which were solved when the tower requested the crew to use the portable VHF unit they had used on arrival. From that moment on, communications proceeded normally. Take-off was authorised at 13:17:30 h and exit from the zone at 13:21:58 with the confirmation of the information frequency of Bordeaux, 125.3 MHz, which the crew had requested.

Communications with Biarritz proceeded without incident. The crew confirmed their destination as Pamplona and the tower authorised them to change the frequency to that aerodrome.

This communication was the last maintained by or received from the aircraft, as is demonstrated by the following reports:

— The General Inspection of the French Civil Aviation Authorities has confirmed that the aircraft did not contact Bordeaux Information.
— The Spanish air traffic control services (Air Transit Division, Air Traffic Control Division, Pamplona control and Vitoria control) have stated that there was no communication at any moment of the flight of the aircraft in question.

1.9. Wreckage and impact information

In its low-level final flight stage, the aircraft first scraped the tops of several trees at a height of around 15 m, continued its descent, cutting the trunks of some trees, and finally collided with the ground, producing a crater of some 6 per 3 m, where a part of the wings and the fuselage remained. A part of the engine was found some 25 m away at the top of a ravine, and at the bottom of this, with a height difference of over 75 m in a descent of some 150 m, the considerably injured bodies of the two crew members were found, dead and hanging from their parachutes, but lying on the ground. The parachutes were hanging from the branches of the trees. The situation (parachutes open, some scattered wreckage and a severed limb near a part of the engine) indicates that the crew ejection system was activated during the accident.

The aircraft was totally destroyed and unrecoverable. Except for the damage to a number of beech trees, no other significant damage was caused.

Appendix A includes a diagram of the accident wreckage.

1.10. Medical and pathological information

The two occupants of the aircraft died as a consequence of the multiple injuries sustained in the course of the accident.

1.11. Survival aspects

In accordance with the endurance stated in the Flight Plan (1:50 h) and take-off time reported by Limoges Aerodrome (13:20 h), and in view of the delay in arrival at Pamplona Aerodrome, the latter activated the established emergency phases: INCERFA, at 15:09 h, ALERFA, at 15:46 h, and finally, having received no information on the location of the aircraft, DETRESFA at 16:00 h. This last communication set in action the Search and Rescue Services; in addition to the ground search, that same afternoon a helicopter was deployed, taking off from Saragossa with destination Pamplona and

returning to Saragossa, and another helicopter and an aircraft were deployed the following morning, beginning their search activities at 06:30 h. As has been stated, the wreckage was located that same morning.

Given the characteristics of the accident and the impact with the ground, there was practically no possibility of survival for the two occupants of the aircraft.

1.12. Tests and research

The radar track of all of the flight is available in an ASSMAN recorder and duplicated in STR on OPERA for the last ten minutes, from take-off at Limoges Aerodrome (first radar contact at 13:20:08 h, FL 013) to the reading taken at 14:19:09 h corresponding to a few moments before the accident. This radar track has been supplied by the General Inspection of the French Civil Aviation Authorities and the French Meteorology Department.

This track shows the following:

The Limoges–Biarritz flight proceeded practically in a straight line following a course around 220° and at a height of 2,000 feet (FL 20), transponder at 2000 and speed between 217 and 222 kt.

The change of the transponder to 1260, indicated by Biarritz control, is detected at 14:12:42 h, that is, 1:09 minutes after confirmation according to the communications with that tower. At that moment the aircraft was on a southward course, as was also indicated by the tower.

In the communication with the Biarritz tower, the pilot reported that he would overfly that aerodrome at 2,300 feet, with a QNH of 1,021 hPa. At that moment, the radar track indicates that the aircraft overflew the aerodrome at FL 20.

After passing Biarritz, and according to the radar data, the pilot commenced a descent (14:13:02 h) to level FL 17 (14:14:04 h) which he maintained for 40 seconds, then commencing a climb to level FL 40, which he reached in three minutes 36 seconds (14:17:40 h). He performed this operation, maintaining the course 183/184° practically steady from the beginning, with only one short excursion to course 192°, and speed 225-235 kt.

This level, course and flying speed were maintained for almost a minute (until 14:18:21 h), at which moment the pilot commenced a descent, reaching level FL 38 at 14:18:53 h, which he maintained until the last real reading before the accident at 14:19:09 h, the last estimated radar position available being at 14:19:25 h. At that moment, the course was 179° and the speed had increased to 239 kt.

