CIAIAC

COMISIÓN DE
INVESTIGACIÓN
DE **A**CCIDENTES
E **I**NCIDENTES DE
AVIACIÓN **C**IVIL

Technical report A-032/2001

Accident to aircraft
Beechcraft B300C, registration
F-GOAE, near Santiago
Airport on 7 June 2001

MINISTERIO
DE FOMENTO

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SECRETARÍA GENERAL DE TRANSPORTES

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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	Grades centigrade
00° 00′ 00″	Grades, minutes y seconds
ACC	Area Control Centre
ADF	Automatic Directional Finder
ALAR	Approach and Landing Accident Reduction
APP	Approach
ATC	Air Traffic Control
BEA	Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile
CFIT	Controlled Flight Into Terrain
CIAIAC	Civil Aviation Accident Investigation Commission
CVR	Cockpit Voice Recorder
DGAC	Direction Générale de l'Aviation Civile of France
DME	Distance Measurement Equipment
FDR	Flight Data Recorder
ft	Feet
GPWS	Ground Proximity Warning System
h	Hour(s)
hPa	Hectopascal
IAF	Initial Approach Fix
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IMC	Instrument Meteorological Conditions
km	Kilometre(s)
kt	Knot(s)
kw	Kilowatt(s)
LOC	Localizer
m	Metre(s)
MDH	Minimum Decision Height
METAR	Meteorological report
MHz	Megahertz
mm-dd-yy	Date (month-day-year)
MSA	Minimum Sector Altitude
N	North
NDB	Non Directional Beacon
PAPI	Precision Approach Path Indicator
PF	Pilot Flying
PNF	Pilot Not Flying
RVR	Runway Visual Range
SAR	Search and Rescue Service
SOP	Standard Operational Procedures
TAFOR	Terminal area forecast
TWR	Control Tower
UTC	Coordinated Universal Time
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	Very High Frequency Omnidirectional Range
W	West

Synopsis

On June 6th, 2001 at 22:10 h UTC (Coordinated Universal Time) a Beech B300C aircraft, registration F-GOAE, departed from Le Mans airport to Santiago in a cargo flight according to instrument flight rules. Near the destination airport, at around 00:00, meteorological conditions were reported to be good, and the crew requested a visual approach to runway 17, even though the active runway was 35.

Once cleared to land, the aircraft encountered a fog patch and from this moment it began a high rate descent (2000 to 3000 ft/min). A minute after entering an unexpected and unforeseen fog patch, at 00:13:02 h of June the 7th, 2001, the aircraft struck some trees, in level flight and with an airspeed of 148 kt.

The wings and engines detached from the fuselage, and they dragged along a scrubland area until they came to a stop.

The crew suffered minor injuries and the aircraft was completely destroyed.

The accident was notified that day to the Civil Aviation Accident Investigation Commission (CIAIAC), who in turn reported it to the Bureau d'Enquêtes et d'Analyses pour la Securite de l'Aviation Civile (BEA) the same day. Throughout the morning of June 7th of 2001, a CIAIAC investigation team moved to the scene of the accident to begin the field investigation.

1. FACTUAL INFORMATION

1.1. History of the flight

The aircraft departed Le Mans airport at 22:10[1]. According to its flight plan the scheduled route would be Le Mans-Arnage-Nantes-Lotee to Santiago de Compostela. It was a cargo flight operated by AEROPE, with OPE062 call sign, and carried parts for vehicle manufacturing. The crew was composed of two pilots, the captain acting as PF (pilot flying) and a copilot as PNF (pilot not flying).

The climb and cruise phases of the flight went along normally. The crew, before being transferred from Madrid Area Control (ACC Madrid) to Santiago Approach Control (APP Santiago), requested Santiago APP[2] the runway in use and weather information. Santiago APP gave them the following information:

> «Runway in use three five and weather the wind is calm the ceiling and visibility okay temperature ten dew point nine QNH one zero two two.»

The copilot read back the information stating the following:

> «Okay runway three five in use wind calm and cavokay QNH one zero two two we call you back as soon Madrid leaving Oscar Papa Echo Zero Six Two.»

After performing the approach briefing for runway 35 (see approach chart in Appendix E), without discarding a visual approach to runway 17, and reading the descent checklist, they called Madrid ACC to begin the descent.

At 23:54:41 the Captain said that runway 17 only had one PAPI bar (Precision Approach Path Indicator) and considered the option of a visual approach, although admitting that it was somewhat difficult. The copilot agreed.

At 23:56:49 Madrid ACC cleared them to descend to flight level 250 and transferred them to Santiago APP.

Immediately after being transferred, at 23:57:46, Santiago APP cleared them down to flight level 100. The descent was carried out at a rate of 2,000 ft/min.

At 00:03:14 they received the following clearance from Santiago APP:

> «Oscar Papa Eco zero six two, proceed to the one eight DME runway three five for straight in ILS approach.»

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[1] Time reference in this report is Coordinated Universal Time (UTC). It is necessary to add two hours to obtain the local time.

[2] Santiago Approach Control and Santiago TWR are the same during night time hours.

in order to have them to proceed to the 18 DME fix, IAF (Initial Approach Fix) for the VOR/DME-ILS/DME approach for runway 35. This communication was not correctly understood by the crew at first, who requested ATC to say it again. Observing the chart, the crew identified the fix as the IAF for the VOR/DME-ILS/DME approach procedure for runway 35.

Appendix D shows the final trajectory followed by the aircraft according to radar information.

At 00:04:47, they requested a visual approach to runway 17. Santiago TWR asked if they requested runway 17. They answered affirmatively and Santiago TWR instructed them to maintain a heading of 236°, and told them to report the field in sight.

Runway 17 had the approach lights, the left PAPI bar and the ILS (Instrument Landing System) glide path out of service. This information appeared on the NOTAM's in force on the day of the accident. During the approach briefing, the crew had mentioned the ILS glide path and left bar of the PAPI. They said nothing about the approach lights.

After this, they spoke about the visual approach, and the Captain told the copilot that they should be aligned with the runway 10 miles out in order to be at 3,500 ft. They also spoke about the MSA (Minimum Sector Altitude), and they both agreed that it was 4,800 ft. No other comments were made regarding the visual approach for runway 17. The PF, although performing a visual approach, tried to follow the VOR/DME-ILS/DME for runway 17 approach profile.

At 00:06:34 the aircraft reported reaching flight level 100 and Santiago APP instructed them to descend to 5,000 ft giving them a QNH information of 1,021 hPa. The aircraft's altitude was 10,800 ft, airspeed of 248 kt and a heading of 238°.

Immediately afterwards, they set and cross checked their altimeters to 1,021 hPa, commenting on the rate of descent, which was 1,500 to 2,000 ft/min.

At 00:08:19 the Captain once again told the copilot that they should be aligned with runway 17 10 miles out of the field and asked the distance. The copilot said that they were 14 miles out. The aircraft had an altitude of 7,170 ft, airspeed of 253 kt and a heading of 236°.

At 00:08:54 the Captain told the copilot to request a right turn to align with the runway. The copilot requested clearance to turn 20° to the right. Santiago APP told them to proceed at own discretion and to report the field in sight. The PF performed the maneuver without further comment.

At 00:09:22 the aircraft was 10 miles from Santiago VOR with airspeed of 240 kt, an altitude of 5,100 ft, a descent rate of 1,700 ft/min and a heading of 249°. They were on the 045° radial of the Santiago VOR. At this moment they were not yet aligned with the runway.

Reaching 4,800 ft, which was the MSA, at 00:09:42, the aircraft maintained altitude. Afterwards they requested descent to 3,500 ft and reported «...we have the... the uh... the ground in sight for the moment».

Santiago APP cleared them to complete the approach to runway 17 with visual contact and to land on runway 17 stating that the wind was calm.

Once cleared to land, they completed the approach checklist. At 00:10:52, with an altitude of 4,200 ft, the altitude alert sounded.

At 00:10:57, the Captain requested one notch of flap to start the landing configuration. They were on a 222° heading with airspeed of 162 kt an altitude of 4,100 ft and were about 7 miles from the Santiago VOR on the 030° radial.

When they reached 3,500 ft, at 00:11:29, the pilot in command said that at 5.9 miles they would have to continue descending and requested landing gear down.

At 00:11:40 the autopilot was disengaged, and 11 seconds later at 00:11:51, the copilot confirmed that the landing gear was down.

At 00:11:55 they intercepted the localizer with a south heading and the altitude alert sounded simultaneously, the aircraft had an altitude of 3,100 ft, the airspeed had come back to 140 kt and the rate of descent was of 1,200 ft/min, they were 5.3 miles the threshold of runway 17.

At 00:12:01 the copilot expressed his surprise due to the poor weather conditions and the Captain did the same.

At 00:12:12 they intercepted the localizer again with a heading of 165° and six seconds later the altitude alert was heard, with an altitude of 2,300 ft. The heading would continue to change to 145° to end up at 150°, so they never recaptured the localizer.

From that moment the aircraft continued descending at a high rate (a maximum of 3,060 ft/min). The pilots made somewhat confusing remarks regarding altitudes.

At 00:12:52 the copilot reported that they were 2.5 DME. At this time the aircraft had an altitude of 1,242 ft (800 ft below the defined glide path for the ILS approach for runway 17) and with 1,300 ft/min descent rate.

At 00:12:53 the altitude alert sound off with an altitude of 1,208 ft. The airport elevation is 1,213 ft.

At 00:12:58 the GPWS (Ground Proximity Warning System) gave the «Terrain, Terrain» alert, indicating the proximity to the ground. Following this, the system gave the «Whoop whoop pull up» warning. According to the flight data recorder, the pitch angle went from –7° to 0° from 00:12:58 to 00:13:02 h.

At 00:13:02 the aircraft impacted against a small pine forest, one minute after encountering the fog patch. The aircraft's airspeed was of 148 kt and with the landing gear down and one notch of flap configuration. From the surprise comments due to the fog until the impact with the trees, the engine RPM's remained constant.

The aircraft wreckage was located approximately 4 km (2.16 miles) from the threshold of runway 17 of Santiago airport, at coordinates 42°56'45" N 008°25'38" W and 343 m (1,125 ft) elevation. Appendix A shows the place where the aircraft crashed.

During the crash, the aircraft lost both wings, the engines and the landing gear causing a fire in the forest area due to the fuel spillage.

The aircraft maintained the initial trajectory and after contacting the ground it came to a stop transversally to the direction of travel, after covering 140 m from the first impact with the trees.

The captain suffered a small head wound but was able to leave the cockpit by his own means. The copilot was uninjured. To abandon the cockpit they used an axe and broke one of the side windows, since the fuselage ended up leaning on the left side after suffering heavy damage and the emergency exits had been blocked by the cargo.

Once outside of the aircraft, the crew contacted their company in France by means of a cell phone, who in turn notified Santiago Control Tower that the aircraft had suffered an accident.

At 00:37 the air transit services notified the emergency services that they had lost an aircraft target that was about to land.

At 00:52 the copilot of the aircraft phoned Santiago Tower and informed them of the aircraft's location and of their physical conditions.

At 01:25 the crew was located by a team that had set out from the airport and transferred to Hospital Clínico de Santiago, where they were examined and given first aid attention to be discharged from the hospital shortly afterwards.

1.2. Injuries to persons

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

1.3. Damage to aircraft

The aircraft was completely destroyed due to the impact.

1.4. Other damage

The aircraft cut some pines, and an area of scrubland was burnt beyond the cut down trees.

1.5. Personnel information

1.5.1. *Pilot*

Pilot information		
Age	44 years	
Nationality	French	
License	Airline transport license (since 09-27-1989)	
Ratings (expiration)	BE 300/1900 (from 02-06-2001 and valid until 02-28-2002)	
	Multiengine land (until 12-31-2001)	
	Instrument flight (until 12-31-2001)	
Experience	Total	3,115 h
	In type	211 h
	Last 90 days	194 h
	Last 30 days	59 h
	Last 24 hours	2 h 40 minutes
Duty period	Start	20:15 h
	Previous rest	35 h

The pilot in Command had joined the company on 07-01-2000.

