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Final Report No. 1923 by the Aircraft Accident Investigation Bureau

concerning the accident

to the aircraft Cessna C 500 Citation I/SP, EC-HFA

on 7 April 2003

at Zurich-Kloten Airport

Bundeshaus Nord, CH-3003 Berne

Ursache

Der Unfall ist darauf zurückzuführen, dass der Pilot mit ungenügenden Sichtreferenzen den Endanflug unter das Minimum fortführte und die Maschine ca. 700 m vor der Pistenschwelle 14 auf den Boden prallte.

Zum Unfall haben folgende Faktoren beigetragen:

- Die ungenügende fliegerische Qualifikation auf dem Unfallmuster.
- Die Ablenkung durch den Passagier während des ganzen Anfluges und auf der Entscheidungshöhe.

General Information regarding this Report

This report contains conclusions by the AAIB about circumstances and causes of the investigated accident.

In accordance with Annex 13 of the Convention on International Civil Aviation, dated 7 December 1944, as well as article 24 of the Swiss Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal appreciation of the circumstances and causes of the accident/serious incident is explicitly not object of the investigation. It is therefore also not the purpose of this report to determine blame or clarify questions of liability.

If this report be used for other purposes than for accident prevention these circumstances have to be duly taken in account.

The definitive version of this report is the original in the German language.

Unless otherwise indicated, all times in this report are indicated in Swiss local time (LT), corresponding at the time of the accident to Central European Summer Time (CEST). The relationship between LT, CEST and universal time coordinated (UTC) is as follows: $LT = CEST = UTC + 2 \text{ h}$.

The masculine form is used in this report regardless of gender for reasons of data protection.

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Final Report

Owner	BANCA MARCH S.A., Palma de Mallorca, Spain
Operator	Ibiza Flights S.L., Ibiza, Spain
Aircraft type	Cessna C 500 Citation I/SP
Manufacturer	Cessna Aircraft Company, Wichita, USA
Country of registration	Spain
Registration	EC-HFA
Accident location	Zurich-Kloten Airport
Date and time	7 April 2003, 12:12 LT

General

Brief description

On 7 April 2003 the Cessna C 500 Citation I/SP, registration EC-HFA, took off at 10:00 LT from Barcelona (LEBL) on a private flight to Zurich (LSZH). The flight took place under instrument flight rules. Using radar vectors, EC-HFA was cleared at 12:05 LT for an approach on the runway 14 instrument landing system (ILS). In the final approach phase, the aircraft entered a snow shower. The aircraft touched down on the grass about 700 m before the runway threshold and skidded in a wide right turn in the direction of the threshold of runway 16. The aircraft was badly damaged. The three occupants were unharmed.

Investigation

The Aircraft Accident Investigation Bureau (AAIB) opened an investigation on the same day in cooperation with the airport authority.

The accident is attributable to the fact that the pilot, with insufficient visual references, continued his final approach below the minimum and the aircraft collided with the ground approximately 700 m before the threshold of runway 14.

The following factors contributed to the accident:

- unsatisfactory flying qualification on the aircraft type involved in the accident.
- distraction by the passenger during the entire approach and at the decision height.

1 Factual Information

1.1 History of flight

A flight from Barcelona to Zurich was scheduled for 7 April 2003. After obtaining the usual flight plan documents, the Cessna C 500 Citation I/SP was refuelled, so that finally there were 3500 lbs of fuel on board. The engines were started shortly before 10:00 LT, in order to taxi to the holding position for runway 20. EC-HFA was assigned a standard instrument departure (SID) via FEVIK. The aircraft lifted off at approximately 10:00 LT and flew to Zurich according to the flight plan which had been submitted. The pilot and two passengers were on board. One passenger, who possessed a private pilot's licence, sat in the cockpit next to the pilot, in the right-hand seat.

At 11:22:47 LT, the pilot established contact with Zurich Area Control Centre radar lower sector west. The air traffic controller (ATCO) instructed him to follow standard approach route BERSU 3E (Annex 4.1). At 11:30:50 LT, the ATCO instructed the pilot of EC-HFA, after reaching EKRIT waypoint, to join the corresponding holding pattern. He informed him of an expected approach time of 12:05 LT. EC-HFA was cleared to FL 170 at 11:35:40 LT.

About 10 minutes later, the passenger, sitting front right, assisted the pilot in obtaining ATIS report "SIERRA". The pilot of EC-HFA asked him to translate this ATIS message into Spanish. In addition to the information about the current weather in Zurich, the two also learned that an ILS approach on runway 14 was to be expected. When the aircraft approached EKRIT waypoint, a lengthy discussion began between the two persons in the cockpit about how to join the holding pattern.

From the position which the aircraft was in at this point, the pilot should have joined the EKRIT holding pattern in accordance with a so-called parallel entry procedure (cf. Annex 4.2). As the radar recordings show, EC-HFA continued to fly the outbound leg for approximately one and a half minutes instead of 45 seconds and turned right instead of left in order to follow the inbound track 067° to EKRIT (Annex 4.3). According to the cockpit voice recorder (CVR) recordings, it was precisely in this phase that the pilot explained to his passenger during approximately five minutes how to join the holding pattern correctly. The subsequent holding patterns were flown with major lateral deviations in comparison with the published procedure.

At 11:49:54 LT, EC-HFA was cleared to FL 160 in the EKRIT holding pattern. Shortly afterwards, the passenger made the pilot aware of an aircraft below them which was apparently in the same holding pattern. About one minute later, EC-HFA was cleared to FL 150. The pilot then began to look into the ILS approach for runway 14 in Zurich. As the CVR recordings also show, the approach preparations were continually interrupted because the pilot had to deal with radio communications in addition to his flying duties. At 11:52:32 LT, the aircraft was cleared to FL 130. Shortly afterwards, the pilot was instructed to contact Zurich approach control arrival sector west.

Up to this point, the pilot had not yet fully completed his approach preparations. He had only mentioned the approach procedure and repeated the localizer course of 137° several times. At 11:53:14 LT, the pilot of EC-HFA called Zurich arrival air traffic control. The latter then informed him that ATIS report "UNIFORM" was now in effect and that he should continue flying at FL 130 in the

EKRIT holding pattern. He was informed that he would be able to begin an instrument approach on runway 14 at 12:05 LT. The pilot again asked the ATCO how long a delay he was still to expect. The ATCO repeated that the approach could begin at 12:05 LT. Shortly afterwards, the passenger asked the pilot what the ATCO had said. After the pilot had explained this to the passenger, he again dealt with the ILS approach procedure for runway 14. In particular, he mentioned the corresponding frequencies of the navigation aids and the navigation systems in which he wished to set these. This process took approximately three minutes to complete. As this was going on, the pilot was repeatedly interrupted by his passenger with queries and statements which were unrelated to the actual management of the flight.