The radar track, superimposed on a map of the zone, is attached in Appendix B.

1.13. Additional information

One additional item of information to be taken into account in the investigation of this accident is the aircraft's fuel situation at the moment of its occurrence.

From the facts set out above, it is deduced that at that moment the aircraft had been flying for one hour and two minutes (time between take-off and the last radar contact at 14.19:25 h), which approximately coincides with the total estimated time for the flight in the Flight Plan.

The engine was started up approximately ten minutes before the first communication with the control tower.

On the other hand, given that:

— The maximum endurance of the aircraft, as indicated in section 1.6 above, is 1 hour 47 minutes at 247 kt and 16,400 ft, and that
— According to the radar track, the flight had been made at a much lower height, 3,800/4,000 feet, and lower speed, with which the fuel consumption would have been greater,

it can be concluded that in the moments prior to the accident the fuel reserves were limited, although there is no record of the pilot reporting this.

2. ANALYSIS

2.1. Progress of the flight

AIn accordance with its Flight Plan, the jet aircraft model L 29 «Delfin», manufactured by the Czech firm Aero Vodochody, registration ES-YLW, took off from Limoges Aerodrome (France), with one pilot and one passenger, also a pilot, on board, on 14 July 1999, to make a VFR flight with destination Pamplona Aerodrome as a part of the «ferry» transport it was making from Estonia with final destination Gambia.

The planned take-off time was 13:00 h but actual take-off was at 13:17:30 h, according to the records of communications with the control tower of Limoges Aerodrome. These communications began with problems of noise at the aircraft end, which were eliminated when the crew changed to a portable VHF unit which they were carrying on board and had had to use on arrival at the aerodrome.

The Limoges-Biarritz flight proceeded normally, on a course around 220°, level FL 20 (2,000 feet) and speed 217-222 kt, according to the radar track.

Arrival in Biarritz was at 14:10:12 h, and Biarritz control authorised the pilot to proceed directly to Pamplona to avoid flying over the town, with a southward course and transponder at 1260. This was confirmed by the pilot and is also confirmed by the radar track. The connection with Biarritz control terminated at 14:16:12 h. There is a discrepancy between the flight altitude of 2,300 feet reported by the pilot to Biarritz control at 14:10:12 h and the level FL 21 (2,100 feet) indicated in the radar track at 14:10:15 h, possibly due to the altimeter setting.

From this moment on, there is no more communication by the aircraft, with neither Spanish nor French centres, the radar track being the only information available to the investigation.

According to this information, and as stated above in section 1.16, the aircraft descended to level FL17, maintained this level according to the radar for 40 seconds, and then began a climb of 3 minutes and 36 seconds to level FL 40, possibly on approaching the Pyrenees Mountains. As has been said, this operation was performed maintaining the southward course (183° to 184° with a short excursion to 192°) and a speed of between 225 and 235 kt.

Finally, the aircraft maintained this level, course and speed for almost one minute (until 14:19:21 h), then began a descent, reaching level FL 38 at 14:18:53 h, maintaining this until the last true reading before the accident (14:19:09 h), the last estimated radar position available in the radar track being at 14:19:25 h.

In this position, immediately before the accident, the data: are latitude 43° 00' 03" N, longitude 01° 32' 44" W, speed 239 kt, course 179° and flight level FL 38, maintaining the last true value measured.

The accident occurred when the aircraft was flying low, even «very low» according to some witnesses. It must have scraped the tops of the trees (some of them up to 15 m high), continuing its descent cutting the trunks of a number of trees and finally colliding with the ground, producing a crater of some 6 per 3 m, the wreckage being scattered as indicated in previous sections.

According to the «Policía Judicial», the accident occurred at an elevation of 1,410 m, equivalent to 4,624 feet, flight level FL 46, in an east-west direction. This discrepancy with the level and course indicated in the radar track could be due to corrections at the last moment, flying at a height at which the aircraft was no longer detected by radar.

2.2. Discussion

According to the available data indicated above, the flight, at least until the last moments before the accident, seemed to proceed normally without any cause for alerting the crew. This statement is endorsed by the fact that the radar track indicates a straight, uniform course until loss of contact and that, as has been confirmed by the nearby control centres which the crew had contacted or planned to contact, no attempt at communication with any of them was detected.

