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Report A-064/2006

Accident involving a PIPER PA-34-220T, registration EC-HOL, on approach to runway 02 at Jerez Airport (Cadiz – Spain), on 15 December 2006

GOBIERNO DE ESPAÑA
MINISTERIO DE FOMENTO

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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 event and its causes and consequences.

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

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

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

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Abbreviations

00°	Degrees
00 °C	Degrees centigrade
CAVOK	Current visibility, clouds and meteorological conditions are better than required
CG	Center of gravity
CPL(A)	Commercial Pilot License (Airplane)
D/E	Dead engine
E	East
EC-HOL	Registration of accident aircraft
FAR	Federal Aviation Regulations of the United States
FH	Flight hours
gal (US)	US gallon, equivalent to 3.785 liters
GPS	Global Positioning System
h	Hour(s)
HP	Horsepower
ICU	Intensive Care Unit
in	inch (1 in = 25.4 mm)
KIAS	Indicated airspeed in knots
kt	Knot(s)
kg	Kilogram(s)
lb	Pound (1 kg = 2.205 lb)
LEFM	Airport code for the Fuentemilanos aerodrome
LEJR	Airport code for the Jerez airport
LH	Left hand
lt	liter
LW	Landing Weight
m	meter
MHz	Megahertz
mm	millimeter
MTOW	Maximum takeoff weight
PAPI	Precision Approach Path Indicator
PPL(A)	Private Pilot License (Airplane)
POH	Pilot's Operating Handbook
RH	Right hand
RoC	Speed or rate of climb
RoD	Speed or rate of descent
RPM	Revolutions per minute
RWY	Runway
S/E	Single-engine operational
TOW	Takeoff Weight
TSO	Time since last overhaul
TWR	Aerodrome control tower
UTC	Universal Coordinated Time
VFR	Visual Flight Rules
V_{MCA}	Minimum control airspeed
V_{SSR}	Recommended single-engine airspeed
V_{XSE}	Best single-engine angle of climb airspeed
V_{YSE}	Best single-engine rate of climb airspeed
W	West
ZFW	Zero Fuel Weight

Synopsis

Owner and operator:	Private
Aircraft:	PIPER PA-34-220T SENECA III; Registration EC-HOL
Date and time of accident:	15 December 2006; at 13:11[1]
Site of accident:	In the approach area to runway 02 at Jerez airport (Cadiz – Spain)
Persons onboard:	Two pilots and two passengers. One of the passengers survived the accident with serious injuries
Type of flight:	General Aviation – Private flight
Date of approval:	11 August 2010

Summary of accident

The aircraft fell to the ground after suddenly entering a spin while on final approach. Over the course of the investigation, it was revealed that the left engine was stopped when the aircraft hit the ground.

[1] All times given in this report are local. To obtain UTC, subtract one hour from local time.

1. FACTUAL INFORMATION

1.1. History of the flight

On 15 December 2006, the aircraft, a PIPER PA-34-220T, registration EC-HOL, was on a private flight from the Fuentemilanos (LEFM - Segovia) aerodrome to Jerez (LEJR - Cadiz) airport. The flight was conducted under visual flight rules (VFR) with visual meteorological conditions (VMC) prevailing throughout the flight. In the aircraft were two pilots, seated in the front seats, and two passengers, seated in the aft seats.

The pilot sitting in the front RH seat was the majority owner of the company that owned the airplane, while the pilot in the front LH seat was a company employee. In the flight plan that was filed, the pilot in the front LH seat was listed as the pilot in command.

The aircraft had taken off from Fuentemilanos at 11:24 and established initial radio contact with the control tower at Jerez airport at 13:02:21. Weather conditions at this airport were CAVOK, with light or calm winds. The runway in use was RWY 02.

Between 13:01 and 13:05, three light aircraft entered the aerodrome's traffic pattern: a Cessna 172 incoming from the east (point E), which joined on the right downwind leg and which was designated by the TWR as number one to land ("traffic no. 1"); EC-HOL, incoming from the west (point W), which joined the traffic pattern on left downwind, and was designated by the TWR as number two to land ("traffic no. 2"); and a Piper PA-28, incoming from the east (point E), which joined the pattern on the right downwind leg and which the TWR designated as number three to land ("traffic no. 3").

"Traffic no. 1" was cleared to land at 13:06:30 and cleared the runway at 13:08:55. Aircraft EC-HOL extended the downwind leg until establishing visual contact with "traffic no. 1" and being cleared by the TWR to turn to base. Once established on final, it was cleared to land at 13:09:05, which it immediately acknowledged. "Traffic no. 3" also had to extend its downwind leg to position itself behind EC-HOL. At 13:10:48, the crew of "traffic no. 3" reported to the TWR that the traffic ahead of it had crashed on short final, half a mile away from the runway threshold. At no time did the accident aircraft declare an emergency or report any problems.

Even though the accident occurred beyond the airport limits, emergency services arrived on the scene quickly, within 12 minutes, with the aid of aircraft no. 3, which remained circling over the site to help rescue services locate it. The site was 1,250 m south of the runway 02 threshold and 170 m west of the runway centerline.

The two pilots and one of the passengers died on impact. The second passenger was seriously injured.

1.2. Injuries to persons

Injuries	Crew	Passengers	Total in the aircraft	Others
Fatal	2	1	3	
Serious		1	1	
Minor				Not applicable
None				Not applicable
TOTAL	2	2	4	

1.3. Damage to aircraft

The aircraft was completely destroyed as a result of the impact with the ground.

1.4. Other damage

There was no other damage.

1.5. Personnel information

1.5.1. *Pilot in command*

Age/Gender: 30/male

Nationality: Spanish

License: Commercial Pilot License (Airplane) - CPL(A)

Expiration date: 17-11-2010

Ratings and expirations:

- Single-engine piston land, valid until 17-11-2007
- Multi-engine piston land, valid until 17-11-2007
- Instrument flight, valid until 17-11-2007

Medical certificate:

- Issue date: 13-10-2006
- Expiration date: 17-11-2007

Flying experience:

- Total flight hours: 210 h
- Flight hours on the type: 15 h
- Additional twin-engine flight hours: 30 h, on Beechcraft B-55 "Baron"

The accident aircraft's logbook listed twelve flights made by this pilot as pilot in command, the first in June 2006 and the last on the day before the accident.

1.5.2. *Pilot seated in the front RH seat*

Age/Gender: 71/male

Nationality: Spanish

License: Private Pilot License (Airplane) – PPL(A)

Expiration date: 07-06-2011

Ratings and expirations:

- Single-engine piston land, valid until 13-06-2006
- Multi-engine piston land, valid until 14-05-2007

Medical certificate:

- Issue date: 16-02-2006
- Expiration date: 16-02-2007
- Notes that eyeglasses must be worn and a spare be available.

Flying experience:

- Total flying hours: 6,685 h
- Flying hours on the type: 400 h

In the six months prior to the accident, he had made 22 flights on the accident aircraft. The last of these had been logged on 28 October 2006.

1.6. Aircraft information

The PIPER PA-34 Seneca is a light twin-engine aircraft with seating for six, certified under FAR Part 23 regulations for single-pilot operation. It is powered by two alternating, supercharged Continental engines that drive variable pitch two-blade Hartzell or three-blade McCauley propellers. The engines and propellers are counter-rotating, the left engine rotating clockwise as seen from behind, and the right engine rotating in the opposite direction.

