No. 5

SADIA S/A Transportes Aéreos, Dart Herald 214, PP-SDJ, accident at Piraquara, Morretes Municipality, State of Paraná, Brazil, on 3 November 1967. Report dated 25 March 1968 released by the Aviation Accident Investigation and Prevention Service, Department of Aeronautics, Inspectorate General, Brazil

1.- Investigation

1.1 History of the flight

The aircraft, registration PP-SDJ, took off from São Paulo/Congonhas airport, São Paulo, at 1015 hours Z, with Curitiba/Afonso Pena, Paraná, as its destination, carrying five crew members and twenty passengers.

In accordance with its approved IFR flight plan, the aircraft was to fly Airway Green 3 at flight level 130, and at a speed of 300 km/h. The flight time on the São Paulo-Curitiba segment was estimated to be 1:00 hour.

After the take-off from São Paulo the flight proceeded in accordance with the approved flight plan in visual meteorological conditions (VMC) as far as the vicinity of Paranaguá. There the aircraft changed to instrument flight (IMC) in moderate turbulence.

At that moment one of the ADF was set on the Paranaguá marine NDB (NX-320 kc/s) and the other on the Paranaguá NDB (PG-340 kc/s).

Without a correct fix being obtained over Paranaguá (see Fig. 5-1) the position report was transmitted at 1117 hours Z to Curitiba Control and the aircraft changed heading, approaching Curitiba on a magnetic heading of 283°. The ADFs were then set respectively on the frequencies of the Curitiba NDB (CT-390 kc/s) and the Bacacheri NDB (BI-300 kc/s).

The pilots found it necessary to change the ADF frequencies several times on the São Paulo-Curitiba segment and finally one ADF was set on the Curitiba NDB and the other on Broadcasting Station ZYM-5 (560 kc/s). In reply to the position report Curitiba Control cleared the aircraft to descend to flight level 70 and report when having the Bacacheri NDB at 30°: the aircraft flew in IMC conditions and moderate turbulence with its airborne radar and VOR switched off.

At 1126 hours Z the pilot reported his position to Curitiba Control as having the Bacacheri NDB at 30° and he was instructed to proceed and hold above Curitiba NDB and descend to flight level 50.

At 1128 hours Z the pilot reported over Curitiba NDB and initiated the downwind leg (IFR descent pattern phase for touchdown on Curitiba/Afonso Pena runway 15). After this radio message the aircraft left the magnetic heading 283° relating to the São Paulo-Curitiba segment to intercept the downwind leg on a heading of 359° in the descent pattern.

Seventeen seconds later when the aircraft had executed approximately 45° of a turn to the right, it collided on a heading of 325° with a hill at an altitude of 4 635 ft.

At the moment of impact the aircraft was executing a turn with slight bank to the right.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	3	18	
Non-fatal	2	2	
None			

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

There was no damage to third parties.

1.5 Crew information

The pilot-in-command of the aircraft held an airline pilot's licence with valid IFR rating and medical certificate. He was 50 years old and had the following experience:

Flying hours	14 104:00
Total on type IP "DH"	2 568:48
Hours flown on this type:	
during the last 30 days	32:32
during the last 24 hours	02:25

The co-pilot held an airline pilot's licence and valid ratings and medical certificate. He was 35 years old and had the following experience:

Flying hours	5 963:18
Hours on this type	
total	2 021:48
during the last 30 days	72:45
during the last 24 hours	02:25

1.6 Aircraft information

Dart Herald PP-SDJ was manufactured in 1965 and had been flown a total of 3 191:45 hours. The last 100 hours check was performed on 31 October 1967. At the time of the accident the aircraft complied with the maintenance regulations.

Airframe: 100 hours inspection on 31 October 1967.

Total hours since last general overhaul: 3 191.45 hours

ENGINES	(1)	(2)
Total hours:	3 191:45	5 207:03 hours
Number of overhauls	-	1
Place of last general overhaul	-	M.R. Royce
Hours since last general overhaul	-	2 510:42 hours
PROPELLERS:		
Hours since last general overhaul	2 695.05	1 757.18 hours

From the aircraft log, the condition of the wreckage, and the characteristics of the accident it was concluded that there was no structural failure.

1.7 Meteorological information

The meteorological conditions at 1128 Z in the area of Curitiba Airport and of the accident were as follows:

Ceiling	8/8 stratus at 100 m
Visibility	14 m
Windspeed	6 kt
Wind direction	200°C
Temperature	16°C
Dew point	15°C
Turbulence	Moderate

Radio-wind observation at 10:40 Z and at 1210 Z were as follows:

ALTITUDE (metres)	DIRECTION (degrees)	SPEED (knots)
1 500	160	06
2 000	150	14
2 500	260	12
3 000	260	20
4 000	260	42
5 000	270	40

1.8 Aids to navigation

The CTR Curitiba navigation aids were flight tested by the Directorate of Air Routes after the accident, to check the efficiency of the air traffic procedures and the effectiveness of the basic air navigation aids. The equipment was found to be functioning normally. Several pilots who were flying in the Curitiba CTR area on the day of the accident and particularly one of them who was flying at the time of the accident did not observe any deficiency in the radio aids.