At 11:57:25 LT, the Zurich arrival ATCO instructed EC-HFA to descend to FL 100 and increase speed to 210 KIAS. After this, the aircraft was to turn onto a heading of 320°. In addition, the pilot of EC-HFA was also informed that the planned distance to the threshold of runway 14 was still 40 NM. The pilot then ordered the passenger to set the frequency of the KLO DVOR beacon on one of the navigation systems. As the CVR recordings show, the atmosphere in the cockpit became increasingly tense, culminating in the passenger asking the pilot not to shout at him any more. Shortly afterwards, the pilot of EC-HFA read back a clearance from the ATCO incorrectly. The ATCO corrected him and then requested him to include the aircraft's callsign when reading back ATC messages.

At 12:01:05 LT, EC-HFA was asked for its current speed. The pilot reported that his current speed was 150 KIAS. The ATCO then instructed EC-HFA to maintain a speed of 160 KIAS and to turn right onto a heading of 090°. They were then to call Zurich final approach control. This was confirmed correctly by the pilot.

At 12:01:47 LT, the pilot of EC-HFA called Zurich final: "*Good morning Zurich, Echo Charlie Hotel Fox Alpha.*" The passenger then asked the pilot to inform the ATCO that they would soon be at 6000 feet, which the pilot then did. The ATCO answered that EC-HFA should maintain FL 60 and that he would call back for a further descent clearance. A discussion arose between the pilot and the passenger as to whether to fly according to QNH now and what was the current QNH for Zurich.

At 12:03:18 LT, the ATCO instructed the pilot to turn left onto a heading of 070° and to maintain a speed of 160 KIAS. A little later, the pilot said to himself that the heading was 070° and that the ILS was set. EC-HFA was then cleared to 4000 ft QNH (1021 hPa).

At 12:04:52 LT, the pilot received an instruction to turn right onto a heading of 110° and to follow the runway 14 ILS. This instruction was read back incorrectly by the pilot. At 12:05:01 LT, the ATCO then again asked for a confirmation of this clearance; this time it was read back appropriately by the pilot.

During the next one and a half minutes, the passenger read out various checklist points, which were each confirmed or commented upon by the pilot. As the radar recordings show, the aircraft flew through the centre of the localizer beam on a heading of approximately 110° without turning onto the runway 14 localizer and following it. The pilot of EC-HFA responded in the affirmative to the ATCO's question: "*...Confirm, you're catching up the ILS?*". He then corrected the heading to the right and followed the localizer a little later. A conversation followed between the pilot and passenger with regard to the autopilot and the flaps.

At 12:06:39 LT, at a distance of approximately 10 NM from ILS DME 14, the aircraft descended below 4000 ft QNH. At 12:07:07 LT, when EC-HFA was at a distance of approximately 9.5 NM, the ATCO informed the pilot that he would be allowed to leave 4000 ft QNH only at a distance of 8 NM from ILS DME 14. However, according to his radar, the aircraft was already at 3600 ft. He instructed EC-HFA to climb to 4000 ft QNH in order to be able to reach the ILS glide slope. The pilot answered: "*(...) I got the ILS caught, but I go to 4000 ft.*" Subsequent to this radio conversation, the passenger mentioned the following to the pilot, with reference to the approach chart: "*Lo pone aquí. Tenemos las montañas ahí – Here it is. We have hills there.*" EC-HFA then climbed back to an altitude of 4000 ft QNH, which it reached at approximately 8 NM. At about 7 NM, it began the descent and therefore found itself above the ILS glide slope.

With the message "*All stations, ah...we have now RVR one thousand four hundred metres, that's ah...showers of snow coming ah... overhead the field and the final, out.*" at 12:07:41 LT, the Zurich final ATCO informed all aircraft on the frequency that a snow shower was approaching the airport. A little later, the ATCO asked EC-HFA whether the aircraft was now stabilised on the ILS; the pilot confirmed this. At this time the aircraft was between 7 NM and 8 NM from the threshold of runway 14, approximately 200 ft above the glide slope. The ATCO also informed the pilot that the runway visual range (RVR) was now 1200 m. The pilot thanked him and asked the passenger to continue reading out the checklist.

When the aircraft was approximately six miles from the threshold of runway 14, EC-HFA was asked to contact Zurich aerodrome control (ADC). This was confirmed by the pilot on the radio. He repeated the frequency several times to the passenger, who was busy entering the frequencies in this phase of the flight.

At 12:09:10 LT, the pilot of EC-HFA reported to ADC: "*Zurich good morning, Echo Charlie Hotel Fox Alpha, on final.*" ADC answered appropriately and gave the pilot the following information: "*(...) Wind 030°, 17 knots*".

There followed a further discussion between the two persons in the cockpit during which the passenger mentioned that it was now essential to fly precisely straight, because there was a 2500 m high tower to one side. It is highly probable that the passenger was referring to an obstacle which is shown on the approach chart with a tower symbol. This obstacle is approximately 9 NM from ILS DME 14, just to the east of the approach centreline and shows an altitude of 2566 ft AMSL (cf. Annex 4.4). The passenger further suggested that for this reason the autopilot should be used. He finally quoted the value of 2200 ft and asked the pilot whether he did not want to set the flaps to "full flaps" position. At this time, EC-HFA received landing clearance for runway 14. This was immediately acknowledged by the pilot. The pilot then confirmed with the words: "*Full flaps... landing gear*" that everything was now ready for the landing.

According to the radar recordings, throughout the final approach phase EC-HFA was always between 200 and 300 ft above the glide slope. At approximately 12:11:15 LT, EC-HFA reached the decision height of 1602 ft. The last recording of the flight path was at 12:11:27 LT. At this time, the aircraft was at an altitude of approximately 1500 ft. The distance to the threshold of the runway was a few hundred metres.

The passenger asked the pilot not to fly manually but to continue to let the autopilot fly EC-HFA, because there was no ground contact at this time. Shortly afterwards, the passenger mentioned that he could now see some of the ground. A few seconds later, the passenger said: "*Arrivando...Pista, ahí!...La vés?...Muy*

bien, vamos muy bien. Dejalo, dejalo que baje – We're arriving... The runway, there!... Do you see it?... Very good, we're very good. Let her go, let her go, she has to descend." Further statements were then made by both persons in the cockpit. From 12:11:14 LT, the CVR recorded noises of the aircraft skidding on the ground for about 20 seconds.

When the aircraft had come to a standstill, the two persons asked each other how they were. The engines were shut down a little later. The pilot tried to contact ADC by radio. For his part, the ATCO called EC-HFA several times at 12:12:08 LT and asked for confirmation that the aircraft was on the ground.

The pilot of EC-HFA finally reported at 12:12:52 LT that the aircraft was on the ground, but that he did not know exactly where he was. He also confirmed that everyone was fine, but asked for help, because the aircraft was badly damaged.

The ATCO again requested the exact position of the aircraft. The pilot finally answered him, saying that they were located directly in front of the runway 14 precision approach path indicator (PAPI). In fact, the aircraft was in front of the runway 16 PAPI. The aircraft approaching immediately after EC-HFA were instructed to go around.