It has three rows that can seat up to six persons. The pilot's and copilot's seats are in the front row. The center row has seating for two persons facing aft with respect to the direction of flight, and the last row has seating for two persons facing forward with respect to the direction of flight.

Aircraft EC-HOL was a PA-34-220T Seneca III model, outfitted with Continental (L)TSIO 360KB1B engines with 220-HP at takeoff and three-bladed McCauley propellers.

1.6.1. *Airframe*

Manufacturer:	PIPER
Model:	PA-34-220T
Production number:	34-8233172
Year of manufacture:	1982
Registration:	EC-HOL
MTOW:	4,407 lb
Owner and operator:	Private

1.6.2. *Airworthiness certificate*

Number:	4737
Type:	Normal Category Airplane
Issue date:	19-08-2005
Expiration date:	19-08-2007

1.6.3. *Maintenance record*

Total flying hours:	2,623 h
Last 100-hr check:	18-09-2006
Hours on last 100-hr check:	2,611 h

The tasks specified in the maintenance program were performed during the last 100-hr check. There is no mention made in the corresponding records of any malfunctions or abnormal defects being found during this check. The life jackets were replaced, a

new battery was installed and the weight of the extinguishers was checked. As for limited lifetime components, no powerplant components were scheduled for replacement until 2009.

1.6.4. *Engines*

Engine	N° 1 (LH)	N° 2 (RH)
Manufacturer:	CONTINENTAL	CONTINENTAL
Model:	TCM TSIO 360KB1B	TCM LTSIO 360RB1B
Power:	220 HP	220 HP
Serial number:	811320-R	242924-R
Total engine hours:	803 approx.	803 approx.
Last 100-hr check:	18-09-2006	18-09-2006
TSO last 100-hr check:	791.34 FH	675.82 FH

1.6.5. *Propellers*

Propeller	N° 1 (LH)	N° 2 (RH)
Manufacturer:	McCAULEY	McCAULEY
Model:	3AF32C508C	3AF32C509C
Serial number:	812126	821122
Last 100-hr check:	18-09-2006	18-09-2006
TSO last 100-hr check:	393.05 FH	393.05 FH

1.6.6. *Weight and balance*

The Pilot's Operating Handbook (POH) gives the procedure for calculating the weight and determining the center of gravity for different baggage, fuel and passenger seating configurations.

In general, these procedures recommend that in the event that there are four occupants onboard, they should sit in the two front and the two center seats. If baggage is being transported, they warn that if the compartment located at the front of the fuselage is

used, the forward limit in the weight and balance diagram may be exceeded; and that if the compartment at the rear of the fuselage is not used, some fuel loading combinations could also violate the forward balance limits.

Using the data from the last weighing of the airplane, assuming average weights for the occupants and that the passengers were seated in the rear seats, bearing in mind that only a light load was found in the aft baggage compartment, and assuming a fuel weight and consumption within the limits specified in paragraph 1.6.7, the following results were obtained for the aircraft's weight and balance values on landing:

- Zero-fuel weight (ZFW): 3,994 lb
- Fuel at takeoff: 400 lb
- Fuel on landing: 200 lb
- Takeoff weight (TOW): 4,394 lb
- Landing weight (LW): 4,194 lb
- CG on landing: 94.12 in-lb

It should be noted that in this aircraft, the maximum takeoff weight was 4,407 lb and the aft limit for the center of gravity was 94.60 in-lb.

1.6.7. *Fuel consumption en route from Fuentemilanos to Jerez*

The accident aircraft used AVGAS 100LL fuel. Its tanks had a 93-gal (US) capacity, equivalent to 558 lb of fuel. Due to takeoff weight limitations, with four occupants, the maximum fuel load was around 415 lb.

Considering the conditions of the flight and assuming the engine regimes recommended in the Flight Manual were used, then, according to the tables and charts in the Manual, an average fuel flow rate of 19 gal (US) per hour of flight time can be estimated. As a result, the total consumption for the flight from Fuentemilanos to Jerez was estimated at 30 gal (US), equivalent to some 200 lb.

1.7. Meteorological information

When the aircraft joined the landing pattern, the control tower reported winds from 360° at 5 t. When the tower cleared the airplane to land, it reported that winds were calm.

Visual conditions were CAVOK and the temperature was approximately 14 °C.

1.8. Aids to navigation

The flight was being conducted under visual meteorological conditions, and as such it was not affected by the condition of navigational aids.

As for the visual aids, the airport had a PAPI system on the approach to runway 02 that provided a visual aid for the glide slope, which was at a 3º down angle. It was operational when the accident took place.

1.9. Communications

The aircraft made radio contact with the Jerez airport control tower at 13:02:21 on a frequency of 118.55 MHz. It maintained contact until the aircraft was cleared to land. All communications were normal.

The nature of the communications maintained by the control tower with the accident and other aircraft of relevance to the accident is given below:

13:02:21	EC-HOL initiates contact with tower.
13:06:30	EC-HOL reports that it is joining the left pattern and is informed that it is number two to land, after number one which, at that time, was on downwind on the opposite pattern.
13:08	EC-HOL reports to tower that it is extending the downwind leg and that it is ready to turn to base. Cleared by tower to do so.
	EC-HOL reports "turning to base. Trying to shorten the approach"
13:08:55	Tower tells "traffic number 1" to leave the runway via taxiway T-3 to the right.
13:09:05	TWR clears the aircraft to land on runway 02, which EC-HOL acknowledges.
13:10:48	"Traffic number 3" reports that the aircraft in front of it has crashed and that it will orbit overhead to indicate its position to emergency services.
13:11:13	Fire brigade is notified.
13:11:50	"Traffic number 3" reports that a farm worker is alongside the wreckage.
13:17:49	Firefighters locate the wreckage.
13:24:55	A rescue helicopter lands at the accident site.

1.10. Aerodrome information

Jerez airport, located to the north of the city, has a single runway in a 02-20 orientation. It is 2,300 m long and 45 m wide. The airport reference point is at an elevation of 68 ft above sea level.

Runway 02 has a PAPI visual aid lighting system for the 3° inclination glide slope.

There are no obstacles in the approach area to runway 02. It is practically uninhabited and features mainly farmland with flat fields.

Appendix A shows a map of the airport and Appendix B the visual approach chart. Appendix C shows an aerial photograph of the runway 02 approach area, indicating the point of impact.

1.11. Flight recorders

The aircraft did not have any flight recorders. None were required for this type of aircraft.

A GPS unit was found in the aircraft wreckage, but no information could be extracted from it. It could not be determined whether it was on at the time of the aircraft's impact with the ground.

1.12. Wreckage and impact information

1.12.1. *Impact site and marks on the ground*

The aircraft impacted the ground 1,250 m to the south of the runway 02 threshold and 170 m west of the extended runway centerline (see figure in Appendix C).

The crash site was on a farm field that was fallow at the time. Due to the high moisture content, the land was soft and unable to withstand the weight of heavy vehicles, which sank in the mud.