Nevertheless, it must be pointed out that the crew had communications difficulties in the initial contact with the Limoges control, which obliged them to change to a portable unit they were carrying on board. It is not known whether this unit was connected to the aircraft's battery nor, in the event that it was self-powered, what was the state of charge of its own batteries, although it is believed that it must have been adequate, and this was the unit used to contact Biarritz control.

The general weather conditions were suitable for VFR flying although, in the mountainous zone where the accident occurred, there were low fog banks according to the statements of the witnesses who heard and even saw the aircraft moments before the accident. None of these witnesses, although they did not see the accident, have said that they heard any malfunctioning of the engine.

Finally, for the reasons set out in section 1.18, it must be noted that before the accident the crew must have been concerned about the fuel reserve. It is possible that this made them fly very low, following the terrain, and that they even started their approach early, which would explain the east-west direction at the moment of the accident.

The conditions, therefore, were a crew flying over unknown mountainous terrain, at low height and with fog banks closer and closer to the ground, with a limited amount of fuel, starting their approach knowing that they were near their destination, and with possible limitations in the communications equipment on board, aggravated by flying low between mountains. The most probable hypothesis seems to be that all of these factors led to an accident of the type known as CFIT (Controlled Flight Into Terrain), which occurs when an airworthy aircraft is unintentionally flown into the terrain under the crew's control.

3. CONCLUSIONS

3.1. Findings

— The pilot and the passenger held the corresponding valid licences for the type of flight they were operating.
— The aircraft had a restricted Experimental Certificate of Airworthiness that did not allow flying outside Estonia without authorization.
— The flight had commenced with suitable weather conditions for VFR flying, although at the moment of the accident the aircraft was flying in a mountainous area with low fog banks which limited visibility.
— The corresponding Flight Plan had been prepared and disseminated by the normal channels.
— In low flight over a mountainous area, the aircraft scraped the tops of a number of trees and collided with the ground, resulting in its destruction and the death of the crew.

3.2. Causes

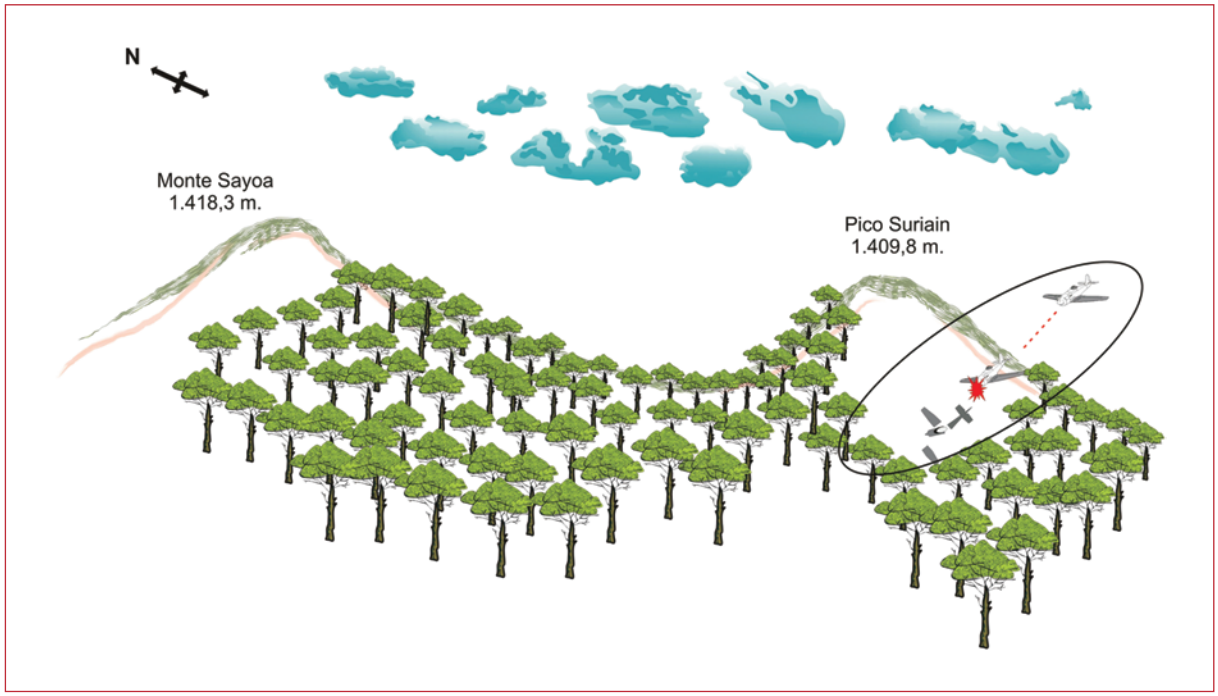
It is considered that the most probable cause of the accident was that, during the final stage of the flight, at very low height, with reduced visibility, with the crew possibly unsure of their exact position, with a limited amount of fuel in the tanks and with possible communications difficulties due to flying at low height between mountains and/or to the crew's communications equipment, the pilot started his approach, the most probable hypothesis being that the accident was of the CFIT type (Controlled Flight Into Terrain).