1.2 Injuries to persons

Type of injury	Crew	Passengers	Third parties
Fatal	---	---	---
Seriously injured	---	---	---
Slightly injured or uninjured	1	2	

1.3 Damage to aircraft

The aircraft was badly damaged. The Cessna C 500 Citation I/SP touched down in landing configuration on the grass in front of runway 14. The aircraft veered to the right and crossed a minor road. In the process, the nosewheel and the right main landing gear were torn off. The aircraft then continued to skid over the ground on its right wing and the remaining left main landing gear and finally came to a standstill in front of the runway 16 PAPI (cf. Annex 4.5 and 4.6).

1.4 Other damage

There was minor crop damage.

1.5 Personnel information

1.5.1 Pilot

Person	Spanish citizen, born 1949
Licence	Private pilot's licence (aircraft) PPL (A) dated 22 July 1983, issued in accordance with JAR on 16 December 2002 by the Spanish civil aviation authority
Ratings	VFR-HJ, visual flying by day

Ratings to be extended	Class rating for multi-engine piston – MEP, valid until 27.07.2003 Type approval for C501/551, valid until 25.11.2003
Instrument flying rating	IR (A), valid until 27.07.2003
Last proficiency check	25.11.2002
Medical fitness certificate	Class 1 Commencement of validity: 13.08.2002
Last medical examination	13.08.2002 Findings: fit, spectacles wearer (VDL)
Total flying experience	>2000 hours ¹
on the accident type	111:35 hours
during the last 90 days	15:20 hours, all on the accident type

At the time of the accident, the main profession of the pilot of EC-HFA was hotelier and he combined his flying with his business activity in Barcelona and the Balearics.

The pilot's IFR training consisted of 70:47 hours on propeller aircraft and 30:00 hours on a procedure trainer. The pilot concluded this training on 18 August 1999. According to information from the Spanish civil aviation authority, the pilot renewed his licences in the year 2000. At the time he stated that he had flown 44:30 hours on Cessna C 414 and 13:28 hours on Piper PA 34 aircraft.

It is also apparent from these records that he began training on the Cessna C 500 Citation I/SP on 22 July 2002. The training comprised 30 flying hours with 42 take-offs. The pilot did not pass an initial skill test which took place on 14 November 2002 on EC-HFA. After eight further hours of training, including 12 take-offs, he acquired the corresponding type approval on 25 November 2002.

The pilot had flown to Zurich once before the day of the accident. This flight took place on 17 August 2002 as part of his training to obtain the type approval.

Essentially, the pilot made flights with EC-HFA between the aerodromes of Barcelona (LEBL), Ibiza (LEIB), Palma de Mallorca (LEPA) and Sabadell (LELL). Occasionally there was a flight to Cannes, where the Cessna C 500 Citation I/SP was serviced.

Immediately after the accident, the pilot stated that from 10 to 12 February 2003 he had taken a Citation II recurrent course with a recognised training organisation.

This training centre confirmed the participation of the pilot involved in the accident with the following comments, written down on 11 March 2003:

¹ According to the pilot's information, he was not required in Spain to record his flying hours in full.

"Flight training curriculum

Cockpit trainer: 01H00

Simulator hours left seat: 06H00

Briefing/debriefing: 03H00

Remarks:

Trainee is below minimum standard level. Need additional training:

- *Instrument general flying*
- *Ground course to understand systems*
- *Simulator training (must complete an initial type rating)"*

1.5.2 The passenger in the second pilot's seat

Person	Spanish citizen, born 1960
Licence	Private pilot's licence (aircraft) PPL (A) dated 2 July 1998, issued in accordance with JAR on 20 February 2002 by the Spanish civil aviation authority
Ratings	VFR-HJ, visual flying by day
Ratings to be extended	Class approval for single engine piston – SEP
Medical fitness certificate	Class 2 Commencement of validity: 06.02.2002
Last medical examination	6 February 2002

The passenger in the second pilot's seat was a person who was close to the pilot.

1.6 Aircraft information

1.6.1 General

The Cessna C 500 Citation I/SP was registered in July 1999 in Spain as EC-HFA and operated by a company in Barcelona. In October 2002, this aircraft was sold on and operated out of Barcelona by Ibiza Flights S.L. up to the time of the accident on 7 April 2003.

1.6.2 Aircraft EC-HFA

Aircraft type	Cessna C 500 Citation I/SP
Manufacturer	Cessna Aircraft Company, Wichita, Kansas, USA
Serial number	0209
Year of construction	1974
Owner	BANCA MARCH S.A., Avda Alejandro Roselló, 4-07002 Palma de Mallorca, Balearics, Spain
Operator	Ibiza Flights S.L., Pso. Vara de rey 2, 07800 Ibiza, Balearics, Spain

Airworthiness certificate	No. 2 dated 11 December 2002, issued by the Spanish civil aviation authority (<i>Dirección General de Aviación Civil</i>)
Certification	No. 4.501 dated 11 December 2002, issued by the Spanish civil aviation authority (<i>Dirección General de Aviación Civil</i>) Category: Private (1), sub-category: Normal flights in icing conditions Night flying Visual flight rules (VFR) Instrument flight rules (IFR) Instrument approaches
Minimum crew	1 pilot
Airframe flying hours	13 309:05 hours
Airframe, number of cycles	14 054
Engines	Two turbofan engines, Pratt & Whitney Canada Inc., type JT15D-1A
Fuel	Kerosene, JET A, A-1, A-2, B, JP-4, JP-5, JP-8
Flight time reserve	After the accident there were still approximately 1200 lbs of fuel in the tanks, corresponding to more than one hour's flying time.
Wingspan	14.35 m
Length	13.26 m
Height	4.36 m
Max. permitted take-off mass	5227 kg (11 500 lbs)
Max. permitted landing mass	5000 kg (11 000 lbs)

1.6.3 Engine number 1 (left)

After the accident, the logbook for the left engine was acquired. It was apparent that records were kept up to 12 February 2003.

Serial number	PCE 76165
Operating time	12 829:55 hours
Flying cycles	13 444
Flying cycles since last check (phase 1 and 2)	136
Operating time since last check (phase 1 and 2)	79:10 hours

1.6.4 Engine number 2 (right)

After the accident, the logbook for the right engine was acquired. It was apparent that records were kept up to 12 February 2003.

Serial number	PCE 76004
Operating time	12 187:35 hours
Flying cycles	12 254
Flying cycles since last check (phase 1 and 2)	136
Operating time since last check (phase 1 and 2)	78:10 hours

1.6.5 Communication and navigation equipment

The following systems were available on EC-HFA for communication and navigation:

- Garmin GNS 430 (GPS/NAV/COM 1)
- King KX 165 (NAV/COM 2)
- King KY 196B (COM 3)
- Trimble TNL 2000 (GPS 2)
- King KHF950 (COM HF)
- King KN 63 (DME)
- King KDF 800 (ADF)
- RCA AVQ-25 (transponder)
- King RDR 2000 (weather radar)
- Collins radar altimeter
- AME King AK-450 (ELT)

1.6.6 Mass and centre of gravity

A loadsheet was drawn up by the pilot for the flight from Barcelona to Zurich. The pilot of EC-HFA came to the conclusion that the mass and centre of gravity were within the permitted limits.