An overhead photograph (see figure 1) of the area shows that after impact, the aircraft, which at that moment was on an approximate heading of 170°, slid backwards only a couple of meters on an approximate heading of 340°.

The debris field was confined, with the nose and front legs destroyed. The wing was resting on its lower surface and remained attached to the fuselage. The tail section evidenced less damage, though the vertical stabilizer had detached and fallen to the ground to the right of the airplane.

Figure 1. Overhead photograph of the area

1.12.2. *Main wreckage findings*

The condition of some of the airplane's components is described below:

- The nose had fragmented into small pieces.
- The left wingtip had struck the ground with force and the wing had bent upward.
- A section of the right wing outside the engine mount had bent downward and collapsed.
- The tail assembly was not dragged along the ground.
- The left propeller had detached from the engine crankshaft plate. None of the three blades showed any material deformations. Two of the blades were covered in mud. The third, in a vertical position, was clean and intact. The blades were at a fine pitch.

- Tracks were seen in the mud resulting from two left-propeller blades whose intrados surfaces had compacted the ground.
- The left propeller cone was bent at an angle of 45° between the two muddied blades and their vertex.
- The right propeller was detached from the engine crankshaft plate. All three blades were twisted. Two of them were buried and the third was covered in mud.
- The right propeller cone was bent around its entire perimeter in a counter-clockwise direction, as seen from behind.
- The left main gear leg was covered in mud up to the hub. The rest of the tire was clean of mud.
- The nose gear tire detached from the wheel and was found among the remains of the airplane's forward components.
- The right main gear leg was in a vertical position and trapped beneath the center portion of the wing.
- On the whole, the trailing edge of the wing showed very little damage.
- The flaps were extended 10°.

These observations, coupled with the structural damage, indicate that at the time of impact, the airplane was in a gear-down configuration with the flaps extended 10º. The right engine was supplying a high amount of power to the propeller and the left engine was not supplying power. Additionally, the left propeller had not been feathered.

1.12.3. *Inspection of the cockpit*

The engine control levers, throttle, pitch and mixture, moved smoothly and actuated their corresponding controls in the engines. Their original positions had been altered during rescue operations. Rescue personnel also shut off the magnetos and uninstalled the battery.

The instruments did not reveal any information regarding the conditions in which the flight was being conducted.

1.12.4. *On-site inspection of fuel and engine systems*

Though the fuel tanks were fractured and much of the fuel had leaked out, some fuel remained inside them. The fuel lines to the engines had gasoline. Specifically, there was fuel at the discharge of the left engine pump.

The right magneto on the left engine turned freely, as did the distributor. The turbocharger also turned freely. The air filter was clean and the oil filter was full of clean

oil. Due to a break in the oil sump from the impact, the engine oil had spilled on the ground. Neither engine crankshaft could be turned by moving the propeller plate.

No indications were found as to the possible cause of the failure and sudden stoppage of the left engine, as a result of which it was prepared for transfer to the workshop for an inspection.

1.13. Medical and pathological information

Three of the aircraft's occupants died as a result of multiple traumas suffered during the impact of the aircraft with the ground.

The fourth occupant also endured serious traumas and required intensive care for a month. He was later able to recover.

1.14. Fire

There was no fire.

1.15. Survival aspects

Search and rescue services were on the scene quickly since the accident occurred in the vicinity of the airport and an airplane orbiting overhead facilitated the finding of the wreckage.

Since the accident took place outside the airport grounds, access to the site was hampered by fences and by muddy terrain.

Someone from the farm was the first to report to the accident site and rescue a surviving passenger. The firefighters then arrived on the scene, followed by a vehicle driven by a marshaller, who was transporting the airport doctor. He tended to the survivor and confirmed the death of the three other occupants. Shortly afterward a rescue helicopter and emergency services reported to the scene with a mobile ICU and took over the care of the survivor.

When the airport doctor arrived, the surviving passenger was outside the airplane, lying on the ground and being tended to by firefighters. The doctor noted the apparent multiple trauma injuries, in the still-conscious passenger.

The rescue team doctor also verified the death of the remaining three aircraft occupants before their bodies were removed by firefighters.

The aircraft's occupants were seated as follows:

- Pilot in command: Front LH seat.
- Other pilot: Front RH seat.
- Surviving passenger: Rear LH seat.
- Deceased passenger: Rear RH seat.

The firefighters verified the absence of hot spots that could ignite a fire, disconnected the battery and doused the area with an extinguishing agent. They then cut the aircraft cockpit in order to extract the bodies of the deceased.

1.16. Tests and research

1.16.1. *Workshop inspection of the left engine*

The aircraft's left engine was taken to an authorized maintenance center for disassembly and inspection with help from representatives of the manufacturer, Continental.

The engine was received at said center with all its chassis attachment points broken, as was the oil sump. The starter motor, right magneto and turbocharger were also received, but detached from the engine.

The most salient points of the inspection conducted on the components are listed below:

- The two magnetos turned by hand and produced sparks.
- The spark plugs showed normal signs of wear as indicated by the manufacturer's comparison charts.
- The fuel pump rotated normally and fuel flow was unrestricted.
- The intake manifold fuel valve and its seals were intact.
- The injectors were free from foreign particles and carbon deposits.
- The fuel regulator moved freely and was intact.
- The oil pump was intact. Even though the oil sump was cracked and had a hole, the residual oil was clean, as was the oil filter.
- The cylinders, pistons, sleeves, segments, etc. were in good condition with normal amounts of combustion deposits. They appeared to have been properly lubricated.
- The crankshaft, its counterweights and bearings were intact, as were the connecting rod assemblies.
- The shaft on the starting motor was bent and offered some resistance to turning.
- The couplings on various accessories were intact.
- The propeller plate studs were exposed, and the heli-coil inserts had been torn axially.

- In summary, the inspection of the left engine did not reveal any abnormality that could have impeded its normal operation or that could have caused a reduction in the power output.

The propeller governor was visually inspected before being pulled from the engine. There was no apparent damage, though once disassembled, it was noted that it had seized and it could not be turned by hand. It was shipped to Hartzell, the manufacturer, for analysis.

1.16.2. *Inspection of the left propeller governor at Hartzell's facilities*

The governor was inspected visually before it was disassembled. The shaft was seized and could not be turned manually. As a result, it was decided not to conduct a bench test.

There were cracks in the housing around two mounting flange holes. It was disassembled. No anomalies were noted, apart from the cracks and fractures of the flanges as noted.

The seizure of the shaft was attributed to a misalignment of the governor body with respect to its base as a result of the impact, which also caused the cracks on the flanges.

All of the damage found was consistent with having resulted from the impact. No discrepancies were found that could have prevented the normal in-flight operation of the component.

1.17. Organizational and management information

Not applicable.

1.18. Additional information

1.18.1. *Description of emergency procedures*

1.18.1.1. Emergency checklists

Emergency checklists titled "EMERGENCY CHECKLIST PA-34-200T SENECA II" were found in the cockpit of the aircraft.