He had flown to Santiago on two previous occasions, one of them at night. These flights had occurred in the past 3 months.

The flights carried out in the past 20 days had been in the same aircraft.

The Captain was the one flying the aircraft (PF) on the accident flight.

1.5.2. *Copilot*

Copilot information		
Age	31 years	
Nationality	French	
License	Airline transport license (since 08-11-1994)	
Ratings (expiration)	BE 300/1900 (from 07-03-2000 and valid until 07-31-2001)	
	Instrument flight (issued 05-29-1997)	
Experience	Total	791 h
	In type	268 h
	Last 90 days	162 h
	Last 30 days	52 h
	Last 24 hours	2 h 40 minutes
Duty	Start	20:15 h
	Previous rest	35 h

The Copilot had joined the company on 08-16-1999.

He had flown to Santiago on two previous occasions in the past twelve months, both of them at night.

The flights carried out in the past 20 days had been in the same aircraft.

The copilot was in charge of the communications and was not flying the aircraft (PNF) on the accident flight.

1.6. Aircraft information

1.6.1. *Cell*

Make: Beech Aircraft Corporation

Model: Beech B300C

Serial number:	FM1
Year of manufacture:	1990
Registration:	F-GOAE
Owner:	Union Financiere de Location de Materiel
Operator:	Aerope

1.6.2. *Airworthiness Certificate*

Number:	114925
Issue date:	04-07-2000
Expiration date:	07-26-2003

1.6.3. *Maintenance records*

Total flight hours:	5,331 hours 40 minutes
Total flight cycles:	7,451
Last scheduled inspection:	05-30-2001
Hours since last inspection:	23 hours 40 minutes

1.6.4. *Engines*

1.6.4.1. Engine 1

Make:	Pratt & Whitney
Model:	PT6A 60A
Power:	830 kw
Serial number:	PCE 95499
Last inspection:	05-30-2001

1.6.4.2. Engine 2

Make:	Pratt & Whitney
Model:	PT6A 60A
Power:	830 kw
Serial number:	PCE 95498
Last inspection:	05-30-2001

1.7. Meteorological information

1.7.1. *Preflight information*

The crew of the aircraft had the following weather information available on the aircraft:

METAR LEST 061930Z 36005KT 9999 FEW035 SCT200 14/10 Q1022 NOSIG=

In other words, the scheduled weather report corresponding to Santiago airport at 19:30 h for the 6th of June indicated that there was a wind from the north of 5 kt intensity, a visibility of 10 km or more, few clouds at 3,500 ft, scattered clouds at 20,000 ft, a temperature of 14 °C, a dew point of 10 °C and the QNH was 1,022 hPa. No significant changes were expected in the following two hours.

TAF LEST 061700Z 061904 01005KT 9999 SCT030 PROB30 TEMPO 0204 2000 BR=

According to this forecast weather report for Santiago airport from the time interval beginning at 19 h of June 6th and ending at 04 h of June 7th it was expected with a 30% chance between 02 and 04 h a reduction of visibility down to 2,000 meters due to mist.

TAFL LEST 061700Z 070018 VRB3KT 9999 FEW015 SCT025 TEMPO 1118 34007KT CAVOK PROB30 TEMPO 0008 2000 BR=

Namely, the forecast weather report for Santiago airport from the time interval beginning at 00 h and ending at 18 h of June 7th it was expected with a 30% chance between 00 and 08 h a reduction of visibility down to 2,000 meters due to mist.

At the time of the accident there was a full moon with a bearing of 160° and a height over the horizon of 21°.

1.7.2. *Information given by Santiago Approach*

When they contacted Santiago Approach at 23:50:24, they were given the following weather information:

«Runway in use three five and the wind is calm the ceiling and visibility okay temperature ten dew point nine QNH one zero two two.»

1.7.3. *Weather conditions at Santiago Airport the day and time of the accident*

According to the information provided by Santiago Airport, the METAR was as follows:

At 23:30

LEST 062330Z 36001KTCAVOK 10/09 Q1022 NOSIG=

This scheduled weather report indicated a visibility of 10 km or more with no significant changes expected in the following two hours.

At 00:00

LEST 070000Z 36002KT CAVOK 10/10 Q 1021 NOSIG=

The scheduled weather report at 00:00 continued to indicate a visibility of 10 km or more with no significant changes expected in the following two hours.

At 00:30

LEST 070030Z 36001KT 0800 R35/P1500 R17/1200 BCFG VV001 10/10Q 1021 NOSIG=

At 00:30 the scheduled weather report indicated a visibility reduction down to 800 meters, a RVR for runway 35 of 1,500 meters and for runway 17 of 1,700 meters and observed fog patches. Vertical visibility was 100 ft. No significant changes were expected in the following two hours.

At 01:00

LEST 070100Z 36001KT 0800 R35/P1500 R17/1200 BCFG VV001 10/10Q 1021 NOSIG=

The 01:00 h scheduled weather report indicated the same horizontal visibility, RVR and vertical visibility values depicted on the 00:30. No significant changes were expected in the following two hours on this report as well.

1.7.4. *Climatology at Santiago Airport*

The INM broadcasts through the Internet information regarding Santiago's Airport climatology. When the accident occurred this information was not available on the Internet.

According to this data, in a climatology study which comprises from 1983 to 1992, visibility was as shown below:

VISIBILITY JUNE. SANTIAGO AIRPORT				
< 800 m	< 1,500 m	< 3,000 m	< 5,000 m	< 8,000 m
1.8%	3.3%	5.6%	14.6%	24.5%

The time frame which registered a larger amount of visibility reduction was that between 00:00 and 08:00 h.

This data shows the singularity of Santiago Airport, where reduced visibility occurs more often than in other airports.

1.8. Aids to navigation

According to published information and also shown on the NOTAMS for Santiago Airport, the status of navigation aids was as follows:

— The approach lights for runway 17 were out of service.
— The glide path for runway 17 was out of service.
— The left PAPI bar was out of service.
— The glide path for runway 35 was unusable below 1,600 ft.

This information was included on the NOTAMS which were in the crew's possession onboard the aircraft.

According to a report provided by Santiago Airport's radar and navigation aids maintenance department, the time frame from 23:00 h of 06-06-2001 till 01:00 h of 06-07-2001 there were no incidences or anomalies that could affect the proper functioning of the operational automation facilities, radar and radio aids other than those indicated on the NOTAMS.

1.9. Communications

During the last half hour of the flight, the aircraft maintained contact with Madrid ACC and Santiago APP.

Several fragments of the communications sustained by the aircraft with both facilities are disclosed in this report, revealing those aspects considered more relevant. Communications functioned without noticeable anomalies.

1.10. Aerodrome information

Santiago airport has one runway which is oriented 17/35, and a length of 3,200 meters. It has an elevation of 1,213 ft.

The day of the accident, works were being carried out in the airport and for that reason the glide path, the left PAPI bar and the approach lights for runway 17 were out of service.

1.11. Flight recorders

The flight data and voice recorders were found in good condition after the accident and were removed from the aircraft.

The flight data and voice recorders were transferred to the BEA facilities for reading. Information was extracted from the FDR (Flight Data Recorder) regarding the flight of the accident and it was processed transforming it into engineering units.

Also, a transcript was made of the conversations taped on the CVR (Cockpit Voice Recorder).

1.11.1. *Flight Data recorder*

The flight data recorder was of the following type:

Manufacturer:	L3 COMUNICATIONS
Model:	Fairchild Model F1000
P/N:	S703-1000-00
S/N:	02149

According to the information contained in the data recorder, the aircraft held an adequate descent rate, with an altitude slightly above the nominal descent path established for the ILS for runway 17 (3°), until the moment it entered the fog which increased until it impacted with the trees. Graph 1 of Appendix C shows the comparison of the descent slope followed by the aircraft versus the ideal path that should have been followed (3°).

In graph 2 of Appendix C it is shown the heading held by the aircraft, and the place where it intercepted and overshot the localizer.

Lastly, graph 3 shows the RPM values for both engines as well as the pitch angle. As one can observer, both engine RPM remain constant and the pitch angle values are negative until impact which becomes 0 at this time.

1.11.2. *Cockpit Voice Recorder*

The voice recorder recorded a total of 31 minutes and 31 seconds, which surpasses the minimum required time of 30 minutes. It was of type:

Manufacturer: Universal Avionics Systems Corporation
Model: Solid State Cockpit Voice Recorder CVR-30B
P/N: 1603-02-03
S/N: 674

On the transcription of the voice recorder, the crew never mentioned having the runway in sight.

The intention of executing a missed approach is neither mentioned.

1.12. Wreckage and impact information

The aircraft was flying at approximately 7 meters of altitude in level flight when it collided with the first trees. In that collision, the wings were torn and the fuel contained in them was spilled causing a fire that affected a 200 m^2 area.

One of the left propeller blades was found in an area before the area of first impact, which was probably caused by a rebound when it hit one of the trees.

The aircraft wreckage was symmetrically distributed with respect to the trajectory held by the main fuselage after the impact, which was the one it had previously. Firstly and on the burnt area with a length of 50 meters approximately, there were parts of the left wing, the left landing gear and left propeller. In that area parts of the right wing were also found.

56 meters from the first impact, the first ground mark appeared, and just beyond that, the left engine. 28 meters from the ground mark there was a furrow of about half a meter deep which must have been made by the right engine hitting the ground.

Following the trajectory of the aircraft, the right engine was found and beyond, the right landing gear. The right propeller was far apart from the trajectory held by the aircraft and turned aside to the right with deformations which indicated that it had power.

Some 140 meters from the first impact was the aircraft's fuselage, positioned perpendicular to the trajectory it had held, and leaned on the left side. The vertical stabilizer and rudder remained attached to the fuselage and showed no signs of being damaged, but the rudder was stuck.

The fuselage had no deformations of importance and one of the cockpit windows was broken, as it had been used by the crew to abandon the aircraft.

Appendix B shows a sketch of the aircraft wreckage distribution.

From the examination of the wreckage it could not be evidenced any malfunctioning of the aircraft.

1.13. Medical and pathological information

The aircraft lost energy as different parts were separated during tree impacts, which allowed the speed to be lowered at the time of ground contact.

The crew did not suffer any serious injury. The Captain had a head wound which he bandaged to stop the bleeding. It is possible that the wound occurred when the aircraft stopped, since it ended up leaning on the left side, where the Captain was.

1.14. Fire

With the first impacts with the trees the wings were torn and the spilled fuel caused a fire. The fuel spread out following the slope of the terrain burning a 200 square meter area of trees, grass and bush.

The aircraft's fuselage was found outside of the burnt area.

The fire, according to the information provided by the airport, was extinguished by the airport's firemen once they located the crew and the aircraft.

1.15. Survival aspects

The aircraft hit the trees at 00:13:02. At 00:13:46, Santiago APP tried to contact the aircraft but there was no answer. They continued to try and checked that it had not landed.

The crew managed to leave the aircraft breaking one of the cockpit windows with an axe.

At 00:25 the Control Tower contacted Madrid ACC to request information regarding the aircraft. At 00:32:30, the Control Tower received a phone call from the company in France, stating that the crew had contacted them and that they had had an accident, they also informed that the crew were not seriously injured.

At 00:37 Santiago APP called the SAR (Search and Rescue Service) to commence the search as soon as possible.

At 00:48 Santiago TWR received information from France of the location of the aircraft involved.

Santiago TWR notified the event to the Civil Guard at 00:51.

At 00:52 the copilot contacted Santiago TWR and notified the position of the aircraft and the physical conditions of the crew.