Since this loadsheet contained mathematical errors, the following analogous calculations were made to determine the mass and centre of gravity in accordance with the owner's specifications:

Item	Arm (in)	Mass (lb)	Moment (in•lb/100)
Seat 5&6	207	200	414.0
Nose Bagg	74	40	29.6
Aft Bagg	375	100	375.0

Item	Arm (in)	Mass (lb)	Moment (in•lb/100)
Total payload	240.765	340	818.6
Basic empty mass	263.4	6804	17 921.7
Pilots	131.0	340	445.4
Subtotal	256.356	7484	19 185.7
Max. 9500 lb			
Blockfuel	255.5	3600	9198.0
Taxifuel	255.5	- 150	- 383.3
Takeoff mass	256.086	10 934	28 000.4
Max. 11,500 lb			
Burnoff	255.5	2200	5621.0
Landing mass	256.233	8734	22 379.4
Max. 11 500 lb			

These calculations showed that the mass and centre of gravity were within the permitted limits during the flight involved in the accident.

1.6.7 Maintenance of the aircraft

From the available documentation, it is apparent that EC-HFA was serviced by a maintenance company certificated to JAR 145.

On 3 July 2002, as part of a check on EC-HFA, the phase inspections 5, 22, 23, 49 and 50 were carried out. At this time the operating time of the aircraft was 13 169:30 hours, with 13 896 flying cycles.

1.6.8 Condition of the aircraft at the time of the accident

Immediately after the accident, the pilot of EC-HFA stated that shortly before the landing he had had a problem with the right engine. This engine was examined. The results of this examination are given in section 1.16.2.

With regard to the navigation displays in the cockpit, the pilot did not claim that there were any malfunctions.

1.7 Meteorological information

1.7.1 General

The information in sections 1.7.2 to 1.7.5 was provided by MeteoSwiss.

1.7.2 General weather situation

The centre of an extended high-pressure area was located over Scandinavia. Switzerland was at the south-eastern edge of this high-pressure area, in a north to north-east air current. In the lower strata of the atmosphere, a north-easterly 'bise' wind was blowing, within which there were some heavy snow showers.

1.7.3 Weather conditions at Zurich airport

1.7.3.1 Weather at the Oberglatt observation station at the time of the accident

Wind	Measuring point runways 14 and 16: 070°, 8 kt, gusting to 22 kt
Ground visibility	700 m
Weather	Snow showers
Cloud	Vertical visibility 130 ft
Temperature	-3 °C
Dew point	-4 °C
Atmospheric pressure	1021 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere
Position of the sun	Azimuth: 152° Elevation: 46°

1.7.3.2 Weather conditions in the runway 14 approach area

In the runway 14 approach area, rapidly changing weather conditions prevailed. Cumulus clouds, causing tightly delimited, partly heavy, snow showers, were travelling from the north-east over the airport area. Good visibility prevailed between the individual showers; the base of the main layer of cloud was at 8400 ft AMSL.

The rapidly changing conditions were also confirmed by eye witnesses. A crew which approached before the flight involved in the accident reported no significant phenomena apart from snow showers; other crews reported wind shears near the ground and a gusting cross wind.

At the time of the accident, a shower cell was passing through the RWY 14 approach area from the north-east.

Between 12:00 LT and 12:20 LT a distinct drop in temperature was recorded at the measurement points for runways 14/16. This reduction in temperature was caused by the cold air flowing out of the shower cell. It is therefore very probable that there were downdraughts within the shower cell, but it is impossible to quantify these. As a result of these downdraughts there were also significant wind shears in the area of the shower cell.

1.7.4 Aerodrome weather forecast

Among other things, the pilot of EC-HFA had the following Zurich terminal aerodrome forecast (TAF) available for planning his flight in Barcelona:

```
070600Z 070716 35005KT 9999 FEW030 BKN060 TEMPO 0716 3500 -SHSN  
BKN040=
```

In clear text, this means that on 7 April 2003, for the period from 07:00 UTC until 16:00 UTC, the following weather conditions were forecast for Zurich Airport:

Wind	350°, speed 5 kt
Meteorological visibility	over 10 km
Cloud	1-2/8, base 3000 ft AAL, corresponding to "slightly overcast" 5-7/8, base 6000 ft AAL, corresponding to "heavily overcast"
Change	Between 07:00 UTC and 16:00 UTC the following intermittent changes are expected: Visibility 3500 m, light snow showers, cloud 5-7/8 at 4000 ft AAL, corresponding to "heavily overcast".

1.7.5 Aerodrome weather reports

In the hour before the accident until shortly after the accident, the following METAR aerodrome weather reports applied:

METAR 070920Z 07014KT 9999 VCSH FEW010SCT035 BKN070 M00/M06 Q1020 8829//99 NOSIG=

In clear text, this means that the following weather conditions were observed at Zurich Airport on 7 April 2003 at 11:20 LT:

Wind runway 14/16	070°, speed 14 kt
Ground visibility	over 10 km
Weather	Showers in the immediate vicinity
Cloud	1-2/8, base 1000 ft AAL, corresponding to "slightly overcast" 3-4/8, base 3500 ft AAL, corresponding to "overcast" 5-7/8, base 7000 ft AAL, corresponding to "heavily overcast"
Temperature	-0 °C
Dew point	-6 °C
Atmospheric pressure	1020 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere
Runway condition	All runways more than 50% wet or puddles of water, depth of accumulation not operationally significant, no reliable information possible regarding effect on braking
Land weather forecast	No significant change expected in the next two hours

METAR 070950Z 09010KT 050V140 9999 VCSH FEW010SCT035 BKN070 00/M06 Q1020 8829//99 TEMPO 1500 SN=

In clear text, this means that the following weather conditions were observed at Zurich Airport on 7 April 2003 at 11:50 LT:

Wind	090°, speed 10 kt Variation in wind direction from 050° to 140°
Ground visibility	over 10 km
Weather	Showers in the immediate vicinity
Cloud	1-2/8, base 1000 ft AAL, corresponding to "slightly overcast" 3-4/8, base 3500 ft AAL, corresponding to "overcast" 5-7/8, base 7000 ft AAL, corresponding to "heavily overcast"
Temperature	-0 °C
Dew point	-6 °C
Atmospheric pressure	1020 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere
Runway condition	All runways more than 50% wet or puddles of water, depth of accumulation not operationally significant, no reliable information possible regarding effect on braking
Land weather forecast	In the two hours following the weather observation it is to be expected that meteorological visibility will at times be reduced to 1500 m, associated with snowfalls. It is expected that the total time of this change will be less than one hour.