The front matter of the checklists contains the following airspeeds for single-engine operation:

- Airspeed for emergency operation

  — MAXIMUM S/E RATE OF CLIMB ..... 89 KIAS
  — MAXIMUM S/E ANGLE OF CLIMB ..... 78 KIAS
  — MINIMUM S/E CONTROL SPEED ..... 66 KIAS
  — MINIMUM RPM FOR FEATHERING ..... 800 RPM

In the event of an in-flight engine failure, the following procedure is specified:

- Engine failure in flight

  — MIXTURE (operative engine) ..... FULL RICH
  — PROPELLER (operative engine) ..... FULL FORWARD
  — THROTTLE (operative engine) ..... MCT (40 inch)
  — COWL FLAP (operative engine) ..... OPEN
  — FUEL FLOW D/E ..... CHECK
  — IF NO FUEL FLOW, FUEL PUMP D/E ..... HI
  — FUEL QUANTITY ..... CKECK
  — FUEL SELECTOR D/E ..... X-FEED
  — ALTERNATE AIR D/E ..... ON
  — MIXTURE D/E ..... CHECK
  — OIL PRESS & OIL TEMP D/E ..... CHECK
  — MAGNETOS D/E ..... CHECK
  — IF D/E NOT START ..... FEATHER
  — POWER & MIXTURE OPER ENGINE ..... ADJUST
  — FUEL BALANCE ..... MONITOR
  — ELECTRICAL LOADS ..... MONITOR

- Land at nearest suitable airport

1.18.1.2. Flight manual. Emergency procedures for an engine failure

The aircraft's flight manual (POH) was not found with the wreckage. It was located at the offices of the company that owned the aircraft. The document, approved on 20 February 1981, had been updated with Revision 15, dated 26 April 1991, and included the document corresponding to the last weighing of the aircraft, dated 26 April 2000. According to information provided by the manufacturer, on the date of the accident, the POH had been updated an additional four times, the last on 29 August 2005.

The emergency procedures for an engine failure (POH 3.3) take into consideration different flight conditions - takeoff, before and after minimum control speed, taxiing, in flight, etc. Several warnings and cautions complement these procedures. Below are the items of relevance to the accident flight:

ENGINE INOPERATIVE PROCEDURES

NOTE The power on the operating engine should be reduced when safe to do so.

DETECTING DEAD ENGINE

Loss of thrust.
Nose of aircraft will yaw in direction of dead engine (with coordinated controls).

ENGINE SECURING PROCEDURE (FEATHERING PROCEDURE)

Minimum control speed	66 KIAS
One engine inoperative best rate of climb	92 KIAS
Maintain direction and airspeed above 85 KIAS.	
Mixture controls	forward
Propeller controls	forward
Throttle controls	(40 in. Hg. Max.) forward
Flaps	retract
Gear	retract
Identify inoperative engine.	
Throttle of inop. engine	retard to verify

To attempt to restore power prior to feathering:

Mixtures	as required
Fuel selector	ON
Magnetos	left or right only
Aux. fuel pump	unlatch, ON HI, if power is not immediately restored - OFF
Alternate air	ON

If power cannot be restored continue with feathering procedure.

Prop control of inop. engine	feather before RPM drops below 800
Mixture of inop. engine	idle cut-off
Trim	as required (3° to 5° of bank toward operative engine - ball 1/2 to l out)
Aux. fuel pump of inop. engine	OFF
Magnetos of inop. engine	OFF
Cowl flaps	close on inop. Engine, as required on operative engine
Alternator of inop. engine	OFF
Electrical load	reduce

Fuel selector	OFF inop. engine, consider crossfeed
Aux. fuel pump operative engine	OFF
Power of operative engine	as required

ENGINE FAILURE DURING FLIGHT (Below 66 KIAS)

Rudder	apply toward operative engine
Throttles (both)	retard to stop turn
Pitch attitude	lower nose to accelerate above 66 KIAS
Operative engine	increase power as airspeed increases above 66 KIAS

If altitude permits, a restart may be attempted. If restart fails or if altitude does not permit restart, see Engine Securing Procedure.

ONE ENGINE INOPERATIVE LANDING

Inop. engine prop	feather
When certain of making field:	
Landing gear	extend
Wing flaps (as required)	lower
Maintain additional altitude and speed during approach.	
Final approach speed	90 KIAS

POH 4.2 specifies a speed for intentionally rendering an engine inoperative during in-flight training of V_{SSE} = 85 KIAS.

POH 4.59 indicates that the loss of altitude during a power off stall with the gear and flaps retracted may be as much as 400 ft.

POH 3.27 warns that intentional spins are prohibited. The first action to recover from an unintentional spin is to immediately retard the throttles to idle position.

POH 4.9 addresses flight preparations and the required determination of the aircraft's weight and center of gravity. It states that the baggage must be weighed, put in place and tied down.

The POH provides graphs to calculate the climb rates with an engine inoperative, its propeller feathered and the refrigeration cowl flaps closed. The flaps and gear are assumed to be retracted.

Section 7.7 on the operation of the propeller states that the time to full feather is approximately six seconds.

The following operating speeds are specified in the event of an engine failure (POH 3.3 and 4.2):

V_{MCA}: 66 KIAS (minimum control airspeed)
V_{XSE}: 92 KIAS (speed for best angle of climb)
V_{YSE}: 78 KIAS (speed for best rate of climb)
V_{SSE}: 85 KIAS (safe, intentional one engine inoperative speed)

The maximum weight stall speed at sea level and with bank angles below 30° is estimated to be 65 KIAS.

The normal approach speed with two engines operating is 92 KIAS.

1.18.2. *Eyewitness statements*

1.18.2.1. Statements by airport personnel

The controller on duty in the tower reported that he had lost visual contact with the aircraft when it was already very close to the runway. He had authorized it to land, which the crew acknowledged. He did not see it fall.

The marshaller who was awaiting the aircraft's arrival to guide it to the stand reported that he saw it as it was descending on the final approach glide slope, and that it suddenly made a sharp 180° turn before falling almost perpendicularly to the ground.

1.18.2.2. Statement from pilot onboard "traffic number 3"

"Traffic number 3" was assigned to a training flight, with an instructor and student onboard. The instructor reported that "traffic number 2" was making a very long final and that they were following them. At a certain point, no. 2 made a steep turn to the right before turning even more steeply to the left and climbing, so much so that they were able to see the entire airplane, as if looking down on it. It then tailspinned, making one and a half turns.

1.18.2.3. Statement from surviving passenger

The surviving passenger was admitted to the ICU, where he regained consciousness on 22 December, a week after the accident.

After regaining consciousness, he could not recall anything about the accident, only that they were on approach.

1.18.3. *Engine failure in a twin-engine airplane*

The failure of an engine in a twin-engine airplane has a significant effect on its performance and on flight control.

From a flight control standpoint, the situation can be complicated. A symmetrical airplane, both aerodynamically and in terms of its power plant, with two counter-rotating engines, such as the PA-34, becomes very asymmetric when an engine stops. This is because of the combined effects of the asymmetric thrust and the drag of the corresponding propeller, which tends to yaw the airplane toward the side with the stopped engine.