4. SAFETY RECOMMENDATIONS

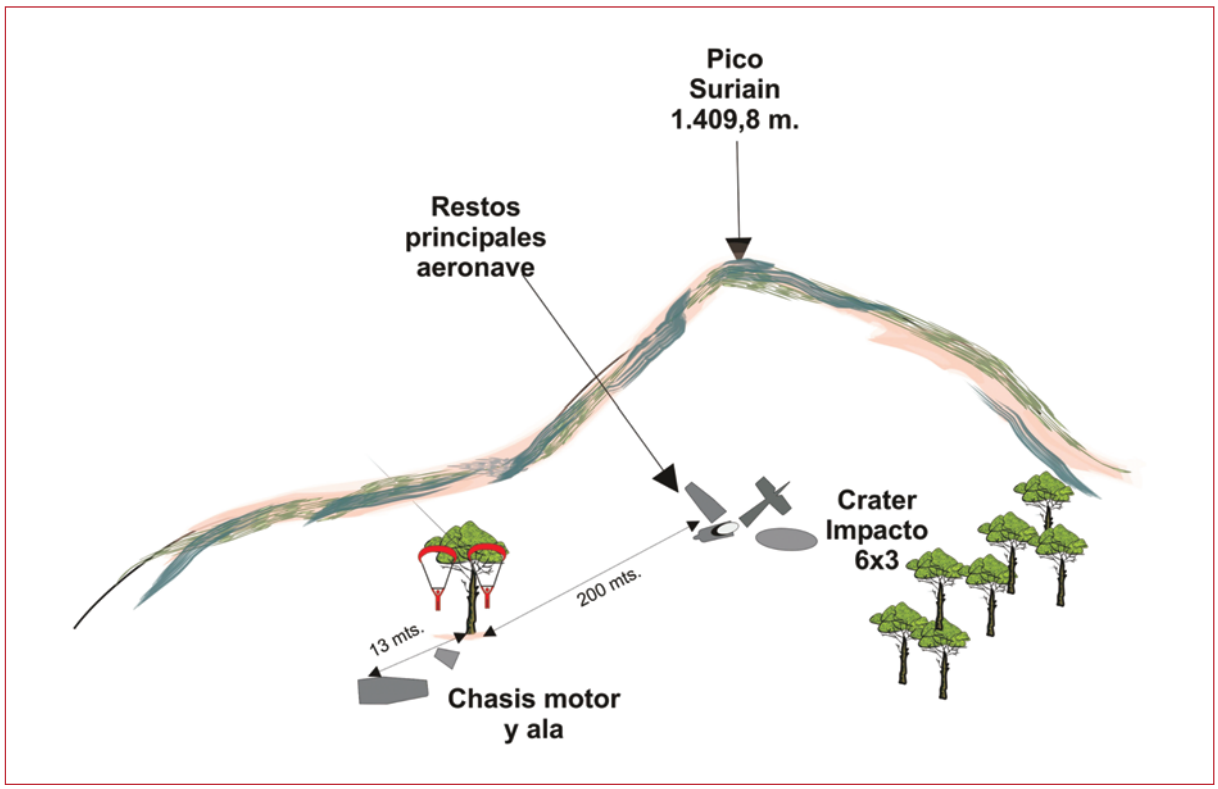
None.