METAR 071020 02017KT 0700 R14/P1500U R16/P1500U R28/P1500U SHSN VV001 M03/M04 Q1021 8829//99 NOSIG=

In clear text, this means that the following weather conditions were observed at Zurich Airport on 7 April 2003 at 12:20 LT:

Wind runway 14/16	020°, speed 17 kt
Ground visibility	700 m
Runway visual range	Runway 14: over 1500 m, increasing Runway 16: over 1500 m, increasing Runway 28: over 1500 m, increasing
Weather	moderate snow showers
Cloud	Vertical visibility 100 ft
Temperature	-3 °C
Dew point	-4 °C
Atmospheric pressure	1021 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere
Runway condition	All runways more than 50% wet or puddles of water, depth of accumulation not operationally significant, no reliable information possible regarding effect on braking
Land weather forecast	No significant change expected in the next two hours

1.7.6 Weather information according to Skyguide

Information SIERRA at 11:20 LT

*LSZH 0920Z 07.04.2003
060 DEG 16 KT
VIS 20 KM
VICINITY SHOWERS
FEW 1000 FT. SCT 3500 FT. BKN 7000 FT
-00/-06
QNH 1020 TWO ZERO
QFE THR 14 970
QFE THR 16 970
QFE THR 28 969
NOSIG*

Information TANGO at 11:52 LT

*LSZH 0950Z 07.04.2003
070 DEG 10 KT
VIS 20 KM
VICINITY SHOWERS
FEW 1000 FT. SCT 3500 FT. BKN 7000 FT
-00/-06
QNH 1020 TWO ZERO
QFE THR 14 970
QFE THR 16 970
QFE THR 28 969
NOSIG*

Information UNIFORM at 11:53 LT

*LSZH 0950Z 07.04.2003
070 DEG 10 KT
VIS 20 KM
VICINITY SHOWERS
FEW 1000 FT. SCT 3500 FT. BKN 7000 FT
-00/-06
QNH 1020 TWO ZERO
QFE THR 14 970
QFE THR 16 970
QFE THR 28 969
TEMPO VIS 1500M. SNOW*

Information VICTOR at 12:20 LT

*LSZH 1020Z 07.04.2003
020 DEG 15 KT
VIS 700 M R14/P1500 R16/P1500 R28/P1500
SHOWERS OF SNOW
VER VIS 130 FT
-03/-04
QNH 1021 TWO ONE
QFE THR 14 971
QFE THR 16 971
QFE THR 28 970
NOSIG*

1.8 Aids to navigation

1.8.1 Navigation aids for ILS approach on runway 14

The instrument landing system for this runway and the Trasadingen (TRA) DVOR/DME are used as navigation aids for an ILS approach on runway 14. Both systems are equipped with distance measuring equipment (DME).

Navigation aid	ILS LLZ 14 ZRH
Geographical location	47° 27' 32.6" N, 008° 34' 03.0" E
Frequencies	LLZ 108.30 MHz, DME channel 20 X
Period of operation	24 hours

Navigation aid	GP 14
Geographical location	47° 28' 49.9" N, 008° 32' 25.4" E
Height above threshold of runway 14	53 ft
Frequencies	334.110 MHz
Period of operation	24 hours

Navigation aid	DVOR/DME TRA
Geographical location	47° 41' 22.2" N, 008° 26' 13.2" E
Height above sea level	1850 ft AMSL
Coverage (DOC)	100 NM/50 000 ft
Frequencies	DVOR 114.30 MHz, DME channel 90 X
Period of operation	24 hours

On 7 April 2003 these transmitter installations were in normal service and according to air traffic control were available without any limitations.

1.8.2 Other navigation aids

Navigation aid	DVOR/DME KLO (Kloten)
Geographical location	47° 27' 25.7" N, 008° 32' 44.1" E
Height above sea level	1410 ft AMSL
Coverage (DOC)	50 NM/25 000 ft
Frequencies	DVOR 114.85 MHz, DME channel 95 Y
Period of operation	24 hours

1.9 Communication

1.9.1 General

Air traffic control unit	Abbreviation	Frequency
Radar lower sector west	RE W	135.67 MHz
Arrival sector west	APW	118.00 MHz
Final	FIN	125.32 MHz
Aerodrome control (tower)	ADC	118.10 MHz

1.9.2 Ground based recordings

The following data in the control tower were continuously recorded by a digital storage system and saved on digital data storage (DDS):

- all VHF radio channels in use; in addition, a recording device for short-term recordings was installed at the ADC workstation
- all wired links between the workstations
- all telephone conversations at the workstations
- radiotelephone links for communication with police and rescue services

Comprehensibility was good and the recording was complete.

The conversations in the control tower were not recorded by an area microphone.

1.10 Aerodrome information

1.10.1 General

Zurich airport is located in north-east Switzerland; the runways have the following dimensions:

Runway designation	Dimensions	Elevation of runway thresholds
16/34	3700 x 60 m	1390/1386 ft AMSL
14/32	3300 x 60 m	1402/1402 ft AMSL
10/28	2500 x 60 m	1391/1416 ft AMSL

The reference elevation of the airport is 1416 ft AMSL and the reference temperature is specified as 24.0 °C.

1.10.2 Runway equipment

The airport is characterised by a system of three runways, two of which (16 and 28) intersect at the airport reference point. The approach corridors of two other runways (16 and 14) intersect approximately 850 metres north-west of the threshold of runway 14. Runways 16 and 14 are equipped with a Category III instrument landing system (ILS) and are therefore suitable for precision approaches. Runway 28 allows non precision approaches based on VOR/DME KLO.

Runway 14 is equipped with a lighting system complying with ICAO standards for continuous operation under all weather conditions. A distinction is made between lighting systems with high (LIH – light intensity high) and low (LIL – light intensity low) intensity.

The high-intensity runway centreline lighting and the high-intensity runway edge lighting are important for landings in poor visibility. The intensity of this lighting can be set to 1%, 3%, 10%, 30% and 100%.

The runway centreline lighting system is laid in the ground and heated. The lamps are installed at 15 m intervals. They are white up to 900 m before the end of the runway. Between 900 m and 300 m before the end of the runway they are alternately white and red, and over the last 300 m they are red only. The emission angle is set vertically to 3°.

The runway edge lighting is positioned at 30 m intervals on both sides and is approximately 1 m outside the useable runway surface. The lights are white and over the last 600 m before the end of the runway they are amber.

1.10.3 Rescue and fire-fighting services

Zurich airport is equipped with Category 9 fire-fighting resources. The concept guarantees intervention within two to maximum three minutes at any point within the airport area. For this purpose the fire-fighting service maintains two main support points – “Base” watch and “North” satellite – which both possess quantities of fire-fighting equipment in compliance with ICAO recommendations. In addition, the Satellite “A” location (at the western end of Fingerdock A), has a general-purpose extinguisher vehicle.

The airport’s professional fire-fighting service is on permanent stand-by during operation of the airport. In the event of an incident or accident, the intervention forces are in constant contact with the control tower and the police using appropriate means of communication.

1.11 Flight recorders

1.11.1 Cockpit voice recorder

EC-HFA’s cockpit voice recorder was removed on the day of the accident and could be evaluated. The quality of the recording was good. The duration of the recording was 30 minutes.

1.11.2 Flight data recorder

No flight data recorder was installed in EC-HFA. Nor was the installation of such a device prescribed.

1.12 Wreckage and impact information

The first point at which EC-HFA made contact with the ground, on the wet grass, was within the airport area, approximately 700 m before the threshold of runway 14. The aircraft then skidded slightly to the right between the runway 14 approach lights. The nose gear and the right main landing gear were torn off when the aircraft crossed a minor road. The aircraft then slid along the ground on the remaining left main landing gear and the right wing until it came to a standstill approximately 400 m before the threshold of runway 16 (cf. Annex 4.6).