At 01:25 the crew was located and transferred to the Hospital Clínico de Galicia, where they were checked out and given first aid, being discharged from the hospital afterwards.

1.16. Tests and research

1.16.1. *Pilot's statement*

The Captain of the aircraft reported in his statement that there was no external pressure for the flight. The cargo loading and departure from Le Mans had been on schedule. He was in good physical condition and had rested the previous day.

Before departure he requested the Santiago weather information as well as the alternate airport, Porto. Weather at Santiago forecasted mist around four o'clock in the morning (local time).

The runway in use at Santiago was 35 and the weather was CAVOK with wind calm. The crew performed a briefing for runway 35, but in case of good visibility they had foreseen a visual approach to runway 17.

According to Santiago's NOTAM's the glide path for runway 17 was out of service and the one for runway 35 was unreliable below 1,600 ft. They were authorized to a fix they could not find, and when they asked for clarification they were told that it was the initial approach fix for runway 35.

They requested to proceed to the Santiago VOR and with the city, the facilities and the ground in sight, requested a visual approach for runway 17. They were cleared to land when they were 20 miles from the airport.

They aligned with the LOC and continued on visual. They had visual ground contact and did not check the descent since they were on VMC.

Suddenly they entered a patch of fog and had the impression of being at higher altitude. A power increase had been initiated at the moment they impacted the trees. They saw the trees with their lights.

They waited for the emergency services for 1 hour and 20 minutes.

The radio altimeter was set for 540 ft for the runway 35 approach. The Captain didn't hear the altitude alert before initiating the go around.

1.16.2. *Copilot's statement*

The copilot in his statement reported that the mission had begun on the midday of June 6th. He was rested and had not worked the previous evening.

They departed Pontoise at 20 hours and 20 minutes and arrived to Le Mans at 20:50. The merchandise arrived at 21:45. The copilot secured the cargo himself.

According to his estimate, they departed at 22:10. It was a normal flight. Before initiating the descent in contact with Madrid, he called Santiago for weather information. The answer was: runway 35, CAVOK, wind calm, QNH. They performed the before descent checks and prepared the chart for the runway 35 approach. He requested descent to Madrid ACC and contacted Santiago approach.

Santiago APP (approach) instructed them to report at the 18 DME fix. They did not understand and the Controller repeated the 18 DME fix. Examining the approach chart, they identified the 18 DME fix as the IAF for the runway 35 ILS approach. Considering the weather conditions, the reporting point, and the operational aspect, the crew requested a visual approach for runway 17.

The PF told him to request opening up 20° to the right to intercept the LOC 17. They were cleared to do so.

They notified visual contact with the ground and received the clearance to land (which was the last communication with ATC (Air Traffic Control)).

Both pilot and copilot tuned the LOC 17 frequency. The PF overshot the LOC intercepting it afterwards. With the runway in sight, they performed the approach checks and actions.

During the preflight planning, the Santiago's NOTAM's indicated the ILS 17 glide path out of service, one side of the 17 PAPI was out of service. The before landing actions were performed: flaps for the approach, landing gear down, low pitch.

They entered the clouds before performing the final checklist. They were in IMC. According to the pilot state, the surprise effect that they suffered when they went into the fog patch had a counter part on the reaction time, as they thought that it was a thin layer and that they would immediately come out. The PF decided to go around during which they collided with the trees.

The copilot stated that he was aware of the altitude alerts each time they were reaching the selected altitude, but confessed that it is common practice to not pay much attention to them. A few seconds before impact he heard warnings but could not identify which.

They found the cockpit lying on its left side. They came out the right window after breaking it with an axe. The emergency exits were inaccessible due to the cargo that was blocking them.

They called the company by means of a cell phone.

They called the Control Tower and informed what had happened, mentioning that they had encountered a patch of fog during the approach. The Tower confirmed that they could also see the clouds from there. They were located by Handling personnel belonging to a company that operates at Santiago airport, who then joined the rescue efforts.

According to their estimate they must have been low, lower than the airport and on the runway axis.

Since it was a visual approach they did not take into account the minimums, and ground separation was maintained visually.

1.17. Organizational and management information

The AEROPE company had an Air Operator Certificate for A1 type of operation (Passengers), issued on January 31st of 2001. It was in possession of the aircraft that had the accident and a Beech 90B with which they performed public transport on demand.

During the investigation several parts of the Operations Manual («Manual d'Exploitation») which was onboard the aircraft, was inspected. This document stated that it had been updated on April 24th of 2001, a few months before the accident. How ever, several contradictions were found in its content. For example, it appeared that AEROPE aircraft needed not any ground proximity alert systems or altitude alert systems, not giving any procedures for their usage.

This part of the manual would not be compliant with the JAR OPS 1.660 and 1.665 for aircraft with a mass of more than 5,700 kg after January the 1st of 1999 and, in fact, the aircraft F-GOAE was equipped with a GPWS, a radio altimeter and an altitude alert, although no company procedure was found onboard regarding their usage.

Other indications on the manual relevant to the accident were:

— The Captain had the obligation to examine NOTAM's applicable to his flight.
— The Operator had an accident prevention program established.
— Minimum flight altitudes were established.
— The minimum altitude for VFR flights is established as 500 ft above ground.
— The Beechcraft 350 aircraft falls into the category of aircraft «B» according to the ICAO's 8168 Doc.

— It is determined that an approach may only be continued until landing if the required visual references are acquired and maintained.
— The minimums established for visual approaches were: MDH (Minimum descent Height) of 500 ft, minimum visibility of 1,600 meters.
— A specific missed approach procedure for VFR flights is established, which will be the same as the corresponding instrument approach. It is stated that since visual flights can be done from several directions, several patterns will be necessary to position the aircraft on the described trajectory for the missed approach, depending on the location at the moment of loosing visual references.
— It is specified that the final descent will not be initiated before identifying the runway threshold, and not before the aircraft is in conditions to continue the descent at a normal rate to land in the touchdown area, and the minimum RVR (Runway Visual Range) for a visual approach is 800 meters. This requirement has the intention of preventing the loss of visual references during the final flare on a visual approach in case of mist. It is warned that crew members must be aware of the risk of disorientation during a descent through a fog patch.
— It is established that for visual approaches it must be stabilized by 500 ft above ground level.
— Santiago Airport was not categorized as B according to JAR-OPS 1.975 and AMC OPS 1.975. So there was no specific briefing for this airport.
— There was a training program for Captains and copilots which included a detailed syllabus of Cockpit Resource Management (CRM).

1.18. Problems related to the runway approach lights

As found in the ICAO's aerodrome design Manual Doc 9157-AM/901 – Part 4 – Visual Aids, un paragraph 1.2.3.17.

> «When descending towards a fog covered ground surface, in thin layers, it can be dangerous since the light beams of the approach lighting systems and runway lighting, which is visible through the fog during the approach, diminish rapidly or completely disappears when the aircraft approaches or penetrates the top part of the fog layer. In ground fog conditions, luminous references are not visible at low altitude and pilots flying strictly on visual references, from the moment the visual references are visible and the time when they are not able to view them, they can perceive a false impression that the aircraft is climbing instead of descending. If one reacts to the sensation that the aircraft is climbing, there is an increase in vertical speed of descent at low altitude without the aid of visual references, or at most with the help of limited visual references, this will cause the aircraft to crash against the ground or the runway at a high vertical speed of descent.»

2. ANALYSIS

2.1. Flight analysis

The crew requested Santiago Approach/Control Tower information regarding weather conditions and the runway in use, before Madrid Control authorized them to change frequency. This allowed them to previously know the runway in use and the existing conditions in order to perform an adequate planning.

During the approach briefing the crew reviewed the field conditions and the in force NOTAM's, although they did not comment that the runway 17 had the approach lights inoperative. In the statements given after the accident both of them forgot to mention that the approach lights for runway 17 were out of service. If one assumes that the crew did not take into account that the approach lights were not functioning and that they had the field in sight, it is possible that they thought, when they entered the fog, that they were higher than they really were. This added to the fact that they ignored the altitude alerts, it is most probable that they did not have a clear idea of their vertical position regarding the ground.

The absence of approach lights, in addition to left wing bar of the PAPI and the glide path of the ILS 17 being out of service, made a night visual approach to that runway very difficult.

The crew studied the approach for runway 35, but did not dismiss the idea of a visual approach to 17 if the weather conditions permitted it, since before beginning the descent they were in visual contact with the ground. The crew had not carried out a visual approach briefing.

Madrid ATC cleared them to descend to FL250 and transferred them to Santiago who cleared them immediately to descend to FL100. The rate of descent was 2,000 ft/min which is reasonable for the distance at which descent was initiated and it may be considered normal.

When Santiago Approach cleared them to the 18 DME fix, the crew did not understand the instructions and asked for them to be repeated. It is possible that the crew thought that they would be cleared to the VOR to perform a standard approach for runway 35.

Afterwards, the Captain told the copilot to communicate their wish to Control, to proceed to the VOR to, in case it was possible, complete a visual approach to runway 17. This request corresponded to the desire of shortening the maneuver considering the good weather conditions existing since, according to the pilots statement, there were no external pressures.

However, this decision is not consistent with the comment made after performing the briefing for runway 35, where he expresses that an approach for runway 17 may be difficult.

ATC asked them if they requested 17 and finally instructed them to keep present heading (236°) and to report the field in sight.

At that time, the Captain asked the copilot information about the minimum sector altitude, and both agreed that it was 4,800 ft. The Captain explained to the copilot that they had to be aligned with the runway 17 axis 10 miles out at 3,500 ft altitude. The Captain stressed on this comment insisting on the fact that the approach had no glide path and that the runway heading was 171°. No more was said about the approach to runway 17 and it probable that the copilot did not have a clear idea of the maneuver that they were going to perform. They also did not mention that runway 17 did not have the approach lights operational.

When they were at 11,000 ft they had 1,500 ft/min descent rate. 14 miles from the field, at 00:08:22, the aircraft was on the correct descent path to make a safe landing.

Afterwards the Captain told the copilot to request to Control to divert to the north for better alignment with the LOC 17. The copilot requested to turn 20° right, without being instructed by the Captain exactly how much the deviation should be. The Captain performed the maneuver without questioning that this would make them intercept the localizer signal much closer. This made them intercept the localizer signal with a heading almost perpendicular to the runway, approximately 6 miles out instead of 10 nautical miles as would have happened if the had turned 60° (see Appendix D).

This confirms that the copilot did not have a clear idea of the maneuver they were performing.

From this moment on, when they intercepted the LOC closer to the threshold than the PF had foreseen, the glide path from that point would have to be greater than 3° steep, which would impede the approach to be with a constant descent rate and of 1,000 ft/min or less.

The PF concentrated in not descending below 4,800 ft, since it was the minimum sector altitude. They contacted ATC which cleared them to land runway 17 with visual contact. The copilot's answer was not assertive and seemed to indicate that he had doubts regarding their capability of remaining visually contact with the ground.

The Captain followed the ILS approach profile, see Appendix E, and told the copilot that at 5.9 miles they should continue descending down to 3,100 ft.

At 00:11:55 they crossed the localizer with a south heading and the altitude alert sounded simultaneously, which was ignored. Shortly before they had lowered the landing gear and disengaged the auto pilot. Therefore the cockpit workload was high.

Until that moment the crew had not mentioned having the runway in sight, nor told ATC, so it seems probable that they had not located Santiago airport's runway.

At about 00:12:01 they encountered a fog patch. The crew did not react to this event, maybe due to the surprise factor and that they concentrated in capturing the localizer. It is possible that they had the belief that it was a thin layer of fog and that they would immediately come out and that prevented a timely reaction.

Afterwards they intercepted once again the localizer with a 165° heading and the altitude alert sounded off. The crew did not hear/respond to this altitude alert.

From this moment the rate of descent started to increase and was held between 2,000 and 3,000 ft/min.