As for the performance, an engine failure results in the loss of 50% of the installed power and increases the drag of the stopped engine and its propeller, which greatly reduces performance. Moreover, a non-feathered engine produces large amounts of drag, thus exacerbating these problems. The ability to climb or to accelerate is proportional to the margin between the power available from the operating engine and the drag from the airplane and the stopped engine. This difference can result in a large reduction in performance. A decrease in speed with respect to its optimum value leads to large quantities of drag, though speeds in excess of the optimum can also increase drag, which drastically reduces the speed margins from a performance standpoint. To summarize, an inoperative engine diminishes the airplane's ability to climb, to increase speed and to reach a more distant point when descending, among other drawbacks.

In an effort to confront this situation, flight manuals specify minimum control speeds with an engine inoperative.

1.18.4. *Flying from the RH seat*

Various sources warn about the risks to a pilot who is not a flying instructor of flying from the RH seat, which is not the usual flying position.

In general, doing these changes the pilot's viewpoint of the visual references when flying and the relative position of all the cockpit instruments, gauges and controls. Under other than ideal conditions and when visibility or possible technical faults complicate the flight, this circumstance serves to aggravate even more those problems that may arise during the flight.

1.19. Useful or effective investigation techniques

Not used.

2. ANALYSIS

2.1. Circumstances o the accident

The PIPER PA-34-220T Seneca III, registration EC-HOL, which had taken off from the Fuentemilanos aerodrome, was arriving at Jerez airport shortly after 13:00 after a flight lasting one hour and thirty-eight minutes and without any reported incidents. Once in that airport's visual traffic pattern, the aircraft followed the control tower's instructions at all times. It did not report any kind of difficulty and it did not declare an emergency. Meteorological conditions were CAVOK with light or calm winds.

It was flying the same path taken by the aircraft ahead of it and as the control tower instructed said aircraft to clear the runway after landing, aircraft EC-HOF reported that it was attempting to shorten its pattern to facilitate the operation of the aircraft following it. After being cleared to land and having acknowledged the clearance, the aircraft plummeted to the ground. An inspection of the wreckage revealed that the impact with the ground had taken place with the left engine stopped and its propeller unfeathered. The airplane was in a gear down and 10° flap configuration.

Every engine and propeller component was found in optima conditions, as verified by a subsequent inspection, as were the fuel system components that were examined. There was fuel present in the tanks all the way up to the fuel pump. The magnetos, turbocharger, valves, governor, etc. were intact or showed only impact damage. A check of the wreckage was unable to reveal any indication to explain the failure of the engine in-flight. There had been signs since early on in the investigation, however, that the left propeller was stationary when it contacted the ground. The propeller struck radially, with one blade to the right of the hub digging into the mud first, followed by the one to the left. The third blade on this propeller remained in a vertical position and did not come into contact with the mud. None of the blades was twisted or showed any sign of torsional bending. The pressure from the intrados surface of the two blades on the mud had compacted it in an aft direction and torn the blades from the crankshaft plate, ejecting them forward.

In short, the investigation was unable to reveal the causes or reasons behind the engine stoppage.

A light twin-engine aircraft with an engine inoperative presents flight characteristics that require very precise piloting. In this case, we know that the aircraft lost control and spun, turning one and a half times, as attested to by the pilot of the aircraft next in landing order.

A check of the wreckage revealed that the landing gear was down, the flaps were at 10° and the right propeller was at full power. Its three blades were completely twisted and there was damage to the periphery of its cone, which proves that it was rotating to the left, as seen from behind, and at power when it contacted the ground. The landing gear wheels, which were lowered, sunk in the mud.

Figure 2. Left propeller cone

The damage to the nose, the left propeller cone and the left wingtip suggested that the airplane was falling at a 40° nose-down angle and banking left. It was also moving backwards on a heading of 340° when its nose was pointed toward 170°. These indications confirm that the aircraft was in a spin as it maintained its momentum from the approach glide slope.

The initial impact of the nose, gear, propellers and left wing absorbed nearly all the kinetic energy.

The right wing flexed downward, as did the rear of the fuselage which, under the ground loads, bent and fell to the ground with little force. It was noted that the tail section did not drag on the ground and barely suffered any local damage.

The impact affected, to a lesser extent, the central part of the fuselage where the passenger in the rear LH seat was located and who, despite suffering from serious trauma, was able to survive.

Given the damage observed and the slim chances of surviving an accident with acceleration forces in excess of 20 g's, it was estimated that prior to the spin, the aircraft was flying below the 3° glide slope and that it fell from a height of 40 m. It is calculated that some three seconds went by between the start of the spin and the impact of the aircraft with the ground.

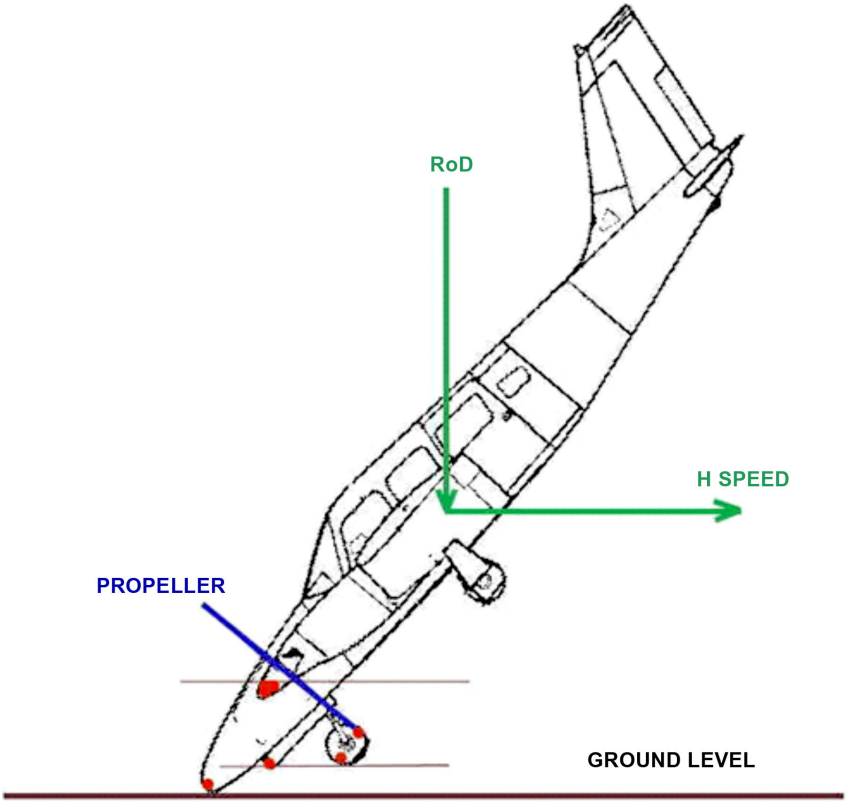


Figure 3. EC-HOL impact diagram

Figure 4. Tail section of EC-HOL

2.2. Preparation for accident flight

The investigation revealed that the operational documentation, the airplane's POH and the checklists were either not onboard, not up to date and were inappropriate for the airplane model variant or specified insufficient actions. The information available onboard raises doubts about whether or not the crew was aware of what exactly the correct procedures were.

As for the arrangement of the weight on the aircraft and its center of balance, no evidence was found that the required calculations were performed. Contrary to the recommendations in the flight manual when flying with four occupants onboard, the two passengers were not seated in the center row of seats, but in the rear row seats. As a consequence, and in light of the calculations performed in 1.6.6, it is believed that the airplane, although within the established limits, was heavy and its center of balance very far back.