1.13 Medical and pathological information

None.

1.14 Fire

Fire did not break out.

1.15 Survival aspects

As the first traces on the ground showed, EC-HFA touched down at a relatively low rate of descent on the wet grass.

The fact that there was no subsequent collision with elements of the approach lighting system for runways 14 and 16 meant that the aircraft's airframe remained intact throughout the deceleration phase.

It should be noted that off-runway contact with the ground by a fast aircraft generally constitutes a high risk to occupants. In the present case, the above-mentioned favourable circumstances meant that the accident passed off without injury.

1.16 Tests and research

1.16.1 Investigation of various aircraft systems

As part of the investigation, the following systems, among others, were examined in terms of their functioning:

- fuel system
- engine de-icing
- engine ignition systems
- engine control systems

No defects could be found. In addition, a boroscopic examination was carried out on both engines. The changes due to soil material which had been sucked in were attributable to the accident.

1.16.2 Examination of engine number 2 (right)

After the accident, the pilot of EC-HFA stated that shortly before the landing he had had a problem with the right engine.

The right engine was examined more closely on a test bench. It was found that all the parameters were within tolerance and that the engine functioned perfectly.

1.16.3 Analysis of the fuel filter and the fuel used

Analysis of the fuel used in EC-HFA, the two fuel filters and the fuel system revealed no abnormalities.

1.16.4 Examination of the autopilot

An investigation was carried out as to whether the autopilot could be switched off in accordance with the test described in the maintenance manual and whether the corresponding warnings were audible and lit up respectively.

During this test it was found that the autopilot could be switched off as specified and the amber warning annunciation AP OFF lit up as required. One defect which was found was that the red AP OFF warning annunciation and the audio warning which indicates that the autopilot has switched off were not functioning.

1.16.5 Investigation of the navigation equipment

The following defects were found in the navigation equipment:

- NAV 2 repeater on the pilot side: After powering up NAV 2 and with missing or erroneous localizer or glide path signals, neither the localizer flag nor the glide path flag were visible in the NAV display. Therefore the device was not usable for navigation.
- The radio altimeter display oscillated continuously between 0 and 50 ft RA. This malfunction was very probably caused by the accident.
- During the inspection of the equipment, the PN 101 compass circuit breaker tripped approximately 10 seconds after the electrical power was switched on. Compass system 2 was therefore unserviceable. NAV 2 could no longer be coupled to the autopilot.

1.17 Organisational and management information

The Ibiza Flights S.L. company had been operating EC-HFA out of Barcelona Airport since October 2002. According to the documentation available, only the pilot on the flight involved in the accident had flown this aircraft up to 7 April 2003. Only private flights were involved, in connection with the pilot's business and private activities.

2 Analysis

2.1 Technical aspects

2.1.1 General

With regard to the navigation displays in the cockpit, no malfunctions were noted by the pilot. Immediately after the accident, the pilot of EC-HFA also stated that shortly before landing he had had a problem with the right engine.

However, a technical examination produced no indications of a malfunction of this engine at the time of the accident.

2.1.2 Autopilot

From the CVR recordings it follows that the autopilot was functioning. As the technical examination of the autopilot showed, it could be switched off normally. If the autopilot is switched off inadvertently, or if it fails in some way, a red warning lamp lights up in the cockpit and an audio warning sounds over the speaker. The technical examination showed that these two warning signals were not working and it would therefore have been possible for the pilot not to notice immediately that the aircraft was no longer being controlled by the autopilot.

However, from the recordings of the cockpit conversations, it is apparent that EC-HFA was being controlled by the autopilot throughout the approach. This can be stated on the basis of the radar recordings of the ILS approach on runway 14. Moreover, this assumption is supported by the passenger's statement at the end of the approach, when he asks the pilot not to switch off the autopilot too early.

However, in view of the above-mentioned autopilot malfunction it was not possible to establish whether or at what point in time the autopilot was switched off. Since this aircraft is unable to make any landings with the aid of the autopilot, it may be assumed that the pilot had the intention of switching off the autopilot before landing. This assumption is confirmed by the rather low rate of descent of the aircraft when it impacted the ground. However, the operating status of the autopilot during the impact is irrelevant.

2.1.3 Navigation equipment

On the navigation equipment side, two technical defects are worth mentioning in connection with a flight under instrument flight rules. The fact that no warning flags were visible on the NAV 2 repeater on the pilot side in the event of an absent or erroneous localizer or glide slope signal meant that the pilot of EC-HFA was unable to exercise appropriate monitoring of the aircraft's two navigation receivers in terms of the correctness of the signals.

Because of a fault in compass system two, the PN 101 compass circuit breaker tripped always after about ten seconds. This made this system unserviceable. Consequently, the autopilot could no longer be coupled to navigation system two.

If compass system one had failed, the autopilot would no longer have functioned, and the pilot would only have had the standby compass available to determine his heading.

2.1.4 Summary

The above-mentioned defects made control of EC-HFA more difficult. The investigation produced no indications of any additional technical faults which might have caused the accident.

2.2 Operational aspects

2.2.1 Pilot

Until the summer of 2002, the pilot involved in the accident flew almost exclusively on a Cessna C 414 and a Piper PA 34.

Among other things, the following events during the flight involved in the accident permit the conclusion that the pilot did not have the necessary capability to fly an aircraft such as the Cessna C 500 Citation I/SP in one-man operation, under IFR and under difficult conditions:

- difficulties handling radiocommunications
- incorrect joining of the EKRIT holding (cf. Annexes 4.2 and 4.3)
- imprecise flying of the EKRIT holding patterns
- flying through the runway 14 localizer beam centre without capturing it
- leaving the intermediate approach altitude of 4000 ft AMSL too early
- an incorrect decision on reaching the decision height

The fact that the pilot had to take the test to obtain the type rating on a Cessna C 500 Citation I/SP twice, and the assessment of the training centre dated 11 March 2003, further allow the assumption that the pilot did not have the necessary basic technical knowledge to detect the faults described in section 1.16.4 and 1.16.5 and take appropriate measures.

This assessment also finds fault with the pilot's general instrument flying skills. This finding is substantiated by the fact that during the 7 April 2003 flight involved in the accident the pilot was not able to correctly join the EKRIT holding (Annexes 4.2 and 4.3). Two possible reasons for this could be on the one hand his relative inexperience on the aircraft type involved in the accident and on the other hand his flying activity under Mediterranean conditions, limited to a few destinations.

Since this training centre also recommended that the pilot of EC-HFA complete a full type transition on the simulator, it is doubtful whether he had been trained in summer 2002 on EC-HFA up to an acknowledged standard.

Finally, it should be mentioned that the necessary entries for this flight were present on the licence.

2.2.2 Analysis of the flight

From an examination of the available documentation, it follows that on 7 April 2003 the pilot was flying to Zurich for the second time. The following circumstances also influenced the course of the flight:

- flying an executive jet in one-man operation
- communication with the air traffic control unit in English
- volume of traffic at the time of the approach
- rapidly changing weather conditions
- the influence of the passenger in the right-hand pilot seat
- a lack of systematic work flow in the cockpit

On the day of the accident, the above-mentioned points, partially occurring simultaneously, affected the entire course of the flight.