This rate of descent could have been caused by the sensation of climbing when entering fog, solely on visual cues. The crew, as reflected in their statement, did not pay attention to the altitude minimums due to the fact that until this moment they were maintaining visual separation with the ground.

The high workload in the cockpit at the time they entered the fog could have also contributed to the increase in the descent rate, since the autopilot had been disconnected 22 seconds before and the landing gear had been extended 10 seconds before. Therefore the aircraft was not trimmed when they entered the fog, and without visual references the pilot was not able to establish a correct glide path.

When the copilot reported 2.5 DME, the aircraft was at 1,242 ft, 800 ft below the ideal glide path and with a rate of descent of 1,200 ft/min. Besides, the aircraft was not aligned with the runway axis therefore the stabilized approach criteria were not met for the approach.

At 1,208 ft the altitude alert was again heard and was ignored by the crew. Four seconds later the GPWS warning was heard without any response from the crew, since they did not recognize the GPWS warning.

Four seconds after the GPWS warning they impacted the trees. They were 946 ft of altitude, much below the field elevation which was 1213 ft.

Although in the pilot's statement it is said that the intention of going around had existed, according to the FDR there was no increase in power and the rate of descent remained unchanged. The pitch angle of the aircraft increased from –6° to 0°, probably due to the fact that the PF saw the trees with the help of the landing lights, or reacted to the GPWS warnings.

In these conditions, the proper crew action, when they entered the fog, would have been to execute a missed approach.

A lack of knowledge and training regarding the altitude alert system and the GPWS is observed, since the crew did not recognize or adequately respond to the alerts. Likewise, the crew did not initiate a go around when the entered the fog, which could mean:

— Lack of training in these types of maneuver (visual missed approaches) and
— Mental confusion due to the unexpectedness of the situation and not having prepared the missed approach procedure.

2.2. Analysis of crew resource management

During the initial phase of the approach, both pilots worked together in a coordinated and cooperative manner, discussing openly the maneuver they were planning to perform. The copilot discussed openly those aspects which were not clear to him and completed the information given by the Captain. It is noticed a high level of participation by the copilot in the Captain's tactical decisions, and an intent to monitor his actions.

From the moment ATC clears them to the 18DME fix, cockpit coordination starts to fail.

Firstly, when the Captain decides to make a visual approach to runway 17, in spite of having previously said that it was somewhat difficult, and tells the copilot to request it without any further explanation, the existing cooperation is fractured.

Afterwards the PF seems to be following the ILS/DME profile for runway 17, but no briefing is made. The only instruction given to the PNF, and insists on it afterwards, is that they had to be aligned and at 3,500 ft by 10 miles out. No eventuality was planned, and the possibility of the need for a missed approach is not considered.

The PNF seemed to not have a clear idea of the approach, and when the PF asks him for a right hand turn to proceed to the 10 mile fix, he requested 20° without waiting for any explanation. Therefore a lack of coordination is detected with each crew member working independently.

When the aircraft entered the patch of fog, the crew froze. They probably thought that it was a thin layer and did not react adequately which would be to perform a missed approach. If this possibility had been discussed in the approach briefing, the crew would have been prepared to make an immediate go around decision.

Another factor to take into account is that there is no defined task sharing in the cockpit and both PF and PNF, limit themselves to finding exterior references from the moment they entered the fog, without checking the instruments or reacting to the altitude alerts.

On the other hand, and even though it seemed that he did not completely understood the maneuver that the aircraft was performing, the PNF never questioned the actions of the PF, until the last moment where he tells him to climb, probably because he saw the trees.

2.3. Analysis of the weather information available to the crew

The crew had available the information which had been issued at 19:30, 4 hours and 30 minutes before the accident. In the TAFOR which included a forecast from 19:00 to 04:00 there was indication of the possibility of fog patches from 02:00 for which the crew must have thought that it did not affect them.

In the TAFOR which included the forecast from 00:00 to 18:00 there was indication of possible fog patches starting at 00:00 until 8:00 of June the 7th. But the crew did not take it into consideration probably because the forecast was for a time interval practically after the scheduled conclusion of the flight.

Furthermore, the information provided by the Tower indicated CAVOK, so it would seem that the fog patch they found must have been solitary and isolated and outside of the airport. In any case, one must consider that the information contained in METAR reports, refer to existing aerodrome conditions, which is where the measuring equipments are located, and TAFOR are aerodrome forecast.

The crew paid no special attention to the fact that the temperature had been dropping from 14° at 19:30 to 10° at 00:00 and that it had come closer to the dew point therefore having a high relative humidity, which in conjunction with the existing high pressure, could lead to fog. Furthermore, when the Control Tower gave them the new QNH, at 00:06:40, the Control Tower said nothing regarding the fact that the temperature was 10° and that the dew point had risen to 10° causing a relative humidity of 100% at that moment.

In the METAR reports up to 00:00 there is a NOSIG at the end of each one, which indicates that no significant changes in weather parameter are expected in the following two hours of the observation, however the 00:30 METAR indicates a visibility of 800 meters and includes patches of fog. The NOSIG at the end of the METAR does not warn the Control Tower of possible visibility problems that should be passed on to the pilots. Therefore, the quality of the meteorological report of 00:00 h should be questioned.

Another important consideration is the existing climatology for Santiago airport, where a visibility reduction at night is frequent even during the month of June.

The crew had only flown to Santiago on two previous occasions; therefore they were not completely familiar with the airport. Also, it has not been possible to determine whether they were given specific information regarding the airport's climatology.

2.4. Analysis of the emergency service's actions

The emergency services were activated once there was certainty that the accident had occurred, at 00:37, 25 minutes after the accident. There were previous attempts to locate the aircraft using several communications and checks were performed to guarantee that the aircraft had not landed.

The crew was located at 1:25, 1 hour and 12 minutes after the accident. This delay in locating the scene of the accident was due to the bad visibility existing in the area, which, in spite of the fire, making the location the aircraft involved in the accident more difficult.

3. CONCLUSIONS

3.1. Findings

— The crew was qualified for the flight and was in the possession of a valid license and ratings.
— The crew had no symptoms of fatigue or external pressure.
— The established Maintenance Plan had been applied to the aircraft and it had a valid Airworthiness Certificate in force.
— No aircraft malfunction was detected in the post inspection.
— The crew did not state that there were any technical problems with the aircraft.
— The company policy regarding the performance of visual flights was adequately defined and the safety measures were correct.
— The weather information in possession of the crew indicated VMC conditions (Visual Meteorological Conditions).
— The crew decided to perform a visual approach to runway 17.
— The approach lights, the left PAPI bar and the glide path for runway 17 was out of service, fact that the crew should have known beforehand through the NOTAM's but did not mention in their later statement.
— The crew did not perform an extensive briefing of the runway 17 procedure.
— The crew decided to use the LOC 17 as an aid for the approach.
— When they were trying to intercept the localizer they entered a fog patch.
— When they entered the fog, the crew did not react, they maintained the same flight attitude and no go around procedure was initiated.
— Until the time of impact, the crew had control over the aircraft, in other words, it was a controlled flight.

3.2. Causes

The probable cause was the decision to start a visual approach without having the runway in sight and the continuance of the visual approach in spite of the loss of external visual references, as they unexpectedly entered a fog patch.

Contributing Factors

As contributing factors to the accident, the following are considered:

— Lack of coordination amongst the crew which resulted in poor cockpit workload distribution, neglecting altitude alerts and instrument references once in the fog.
— Lack of planning and preparation of the approach which caused the PNF to not completely know the procedure they were going to perform resulting in an ineffective decision making when the aircraft entered the fog.

— Lack of response to the GPWS alerts due to inexistent procedures and lack of knowledge and training.
— The aircraft encountered the fog patch when the workload was highest. The autopilot had been disconnected, they were attempting to intercept the LOC 17, the landing gear was extended and the aircraft was not trimmed.
— The mental predisposition of both crewmembers to complete a visual approach, even before starting the descent to Santiago, since the weather information that they had got indicated VMC conditions and did not warn against possible visibility problems.

4. SAFETY RECOMMENDATIONS

4.1. Operational inspections

During the investigation it has been proven that the company's operations manual had information deficiencies and contained diverse contradictions, and that the crew neither followed some of the guidelines stated nor other widely accepted practices for IFR and VFR approaches in commercial air transport. Since the operator company dissolved after the accident, it is considered that the best way to spread out the safety lessons extracted from this accident is that the French DGAC takes them into account in their operational inspection duties. For which:

REC 16/06. It is recommended to the French DGAC in operational inspections to similar companies similar to AEROPE to specifically check:

a) Clear operational guidelines are given out to the crews that, in the absence of other limiting factors, and especially in night flights, force the crews to always use approaches which offer the most amount of navigational aids of the arriving airport.
b) That they have procedures in the use of GPWS and provide adequate training in this matter to the flight crews to guarantee an immediate response to the associated warnings.
c) That they have procedures and provide adequate training to flight crews to ensure that approach briefings, be them IFR or VFR, contain all information regarding the procedure to be carried out, criteria to decide and the way to perform a missed approach procedure, and the correct cockpit workload distribution for the execution, especially during to transfer from instrument flight to visual and vice versa.

In particular, clear guidelines should be given out and training to perform an immediate go around in VFR approaches in case of the appearance of unforeseen visibility or weather conditions, guaranteeing that the work load management onboard permits both scan of the instruments and the search for exterior references so as to maintain an adequate aircraft situational awareness.

4.2. Meteorological information

From the meteorological information analysis it is noticed that:

1. In the forecasts included in the METAR (TREND) at 22:30, 23:00, 23:30 and 24:00 h it is not provided the variation in visibility which were produced between 00:00 and 2:00 h.

2. In the TAF released at 17:00 h which included the forecast period between 19:00 and 04:00 h it was forecasted, with a probability of 30%, between 02:00 and 04:00 h, a visibility reduction down to 2000 meters and mist, not providing the variations which were produced between 00:00 and 02:00 h.
3. In the TAF released at 17:00 h which included a forecasts period between 00:00 and 18:00 h on 7 June it was expected, with a probability of 30%, between 00:00 and 08:00 h, a visibility reduction down to 2000 meters and mist, considering visibility variations between 00:00 and 2:00 h.

From the aforementioned, it is deduced a lack of coherence in the forecasts made: TREND, TAF between 00:00 and 02:00 h, period when the accident took place.

Along these lines, the Aircraft Accidents Investigation Commission released a recommendation REC 21/2004 included in the accident report A-50/1997, approved during the Board meeting of May 2004, addressed to the National Meteorological Institute (INM), which says in its section b):

> b) Assure the necessary coherence among different meteorological forecasts for aviation which were referred to the same period of time, place and area.