2.3. Onboard roles

The PIPER PA-34-220T aircraft is certified to be flown by a single pilot, meaning that, strictly speaking, the distribution of tasks among the crew should not be a consideration. And yet, in this case, the pilot's seat was occupied by a relatively inexperienced pilot with only 15 flying hours on the type and 215 in total, though he was instrument rated.

The copilot's seat was occupied by the aircraft's usual pilot, who had almost 7,000 h of flying experience, though he was only VFR rated. The extent of his experience in the RH seat of the cockpit is unknown. It may be assumed that in an emergency situation, given his ample experience and his condition as the *de facto* owner of the airplane, he would exert a considerable influence on the crewmember acting as pilot in command.

It is possible that the rapport between the two crewmembers, not having anticipated the need to share tasks, led to confusion when the emergency arose and probably even to opposing control actions during the emergency's brief duration.

It is estimated that the time from the loss of stability to the spin only lasted a few seconds. It seems unlikely that the crew had sufficient time to coordinate their actions, such as feathering, which requires at least six seconds, or landing gear retraction to improve performance. They would have had to feather the engine earlier, as soon as the engine failed and before the propeller rpm's dropped below 800, at which spin rate the propeller pitch centrifugal latch pins close. There are no provisions for having two pilots coordinate these actions, and the time period for doing so is extremely short.

The instinctive inputs of either or both pilots to the flight and engine controls could have triggered the loss of control. Since they were in the pattern, it makes no sense to assume that they were flying at a slow speed deliberately. A more likely scenario is that it was the inputs to the controls as they attempted to prolong the glide and reach the threshold of the landing runway that caused them to drop from approach speed to stall speed.

2.4. Flight characteristics with an engine inoperative

Item 1.18.3. summarizes certain considerations regarding the implications of having the more experienced of the two pilots flying in the RH seat of the cockpit, to which he may not have been accustomed, and of the degraded performance and flight control issues involved in flying with only a single engine in operation.

The indications in the POH envision such difficulties and the warnings, precautions and instructions it offers call for a landing without delay or to discontinue the flight above almost any other consideration. A go-around must be avoided if possible, and a takeoff must be aborted even if there is insufficient distance to stop within the runway; or, at least, consideration must be given to departing the runway. It warns that under certain excessively high or low speed conditions, the airplane will not climb. Moreover, the performance for this type of airplane diminishes greatly in a dirty configuration, such as with the gear down, ready to land, flaps extended and a propeller stopped and unable to be feathered due to the actuation of the centrifugal latch pins that impede increasing the pitch of the blades.

The procedures continue addressing the aircraft control problems by instructing that, as in the event of an engine loss at an airspeed below 66 KIAS, thrust be reduced so as to avoid asymmetrical flying conditions.

It is possible that some pilots may not understand that a reduction in airspeed after an engine failure results in a flight condition similar to that with a fault while at low speed. Whenever flying only with a single engine, a further loss of speed in an aircraft of this type will result in being close to the minimum control airspeed and requires that speed be recovered by resorting to the airplane's altitude. If this is insufficient, then an immediate forced landing is called for so as to retain control of the aircraft at all times. In the event at hand, the option of attempting to land at one of the farming fields in the approach area would have posed an advantage.

Flight characteristics degrade even more if the aircraft's state or condition are compromised. If the position of the center of gravity is too far back, the effect of the flight controls is reduced, meaning that the minimum control airspeed is increased. What is more, there is a greater propensity to spin if the center of balance is toward the rear. In this case, even if the speed does not drop below 66 KIAS, the minimum

control airspeed may be above this limit. Under these circumstances, if extreme asymmetrical conditions exist while flying coincident with even a slight drop in speed, control of the aircraft may be lost. The large drag of a wind milling propeller would influence the tendency to spin.

In summary, it is likely that in this event, there was a compromise in performance resulting from an engine failure coincident with high drag due to an unfeathered propeller and a landing configuration with the gear down and the flaps at 10°, along with the inability to control the aircraft as a consequence of flying with maximum asymmetric thrust and allowing the airspeed to drop.

3. CONCLUSION

3.1. Findings

- Both pilots were properly licensed to conduct the flight.
- The pilot had limited flying experience on this type of airplane.
- The copilot had an extensive flying experience of almost 400 h on this airplane type and nearly 6,700 total flying hours.
- The two passengers onboard the aircraft were seated in the back row instead of the center row, as recommended by procedures.
- No weight and balance sheet could be found for this specific flight.
- There was no POH in the cockpit. The emergency checklists that were found were for a different variant of the airplane.
- The pilot in command, possibly as a result of his limited number of flying hours on this airplane, was not well acquainted with the emergency procedures.
- The left engine stopped while the aircraft was on final approach to runway 02 at Jerez airport.
- No technical reasons could be found to account for the stoppage of the engine.
- The crew did not declare an emergency, nor were any indications found that the engine stoppage could have occurred for operational reasons.
- The airplane stalled and went into a spin, turning one and a half times before impacting the ground.
- The point of impact was 1,250 m south of the runway 02 threshold and 170 m left to the extension of the runway centerline.

3.2. Causes

The accident probably resulted from a loss of control of the aircraft with a stall and spin at low altitude as it was on the approach glide slope with an engine inoperable at an airspeed close to the minimum control airspeed.

It has not been possible to determine why the left engine was stopped at the moment the aircraft impacted the ground.

The little experience of the pilot in command in this type of aircraft and the possible lack of coordination between both pilots are considered as contributing factors to the accident, which could have lead to the emergency procedures not being correctly applied in case of an engine failure in this aircraft.

4. SAFETY RECOMMENDATIONS

No safety recommendations have been issued.