This starts with the basic prerequisite that IFR flying in one-man operation requires the aircraft to be flown with a certain systematic. If such a systematic is not comprehensively implemented, the pilot of an aircraft type such as the Cessna C 500 may quickly lose his overview and can no longer carry out procedures in a structured fashion during the flight, respectively understand them.

The CVR recordings prove in several instances that the pilot was often interrupted in his work throughout the flight during important flight phases. The fact that after such an interruption the pilot repeatedly started the original process from the beginning is evidence of the lack of a systematic approach. One example is the fact that the approach briefing was never completed in full, because the pilot was repeatedly busy communicating with ATC or was reacting unnecessarily to trivial comments by his passenger.

As a result of the lack of a systematic approach, the pilot's capacity became increasingly limited and during the final phase of the approach this meant that he was no longer able to judge at the decision height whether a go-around might not have been more appropriate under the prevailing weather conditions. The decision nevertheless to force the landing was certainly abetted by the passenger's comment that he could see the runway. The pilot's constant workload at this time probably led to a certain restriction of concentration.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- Aircraft EC-HFA had various minor defects. However, there is no indication that these or other defects had any effect on the accident.
- There are no indications that the right engine complained about by the pilot was not functioning normally at the time of the accident.
- The logbooks of both engines were maintained up to date only up to 12 February 2003.

3.1.2 Pilot

- The pilot was in possession of appropriate pilot's licences.
- The pilot's flying activity was limited to a few destinations in the Mediterranean area of Spain and France.
- In order to obtain a type rating for the Cessna C 500 Citation I/SP, the pilot had to take the test twice.
- Approximately two months before the accident, a training centre assessed the pilot's skills in controlling an aircraft similar to the type involved in the accident as unsatisfactory.
- This training centre recommended that the pilot undergo a complete type transition on the simulator.
- The pilot flew EC-HFA to Zurich for the first time some eight months before the accident.
- The passenger in the right cockpit seat was in possession of a private pilot's licence.

3.1.3 History of the flight

- At the time of arrival in Zurich the volume of traffic was relatively high.
- The pilot was not able to correctly join the EKRIT holding.
- The pilot several times had difficulties in following the air traffic control unit's instructions.
- Throughout the approach, the pilot was distracted several times by the passenger in the right cockpit seat.
- The pilot flew through the centre of the localizer beam on a heading of approximately 110° without turning onto the runway 14 localizer and following it.
- The air traffic control unit made the pilot aware of this mistake.
- The altitude was not complied with during the final approach before reaching the final approach point (FAP).

- The air traffic control unit drew the pilot's attention to the fact that his altitude was too low in this flight phase.
- A shower cell was passing through the runway 14 approach area from the north-east.
- At 12:07:41 LT, Zurich final air traffic control informed all crews on its frequency of the current runway visual range of 1400 m.
- At 12:08:13 LT, Zurich final air traffic control informed the pilot of EC-HFA that the runway visual range was now 1200 m, because of the snow shower.
- EC-HFA collided with the ground at approximately 12:11 LT about 700 m in front of the threshold of runway 14.
- The wreck came to a standstill approximately 400 m ahead of the threshold of runway 16.

3.2 Cause

The accident is attributable to the fact that the pilot, with insufficient visual references, continued his approach below the minimum and the aircraft collided with the ground approximately 700 m before the threshold of runway 14.

The following factors contributed to the accident:

- unsatisfactory flying qualification on the aircraft type involved in the accident.
- distraction by the passenger during the entire approach and at the decision height.

Berne, 23 November 2006

Aircraft Accident Investigation Bureau

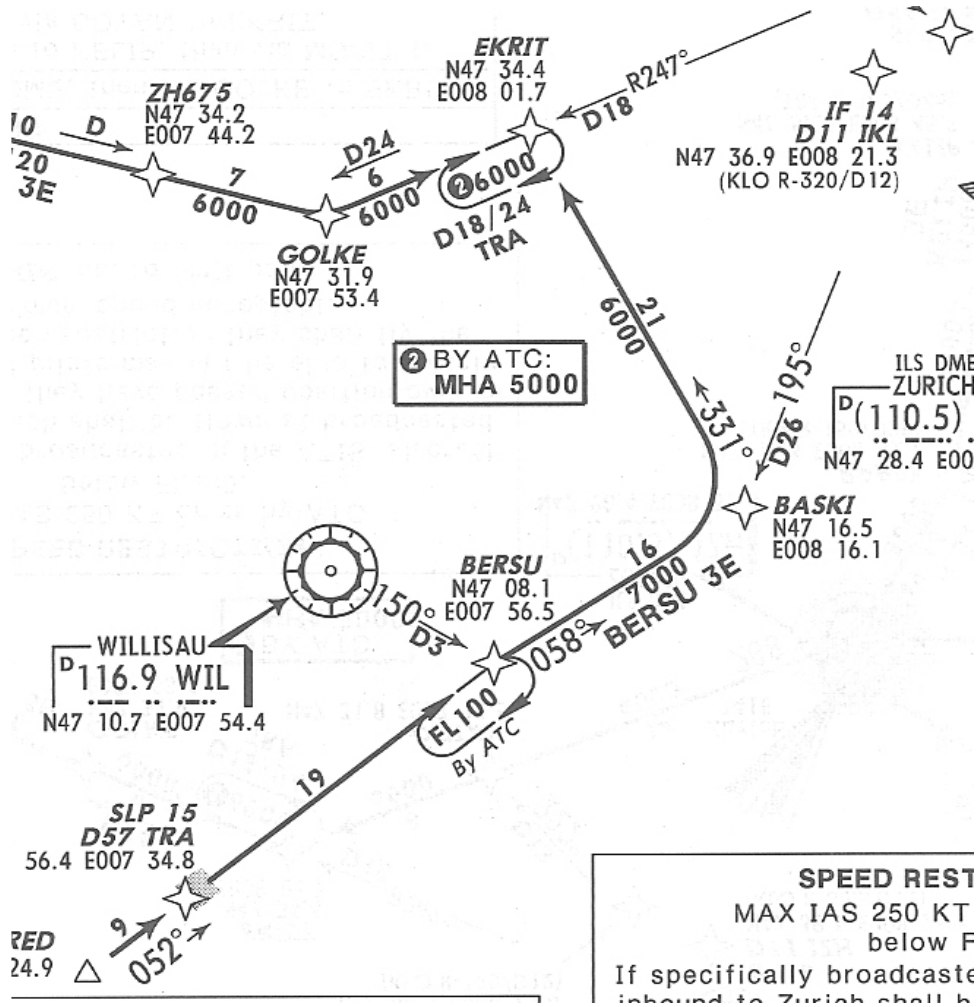
This report contains conclusions by the AAIB about circumstances and causes of the investigated accident.