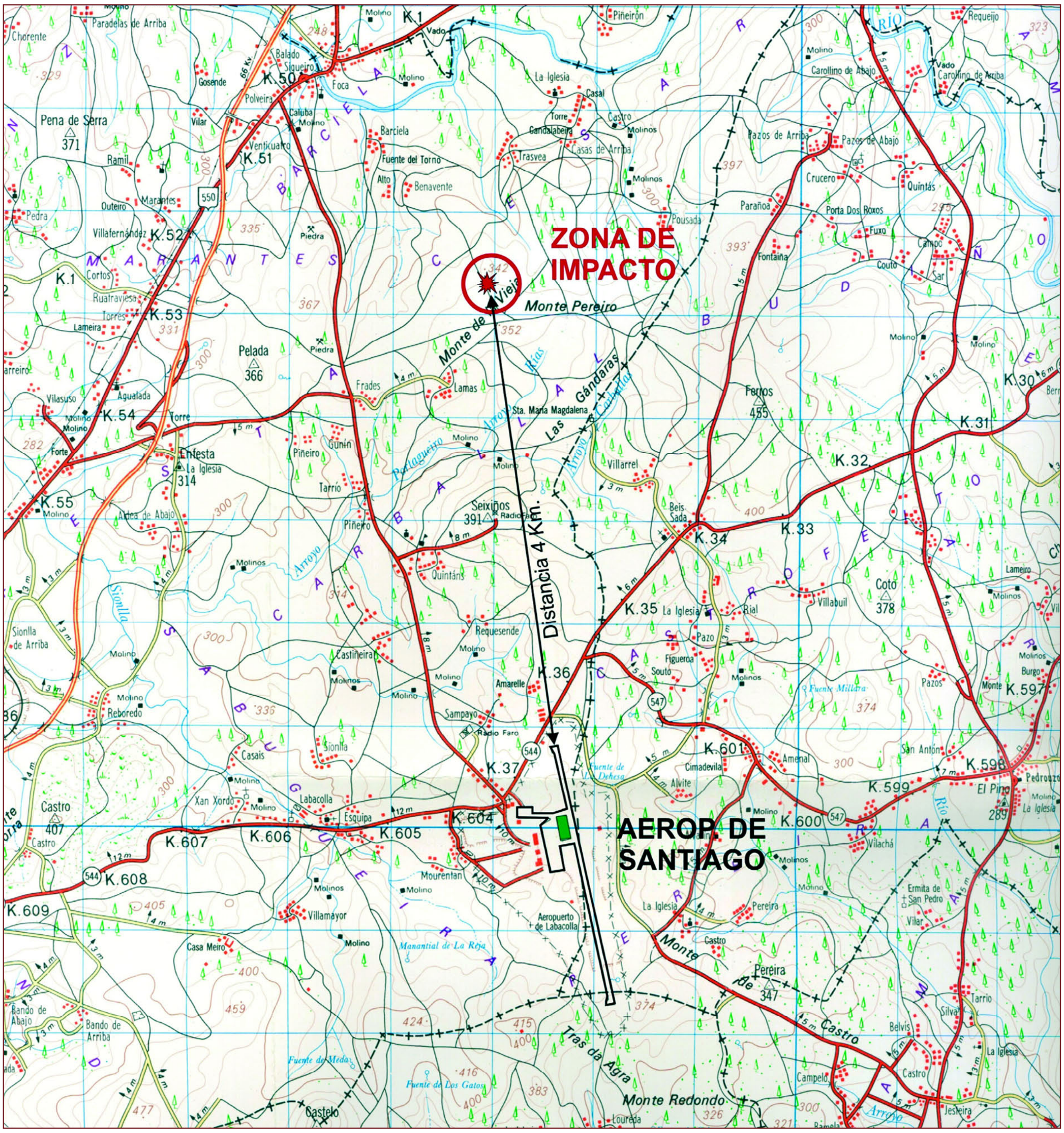
So far it has not been received any information about the actions that INM has undertaken or intend to undertake to correct the deficiencies detected in relation to the lack of coherence among different forecasts.

Therefore, in the light of the investigation conclusions,

REC 17/06. It is reiterated to the INM the need to accomplish REC 21/04 section b).

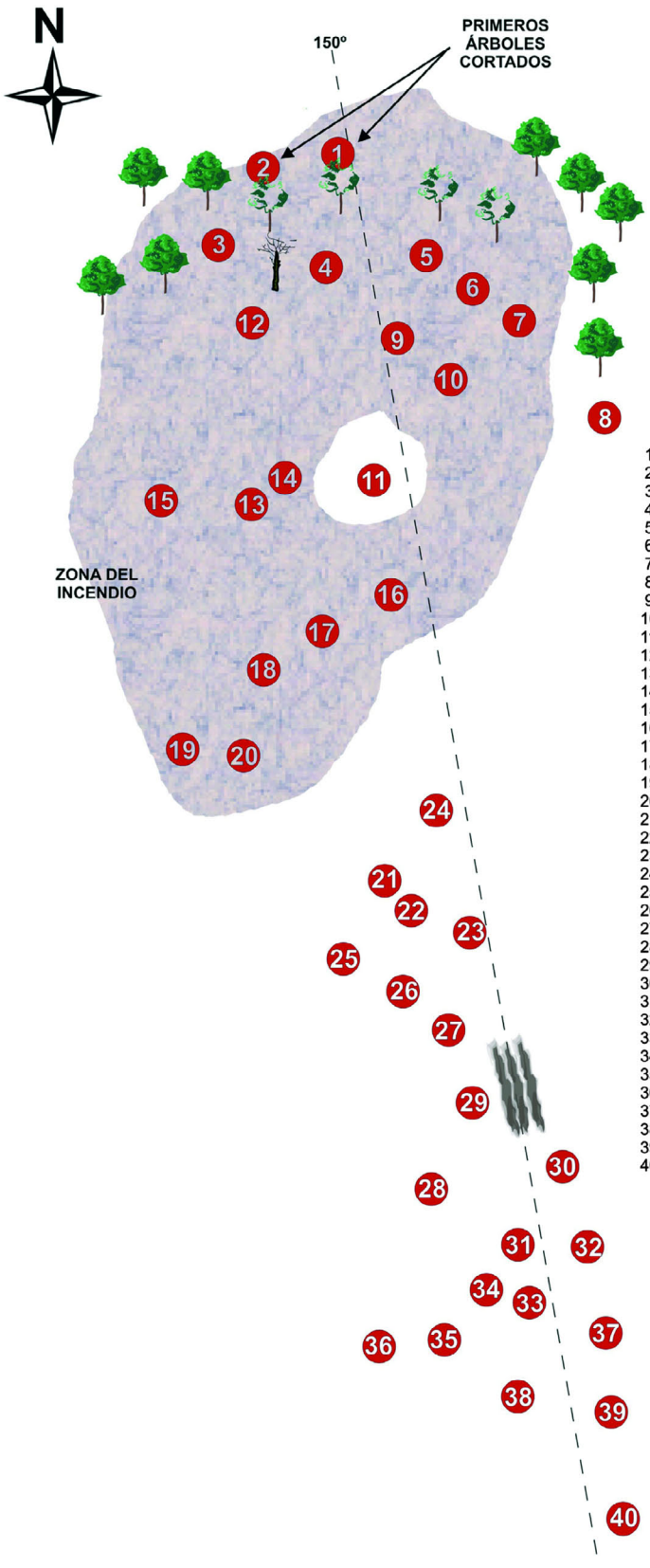
APPENDICES

APPENDIX A
Point of impact of the aircraft



ZONA DE
IMPACTO
Distancia 4 Km.
AEROP. DE
SANTIAGO
Monte Pereiro
Monte de Vieja
Las Gándaras
Aeropuerto de Labacolla
Monte Redondo
Tras da Agra
Monte de Castro
Pena de Serra
Pelada
Seixinos
Entesta
Sampayo
Labacolla
Villamayor
Casa Meiro
Castro
Coto
Fontaiña
Pazos de Abajo
Pazos de Arriba
K.50
K.51
K.52
K.53
K.54
K.55
K.30
K.31
K.32
K.33
K.34
K.35
K.36
K.37
K.597
K.598
K.599
K.600
K.601
K.604
K.605
K.606
K.607
K.608
K.609