APPENDICES

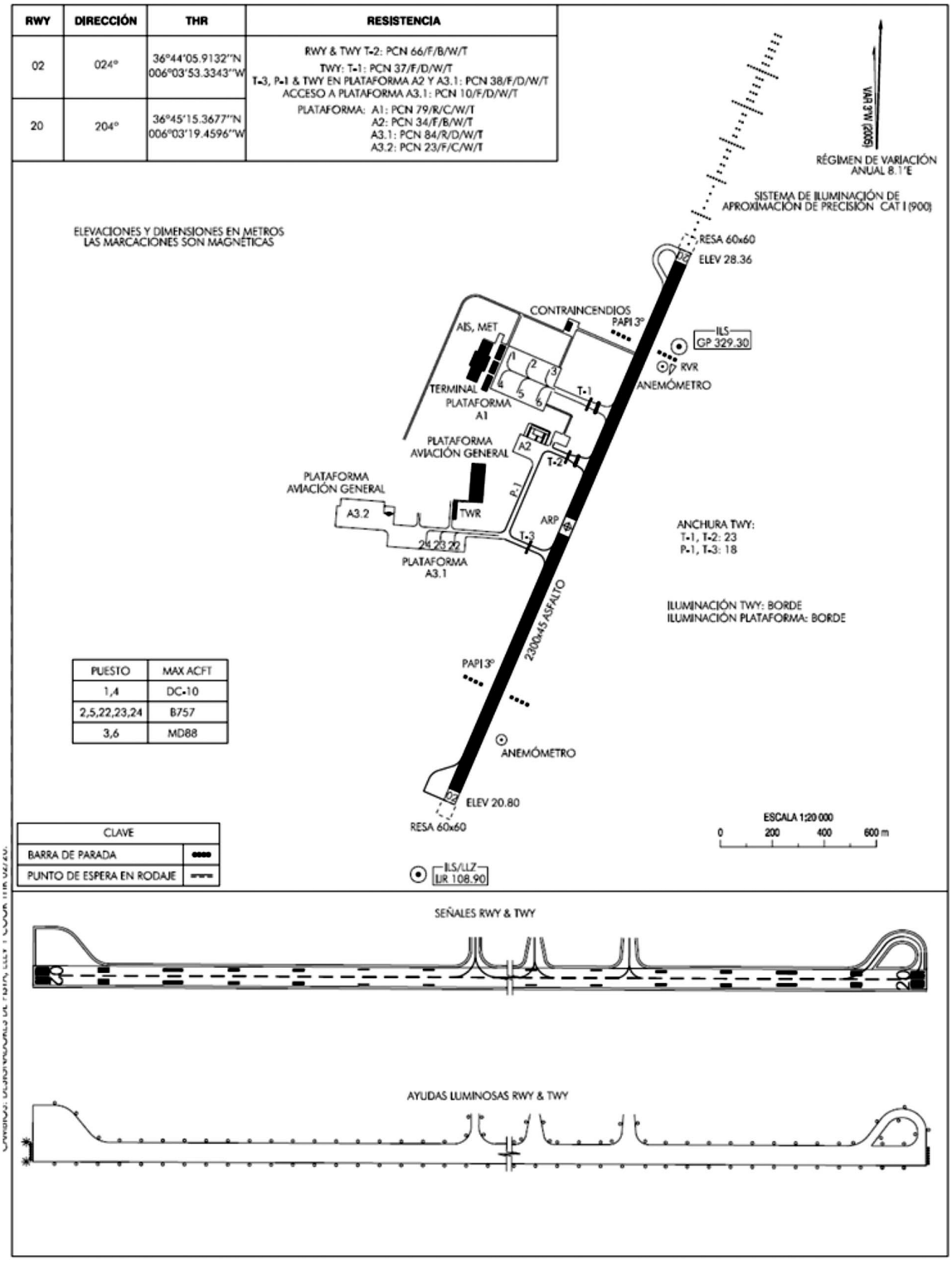
APPENDIX A
Airport map

AIP
ESPAÑA

AD 2-LEJR ADC
WEF 11-MAY-06

PLANO DE AERÓDROMO-OACI 36°44'41"N 006°03'36"W ELEV 28.36 m TWR 118.55 GMC 121.60 **JEREZ**

RWY	DIRECCIÓN	THR	RESISTENCIA
02	024°	36°44'05.9132"N 006°03'53.3343"W	RWY & TWY T-2: PCN 66/F/B/W/T TWY: T-1: PCN 37/F/D/W/T T-3, P-1 & TWY EN PLATAFORMA A2 Y A3.1: PCN 38/F/D/W/T ACCESO A PLATAFORMA A3.1: PCN 10/F/D/W/T PLATAFORMA: A1: PCN 79/R/C/W/T A2: PCN 34/F/B/W/T A3.1: PCN 84/R/D/W/T A3.2: PCN 23/F/C/W/T
20	204°	36°45'15.3677"N 006°03'19.4596"W	



PUESTO	MAX ACFT
1,4	DC-10
2,5,22,23,24	B757
3,6	MD88

CLAVE	
BARRA DE PARADA	
PUNTO DE ESPERA EN RODAJE	

AIS-ESPAÑA

AIRAC AMDT 04/06

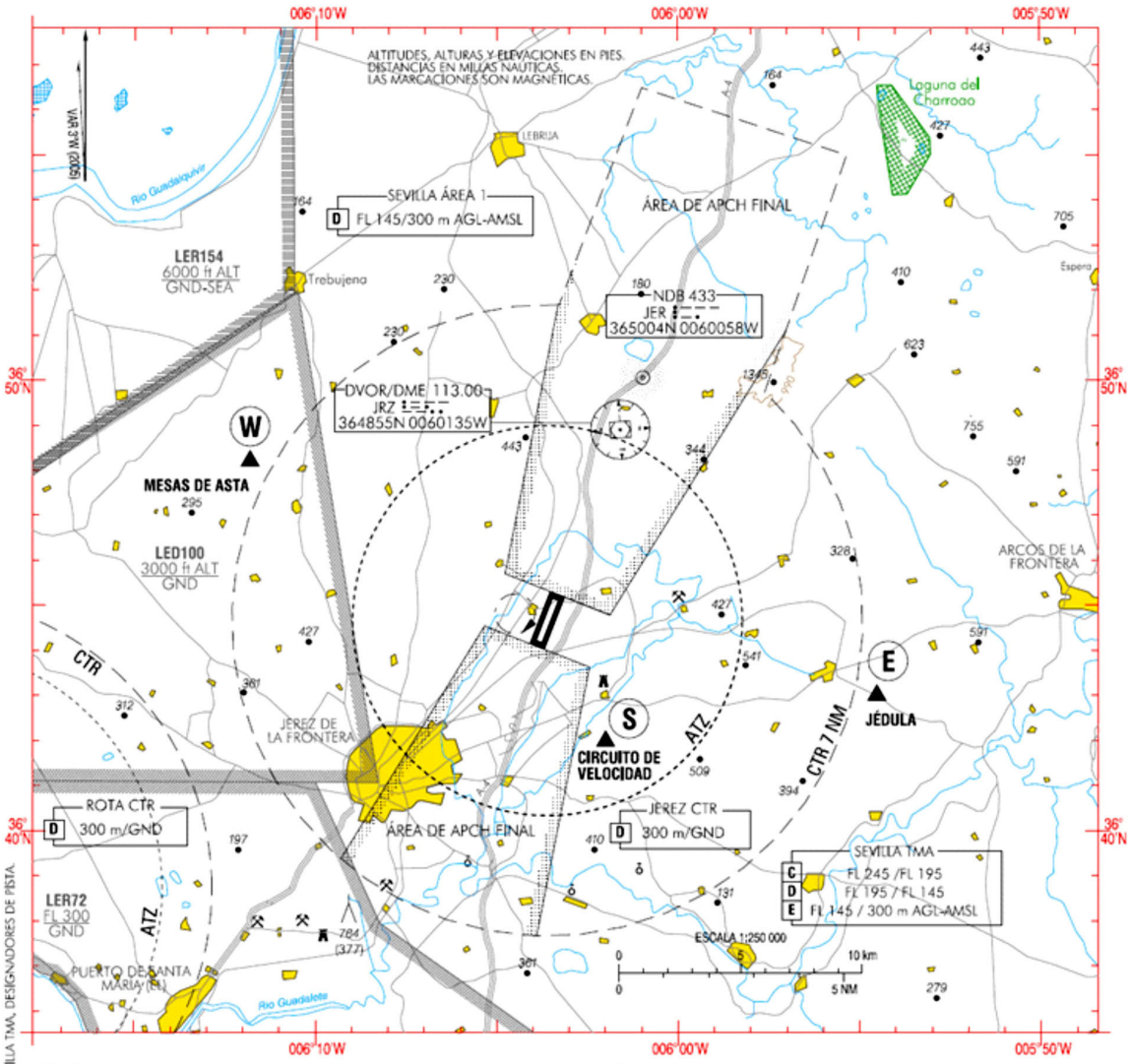
APPENDIX B
Visual approach chart

CARTA DE APROXIMACIÓN
VISUAL / VAC-OACI

ELEV AD
93

APP	128.50
TWR	118.55
GMC	121.60

JEREZ
LEJR



CAMBIOS: RETIRADA LER92, NUEVA LER154, CLASIFICACIÓN SEVILLA TMA, DESIGNADORES DE PISTA.