In accordance with Annex 13 of the Convention on International Civil Aviation, dated 7 December 1944, as well as article 24 of the Swiss Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future accidents or serious incidents. The legal appreciation of the circumstances and causes of the accident/serious incident is explicitly not object of the investigation. It is therefore also not the purpose of this report to determine blame or clarify questions of liability.

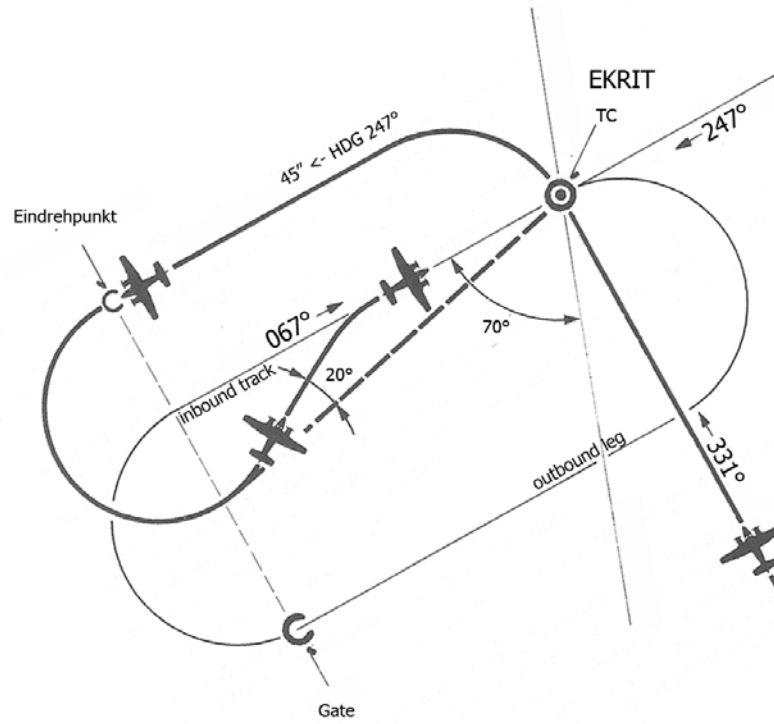
If this report be used for other purposes than for accident prevention these circumstances have to be duly taken in account.

Annexes

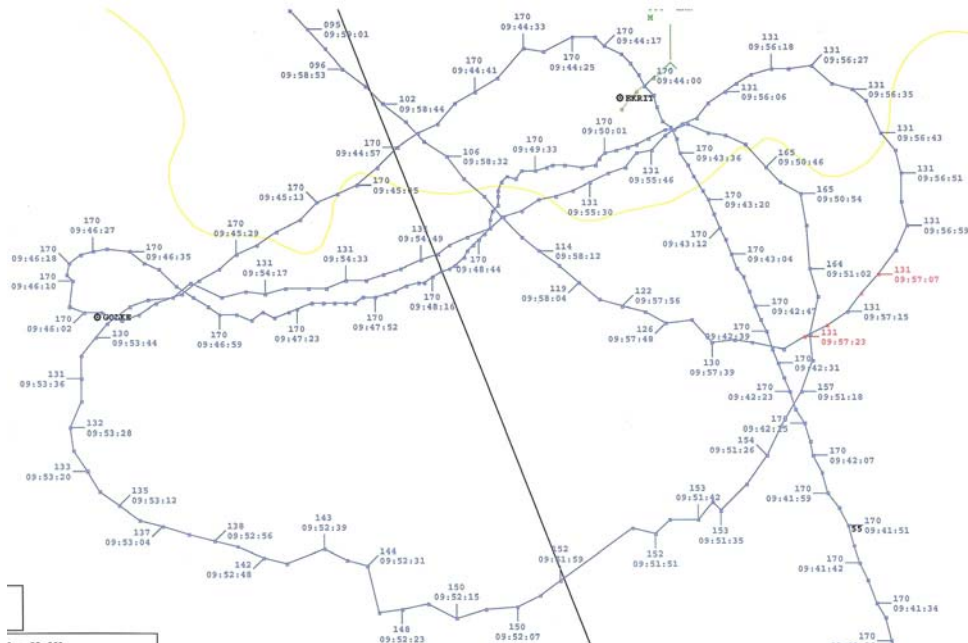
Annexe 1: Standard approach route BERSU 1E



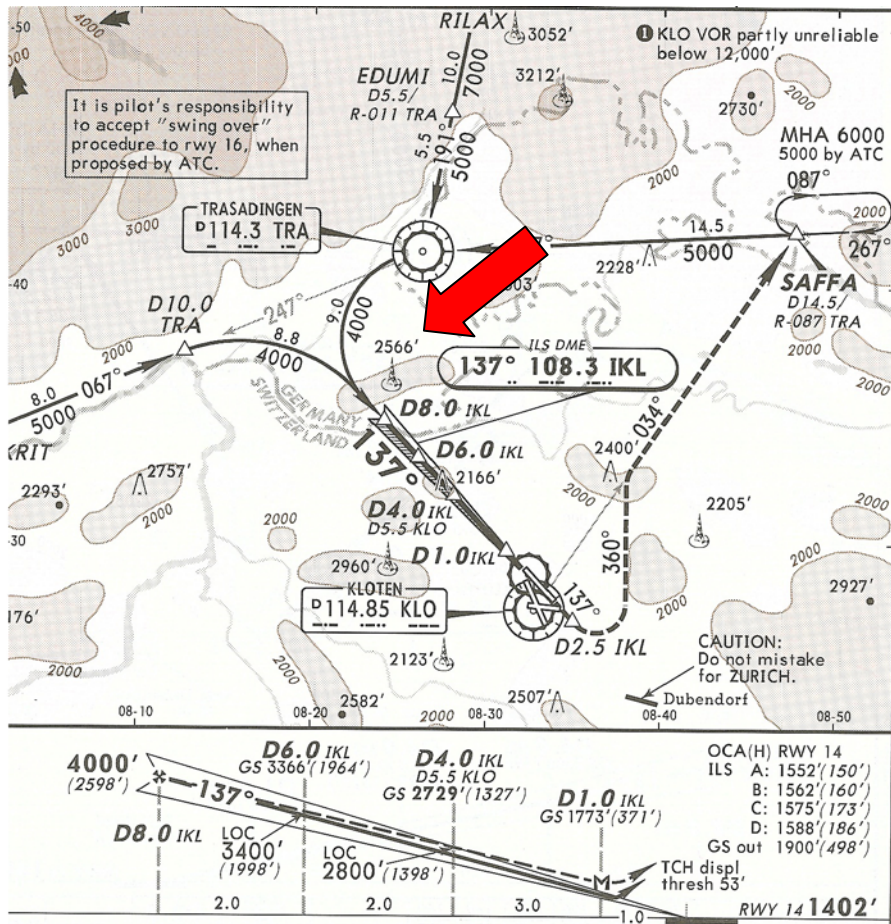
Annexe 2: Parallel entry procedure



Annexe 3: EC-HFA radar recording, joining EKRIT



Annexe 4: Obstacle to the west of the runway 14 centreline



Annexe 5: Wreck of EC-HFA



Annexe 6: Final position of the wreck