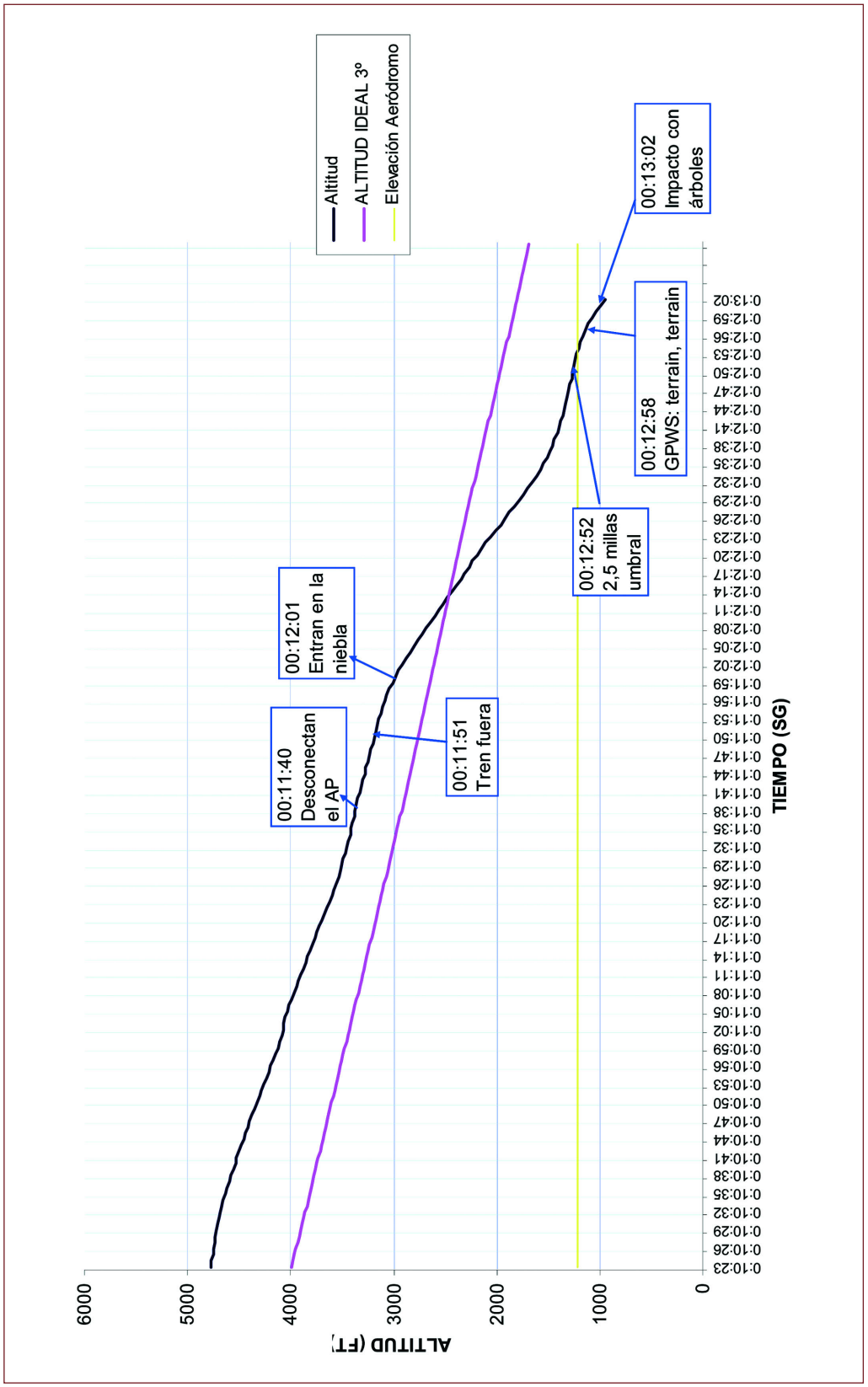
APPENDIX B
Wreckage distribution



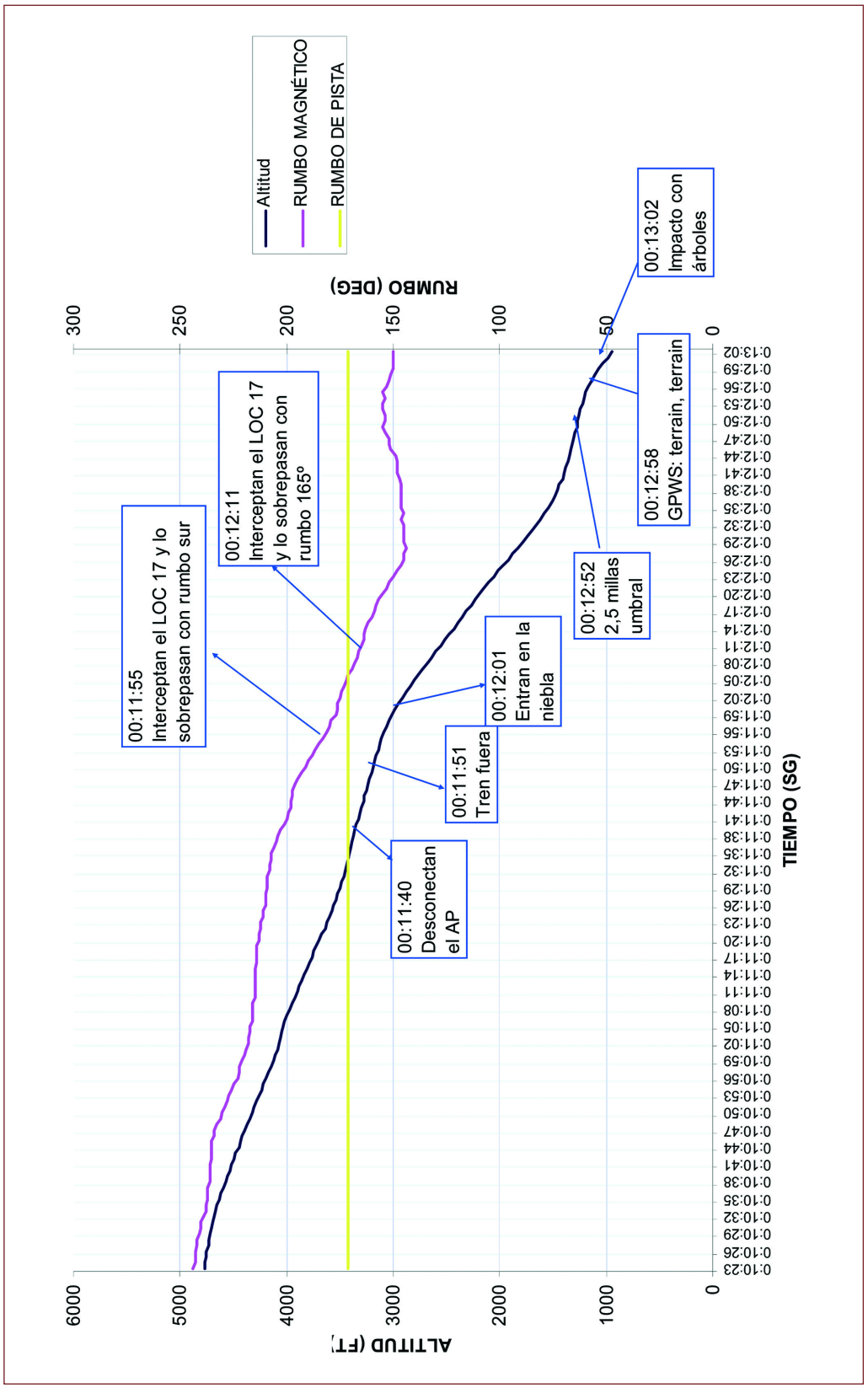
LEYENDA

1- CARENADO MOTOR COLGADO DE ÁRBOL
2- CABLE DE MANDO (ALERÓN) COLGADO DE ÁRBOL
3- PLANO DERECHO, SIN WING-TIP
4- ESTABILIZADOR HORIZONTAL
5- CAPÓ MOTOR IZQUIERDO
6- ALERÓN
7- FLAP (½ m)
8- WING-TIP IZQUIERDO (SIN QUEMAR)
9- TREN IZQUIERDO
10- PLANO IZQUIERDO
11- PIEZA NO QUEMADA
12- ESTABILIZADOR HORIZONTAL
13- CARENADO MOTOR
14- PUERTA TREN
15- PLANO IZQUIERDO CON COMPENSADOR
16- TROZO PLANO DERECHO/FLAP
17- CARENADO
18- WING-TIP DERECHO QUEMADO
19- HÉLICE IZQUIERDA (FALTA UNA PALA)
20- FLAP
21- MOTOR IZQUIERDO
22- TRONCO QUEMADO ARRASTRADO
23- SUJECIÓN HÉLICE
24- HUELLA Nº 1 (AVIÓN SUELO)
25- TROZO PUNTA PALA
26- TROZO ANTENA
27- TROZO PLANO
28- HÉLICE DERECHA
29- HUELLA FUSELAJE Y MOTOR DERECHO
30- RUEDA DE MORRO (22 x 6,75)
31- HUELLA DEL MOTOR DERECHO
32- DEPOSITO DE GOMA
33- CAPÓ MOTOR DERECHO
34- RADIADOR DE MOTOR
35- MOTOR DERECHO
36- BATERÍA
37- LARGUERO
38- COMPUERTA DEL TREN
39- TREN DERECHO
40- FUSELAJE

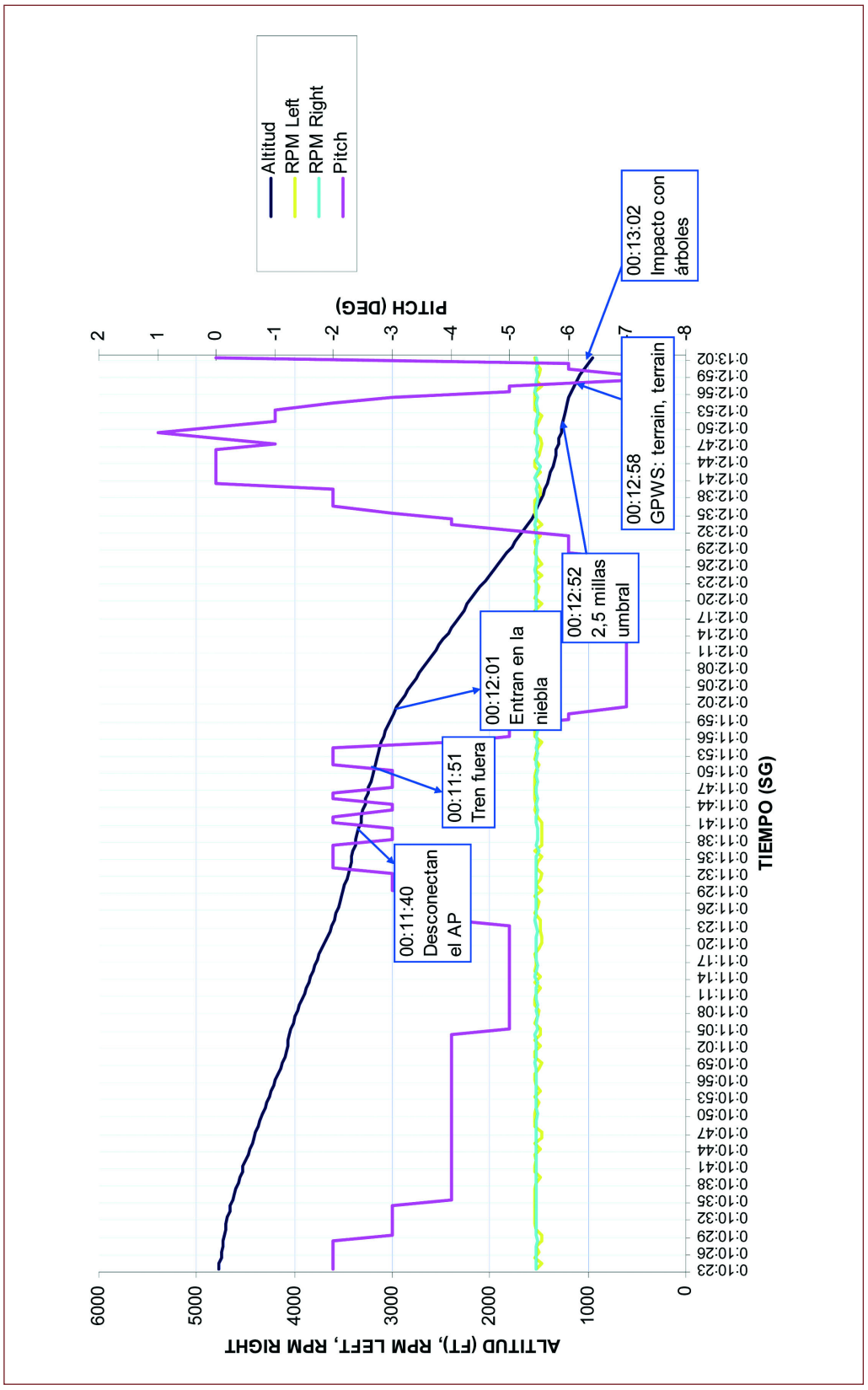
APPENDIX C
Flight data recorder information