ENTRADAS:

Los pilotos establecerán contacto radio con TWR cinco minutos antes de entrar en el CTR. Los puntos de entrada son E (Jédula) y W (Mesas de Asta).
Desde estos puntos, después de recibir instrucciones de TWR, las aeronaves procederán perpendicularmente a la pista para integrarse en el tramo de viento en cola del circuito de tránsito de aeródromo, o bien podrán proceder a hacer esperas sobre el punto S (Circuito de velocidad).
La altura a mantener dentro del CTR será de 1000 ft AGL.

ARRIVALS:

Pilots shall establish contact with TWR 5 minutes before entering in the CTR.
The inbound points are E (Jédula) and W (Mesas de Asta).
From these points, after receiving instructions from TWR, aircraft shall proceed perpendicularly to runway to join the down wing leg of aerodrome traffic circuit or shall proceed to hold at point S (Circuito de velocidad).
The height to be maintained within the CTR will be 1000 ft AGL.

FALLO DE COMUNICACIONES:

Las aeronaves entrarán en el CTR por el oeste del AD, entre la pista y la vía de ferrocarril, manteniendo 500 ft AGL para integrarse en el circuito de fallo de comunicaciones hasta recibir instrucciones luminosas de TWR.

COMMUNICATION FAILURE:

Aircraft shall enter the CTR from the west of the AD, between the runway and the railway, maintaining 500 ft AGL in order to join the traffic circuit for aircraft with communication failure expecting light signals from TWR.

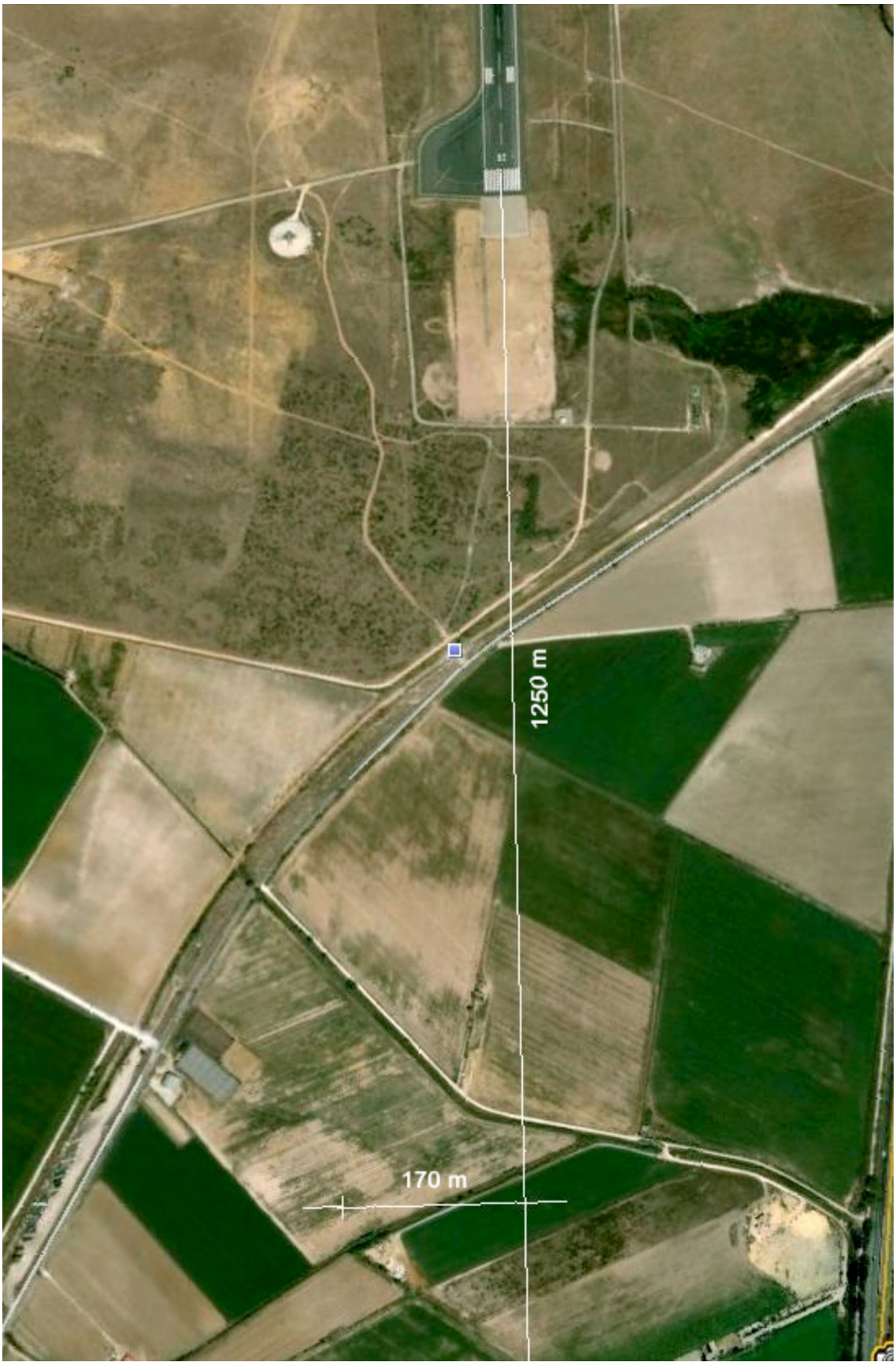
OBSERVACIONES:

- Evitar el sobrevuelo de la Laguna de Medina (363718N 0060353W).
- El punto S se utilizará únicamente como punto de espera, nunca como punto de entrada al CTR.
- Angulo del PAPI RWY 02/20: 3°
- En ningún caso se cruzarán las ÁREAS de APCH FINAL sin permiso de TWR.
- A título informativo, se incluyen las coordenadas geográficas de los puntos:
  W: 364725N 0061013W
  E: 364332N 0055551W
  S: 364200N 0060200W

REMARKS:

- Overflight of Laguna de Medina should be avoided (363718N 0060353W).
- Point S will be used only as a holding point, never as an inbound point to the CTR.
- PAPI Angle RWY 02/20: 3°
- The FINAL APCH AREAS shall never be crossed without prior permission from TWR.
- For information purposes, the geographic coordinates of the points are included:
  W: 364725N 0061013W
  E: 364332N 0055551W
  S: 364200N 0060200W

APPENDIX C
Impact site


1250 m
170 m