APPENDICES

APPENDIX A
Final flight path and wreckage diagram

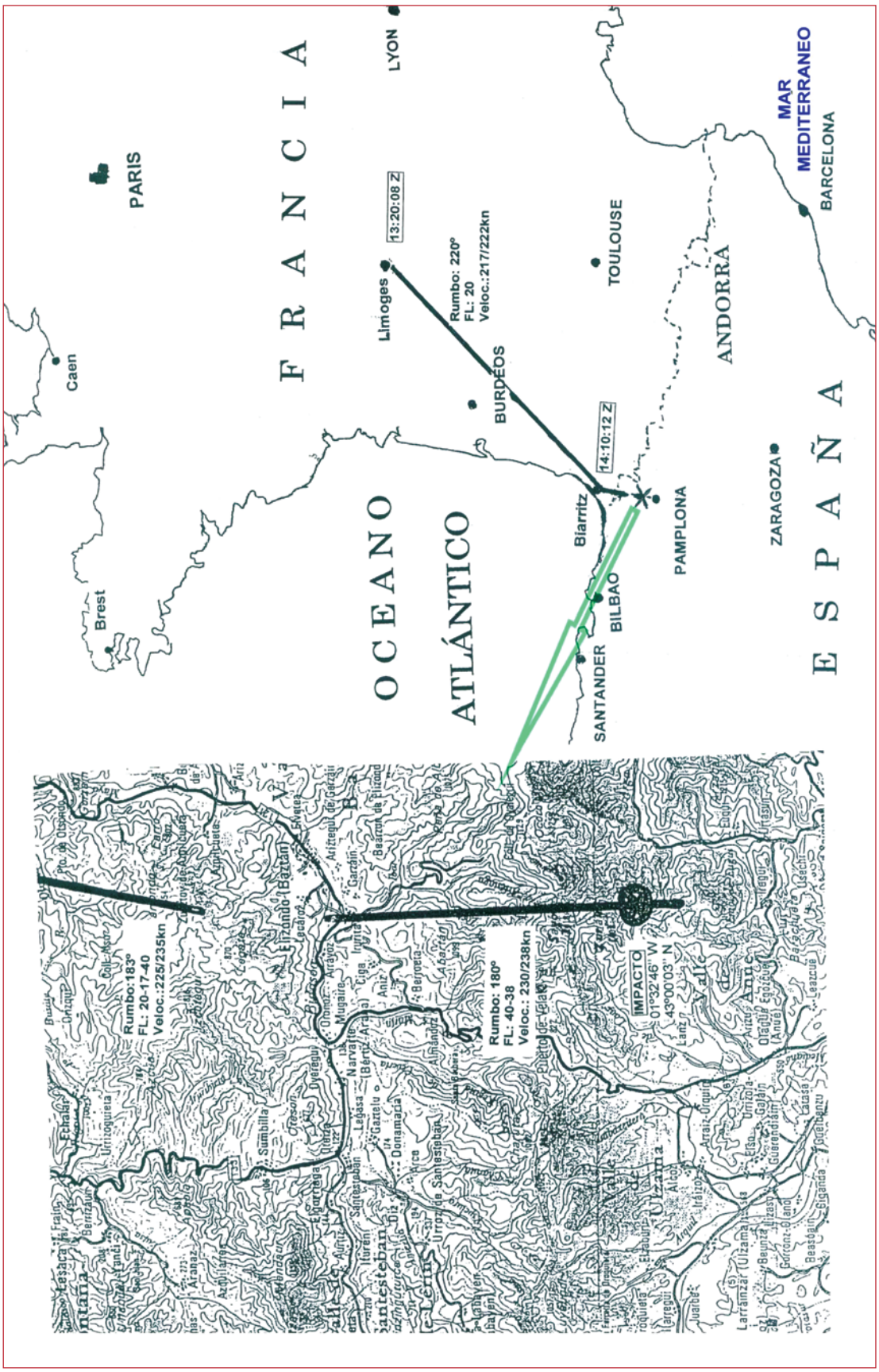


Final path of the aircraft



Wreckage layout

APPENDIX B
Location map and radar track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OCEANO ATLÁNTICO
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PARIS
LYON
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BURDEOS
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ANDORRA
BARCELONA
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PAMPLONA
ZARAGOZA
BILBAO
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Rumbo: 180°
FL: 40-38
Veloc.: 230/238kn
IMPACTO
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