Graph 1. *Actual versus nominal glide slope*

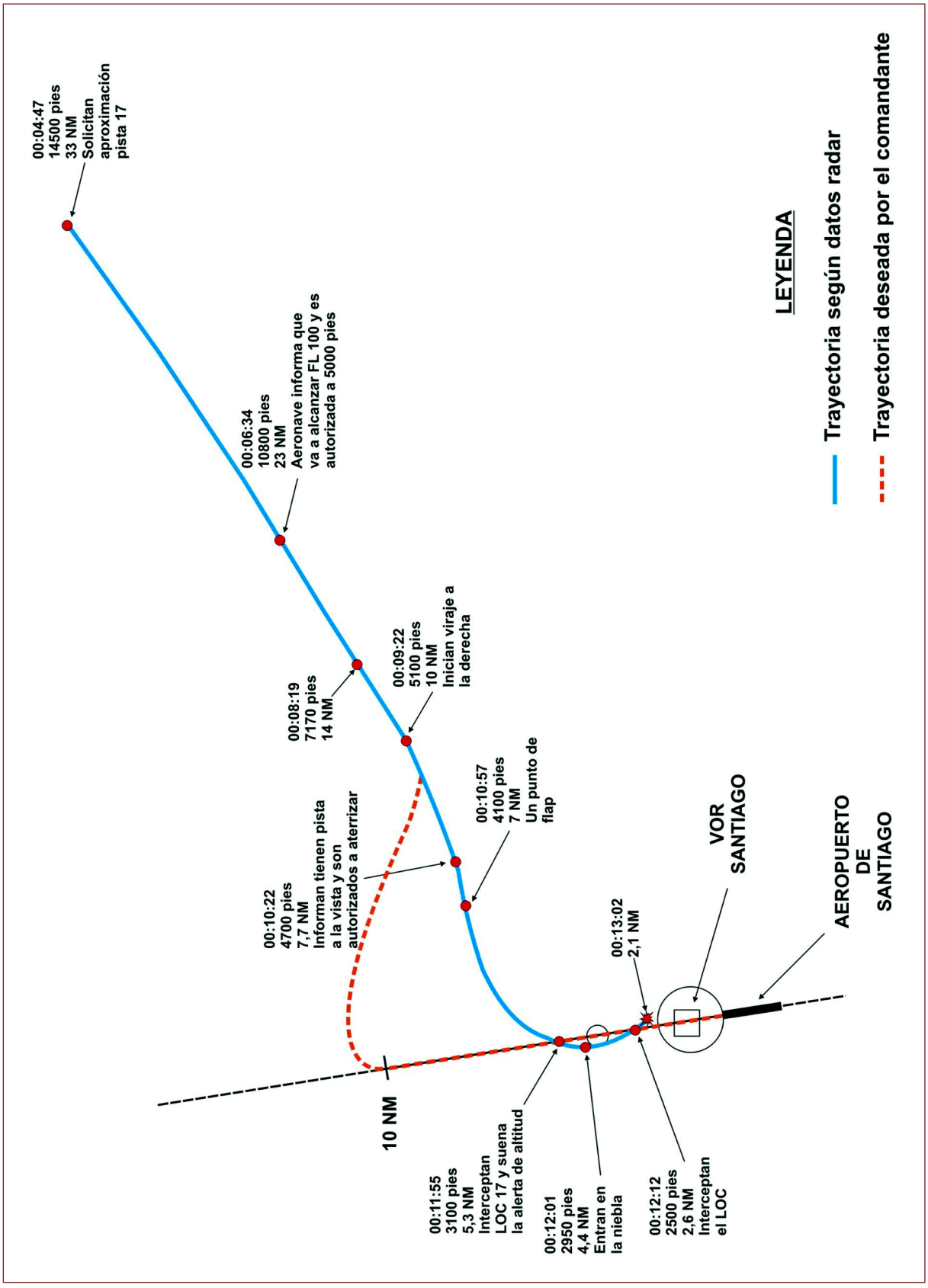


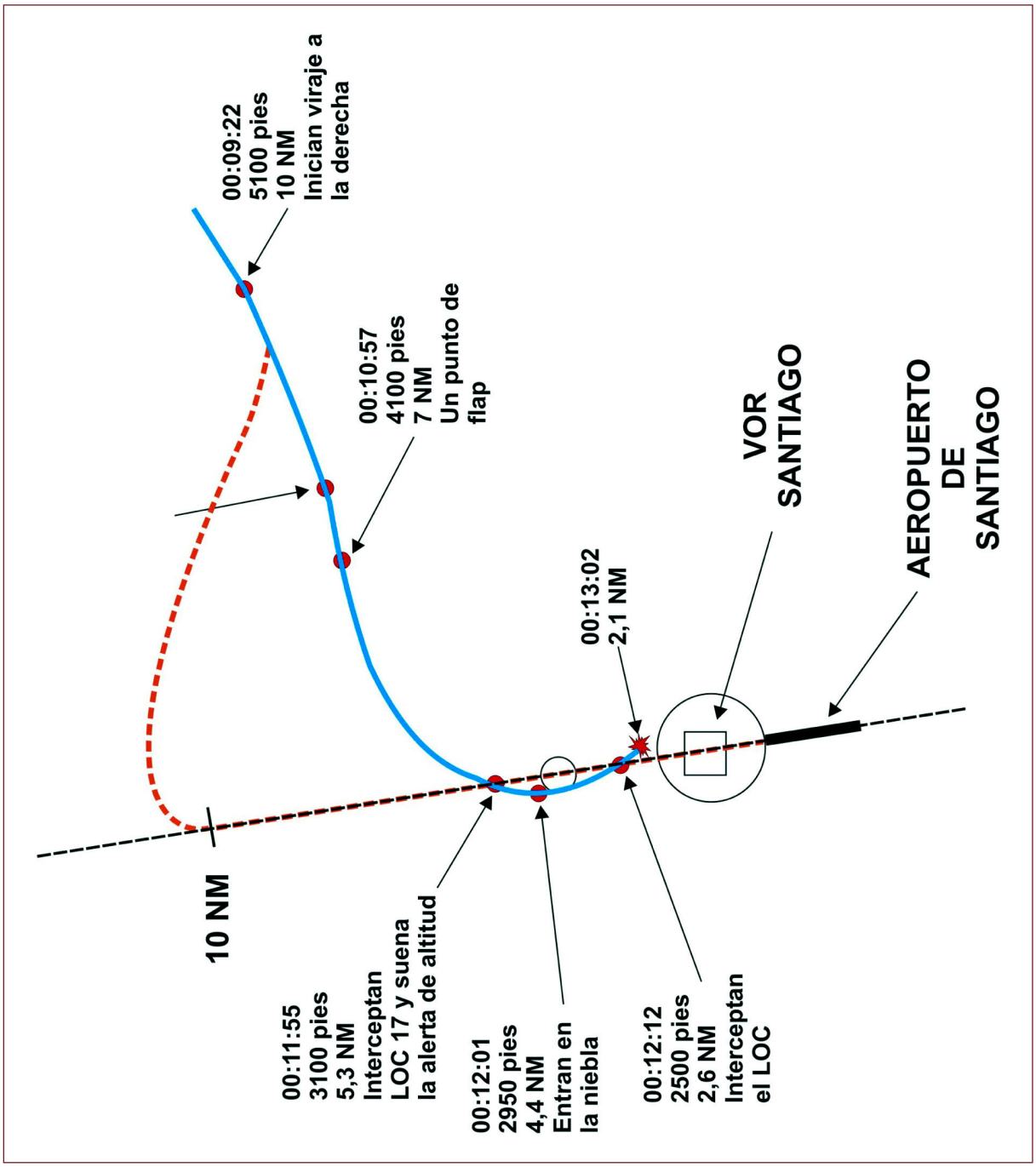
Graph 2. *Aircraft's heading*



Graph 3. *Pitch and engine parameters*

APPENDIX D
Truel path versus ideal path


LEYENDA
Trayectoria según datos radar
Trayectoria deseada por el comandante
AEROPUERTO DE SANTIAGO
VOR SANTIAGO
10 NM
00:04:47
14500 pies
33 NM
Solicitan aproximación pista 17
00:06:34
10800 pies
23 NM
Aeronave informa que va a alcanzar FL 100 y es autorizada a 5000 pies
00:08:19
7170 pies
14 NM
00:09:22
5100 pies
10 NM
Inician viraje a la derecha
00:10:22
4700 pies
7,7 NM
Informan tienen pista a la vista y son autorizados a aterrizar
00:10:57
4100 pies
7 NM
Un punto de flap
00:11:55
3100 pies
5,3 NM
Interceptan LOC 17 y suena la alerta de altitud
00:12:01
2950 pies
4,4 NM
Entran en la niebla
00:12:12
2500 pies
2,6 NM
Interceptan el LOC
00:13:02
2,1 NM


00:09:22
5100 pies
10 NM
Inician viraje a
la derecha
00:10:57
4100 pies
7 NM
Un punto de
flap
00:13:02
2,1 NM
VOR
SANTIAGO
AEROPUERTO
DE
SANTIAGO
10 NM
00:11:55
3100 pies
5,3 NM
Interceptan
LOC 17 y suena
la alerta de altitud
00:12:01
2950 pies
4,4 NM
Entran en
la niebla
00:12:12
2500 pies
2,6 NM
Interceptan
el LOC

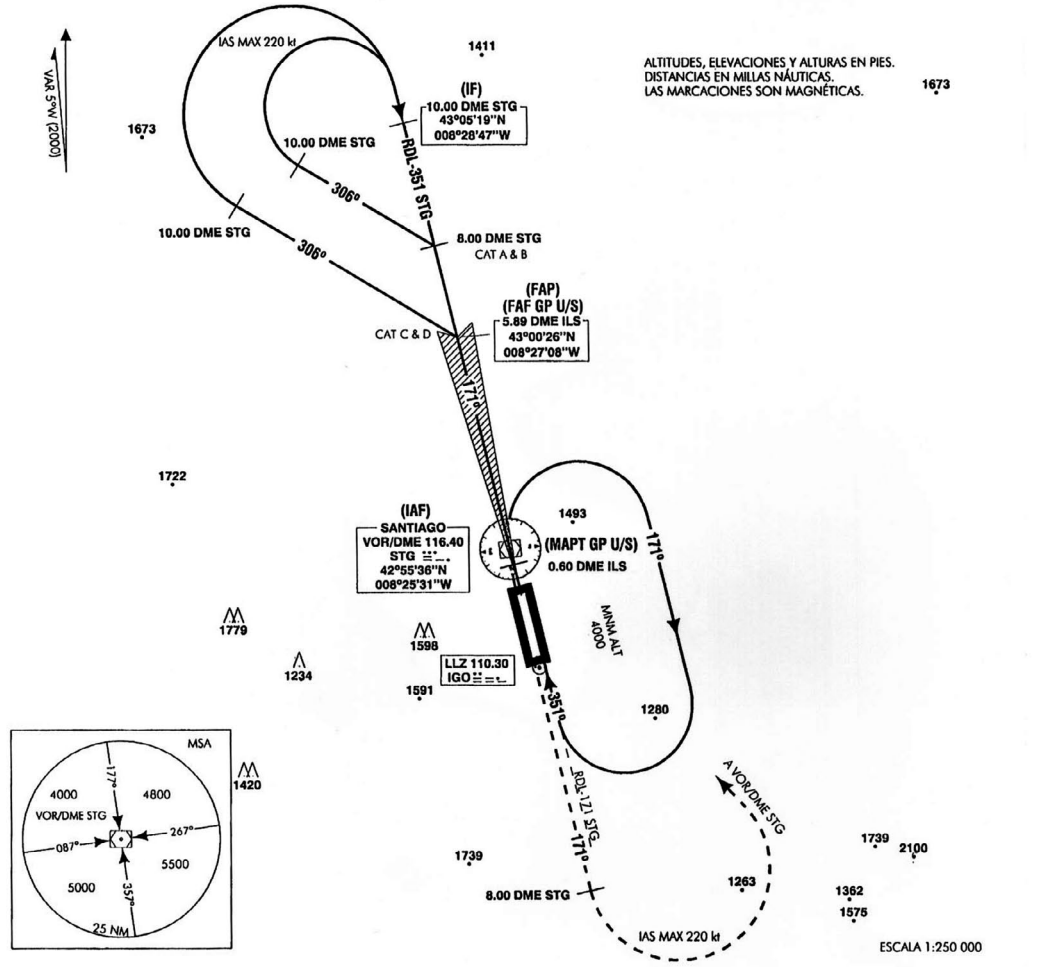
APPENDIX E
VOR/DME ILS/DME 17 approach chart

CARTA DE APROXIMACIÓN
POR INSTRUMENTOS-OACI

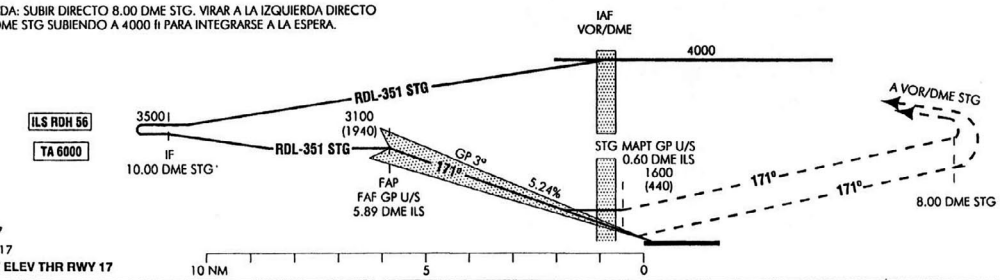
ELEV AD
1213

APP 120.20
TWR 118.75
GMC 121.70

SANTIAGO
VOR/DME-ILS/DME
RWY 17



FRUSTRADA: SUBIR DIRECTO 8.00 DME STG. VIRAR A LA IZQUIERDA DIRECTO A VOR/DME STG SUBIENDO A 4000 ft PARA INTEGRARSE A LA ESPERA.



CAMBIOS: RETIRADAS OM Y MM, NUEVO DME(ILS), VAR.

ELEV:1167
THR RWY 17
HGT REF ELEV THR RWY 17

OCA/H		A	B	C	D
STA	CAT I	1375 (208)	1385 (218)	1395 (228)	1405 (238)
	GP U/S	1600 (440)			
En circuito (H) sobre 1213		2000 (790)	2000 (790)	2100 (890)	2200 (990)

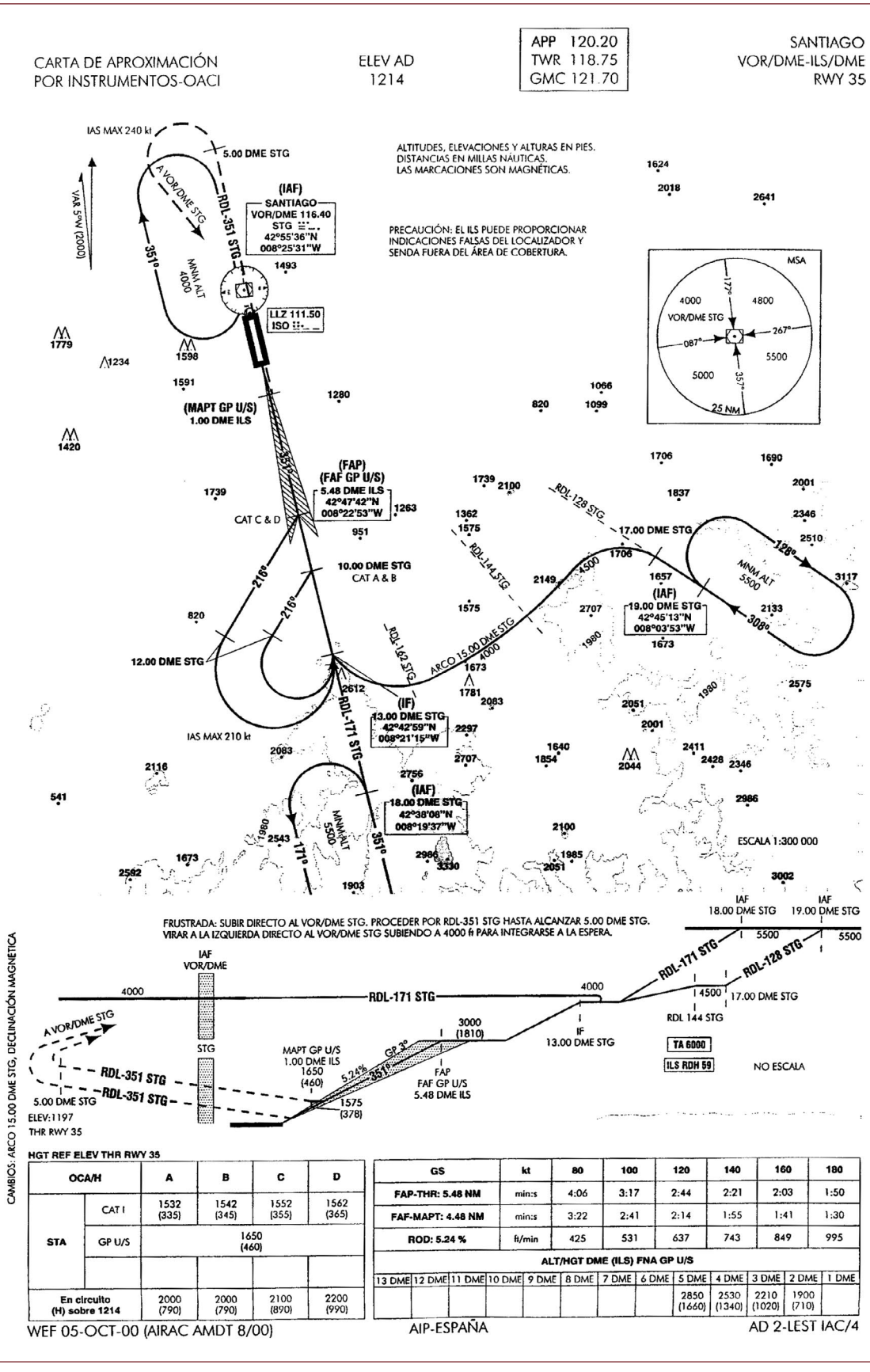
GS	kt	80	100	120	140	160	180
FAP-THR: 5.89 NM	min:s	4:25	3:32	2:57	2:32	2:13	1:58
FAP-MAPT: 5.29 NM	min:s	3:58	3:10	2:39	2:16	1:59	1:46
ROD: 5.24 %	ft/min	425	531	637	743	849	955

ALT/HGT DME (ILS) FNA GP U/S												
13 DME	12 DME	11 DME	10 DME	9 DME	8 DME	7 DME	6 DME	5 DME	4 DME	3 DME	2 DME	1 DME
								2820 (1660)	2500 (1340)	2180 (1020)	1870 (710)	

WEF 02-NOV-00 (AIRAC AMDT 10/00)

AIP-ESPAÑA

AD 2-LEST IAC/2

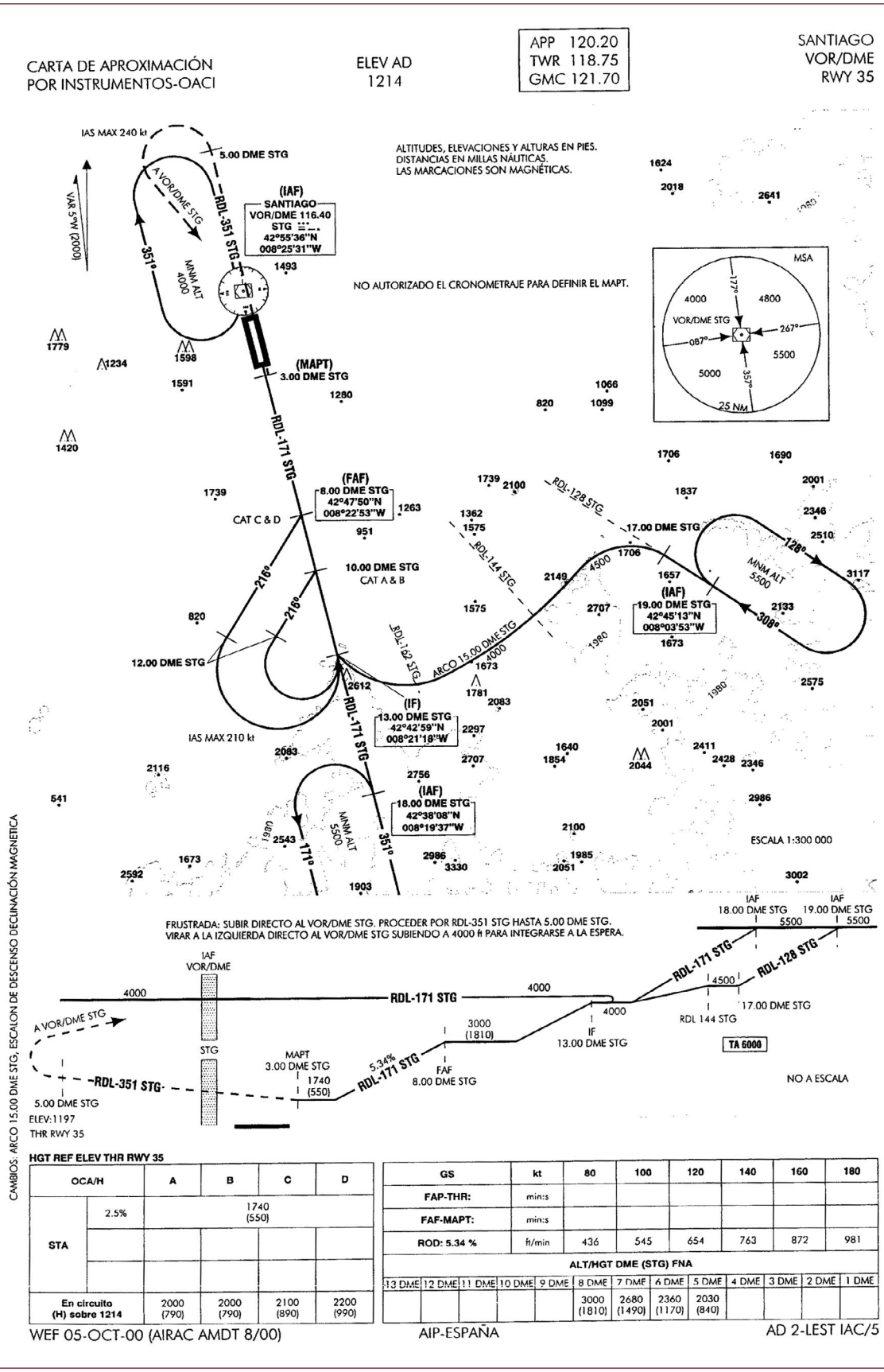


HGT REF ELEV THR RWY 35

OCA/H		A	B	C	D
STA	CAT I	1532 (335)	1542 (345)	1552 (355)	1562 (365)
	GP U/S	1650 (460)			
En circuito (H) sobre 1214		2000 (790)	2000 (790)	2100 (890)	2200 (990)

GS	kt	80	100	120	140	160	180
FAP-THR: 5.48 NM	min:s	4:06	3:17	2:44	2:21	2:03	1:50
FAF-MAPT: 4.48 NM	min:s	3:22	2:41	2:14	1:55	1:41	1:30
ROD: 5.24 %	ft/min	425	531	637	743	849	995

ALT/HGT DME (ILS) FNA GP U/S												
13 DME	12 DME	11 DME	10 DME	9 DME	8 DME	7 DME	6 DME	5 DME	4 DME	3 DME	2 DME	1 DME
								2850 (1660)	2530 (1340)	2210 (1020)	1900 (710)	


CARTA DE APROXIMACIÓN
POR INSTRUMENTOS-OACI
ELEV AD
1214
APP 120.20
TWR 118.75
GMC 121.70
SANTIAGO
VOR/DME
RWY 35
ALTITUDES, ELEVACIONES Y ALTURAS EN PIES.
DISTANCIAS EN MILLAS NÁUTICAS.
LAS MARCACIONES SON MAGNÉTICAS.
NO AUTORIZADO EL CRONOMETRAJE PARA DEFINIR EL MAPT.
IAS MAX 240 kt
5.00 DME STG
A VOR/DME STG
RDL-351 STG
(IAF)
SANTIAGO
VOR/DME 116.40
STG
42°55'36"N
008°25'31"W
VAR 5°W (2000)
351°
MNM ALT 4000
(MAPT)
3.00 DME STG
RDL-171 STG
(FAF)
8.00 DME STG
42°47'50"N
008°22'53"W
CAT C & D
10.00 DME STG
CAT A & B
216°
12.00 DME STG
(IF)
13.00 DME STG
42°42'59"N
008°21'18"W
IAS MAX 210 kt
(IAF)
18.00 DME STG
42°38'08"N
008°19'37"W
MNM ALT 5500
171°
RDL-162 STG
ARCO 15.00 DME STG
RDL-144 STG
RDL-128 STG
17.00 DME STG
(IAF)
19.00 DME STG
42°45'13"N
008°03'53"W
128°
308°
MSA
4000
4800
5500
5000
VOR/DME STG
087°
177°
267°
357°
25 NM
ESCALA 1:300 000
FRUSTRADA: SUBIR DIRECTO AL VOR/DME STG. PROCEDER POR RDL-351 STG HASTA 5.00 DME STG.
VIRAR A LA IZQUIERDA DIRECTO AL VOR/DME STG SUBIENDO A 4000 ft PARA INTEGRARSE A LA ESPERA.
IAF
VOR/DME
STG
A VOR/DME STG
RDL-351 STG
5.00 DME STG
ELEV:1197
THR RWY 35
MAPT
3.00 DME STG
1740
(550)
5.34%
RDL-171 STG
FAF
8.00 DME STG
3000
(1810)
IF
13.00 DME STG
RDL 144 STG
17.00 DME STG
TA 6000
NO A ESCALA
IAF
18.00 DME STG
5500
IAF
19.00 DME STG
5500
4500
CAMBIOS: ARCO 15.00 DME STG, ESCALON DE DESCENSO DECLINACIÓN MAGNETICA
HGT REF ELEV THR RWY 35
OCA/H
A
B
C
D
STA
2.5%
1740
(550)
En circuito
(H) sobre 1214
2000
(790)
2000
(790)
2100
(890)
2200
(990)
GS
kt
80
100
120
140
160
180
FAP-THR:
min:s
FAF-MAPT:
min:s
ROD: 5.34 %
ft/min
436
545
654
763
872
981
ALT/HGT DME (STG) FNA
13 DME
12 DME
11 DME
10 DME
9 DME
8 DME
7 DME
6 DME
5 DME
4 DME
3 DME
2 DME
1 DME
3000
(1810)
2680
(1490)
2360
(1170)
2030
(840)