Examination of the aircraft showed that the airborne ADF were set respectively on 390 kc/s (CT) and 550 kc/s. It is probable that the pilot did not set the ADF on the Broadcasting Station ZYM-5 560 kc/s, the transmitter of which is in the immediate vicinity of the procedural turn in the descent pattern.

The Curitiba VOR (VCT 116.5 Mc/s) was functioning normally; however the aircraft VOR was not switched on.

1.9 Communications

The communications between the aircraft and Curitiba Control were normal. The radio reports from the aircraft did not indicate any abnormal condition in flight.

1.10 Aerodrome facilities

The aerodrome facilities were adequate for safe performance of the flight.

1.11 Flight recorder

None.

1.12 Wreckage

The aircraft, after it had turned approximately 45° to the right in order to intercept the downwind leg of the descent pattern of Curitiba airport collided with rising terrain at an altitude of 4 635 ft with its landing gear and flaps extended. The marks made by the impact show that the aircraft was turning to the right. The initial impact occurred with the aircraft on a heading of 325°. The aircraft was totally destroyed.

The wreckage was found 25 kms from Curitiba/Afonso Pena, its co-ordinates were 25°31's - 48°58'W. This was approximately 2.5 km to the right of and 700 m from the position 30° to Curitiba/Bacacheri; on QDM 275° from Curitiba/Afonso Pena and QDM 30° from Curitiba/Bacacheri.

At the site of the accident the following observations were made:

Altimeters:	Setting 1015.0 mbs, reading 4 640 ft
Radar:	Off
Pilot's chronometer:	17 sec
Clock:	09:28 P
Rate of climb indicator:	Indicating slight climb
Trans-receiver:	1 - 119.70 MRZ
RFC VOR:	Off
ADF 1:	390 kc/s
ADF 2:	550 kc/s.

1.13 Fire

There was no fire in flight or after impact.

1.14 Survival aspects

In view of the meteorological conditions in the Curitiba area on the day of the accident the SAR team did not identify the site of the accident and did not rescue the survivors until the morning of the following day.

1.15 Tests

After the accident, the air traffic procedures and the functioning of the basic navigational aids of the Curitiba CTR were tested by the laboratory aircraft of the Directorate of Civil Aviation. The results of the flight tests showed that the procedures were satisfactory to meet the flight safety requirements, and the basic aids fulfilled the desirable operational requirements.

No deficiencies were noted in the various flights over the area in the proximity of the accident site. The air traffic procedures of Curitiba CTR which have been used for more than 6 years provide satisfactory safety conditions and have never been responsible for aviation accidents; no complaints have been registered from pilots operating in this CTR in IFR conditions. A few days after the accident technicians from the Ministry of Aeronautics investigated the possibility of interference from a metal tower 9 m in height, in the vicinity of the accident site, with the ADF on board the aircraft. The result of this investigation was that the tower did not function as an active element and as such could not in any way interfere with radio navigation or radio communication. It was simply a metal post and nothing more.

2.- Analysis and Conclusions

2.1 Analysis

After consideration of all the facts and circumstances of this accident it was found that human and material factors were not contributory or decisive elements in the occurrence of the disaster. However, the physical factor, in relation to development of the flight and operational procedures, had a significant influence as was found in the tests performed during the investigation.

With respect to the progress of the flight the time-distance factor between Paranaguá and Curitiba/Afonso Pena is important in view of the circumstances of the flight on this segment. The position report over Paranaguá was transmitted to Curitiba Control at 1117 hours Z, the position 30° to Curitiba/Bacacheri at 1126 hours Z and the fix over Curitiba/Afonso Pena at 1128 hours Z (see Fig. 5-1). It was observed that the aircraft flew 11 min to cover the 67 km separating Paranaguá and Curitiba/Afonso Pena, i.e. a ground speed of 365 km/h (197 kt). However, the distance between Paranaguá (PG) and the point of impact was hardly 46 km.

Upper air winds did not have any significant influence.

Various circumstances of the flight were inter-related with this situation such as:

The use of ADF by the pilot: five frequency changes were made on the two ADF's after the aircraft flew over the NX or PG NDB at Paranaguá.

Five frequency changes with disturbing factors: turbulence, doubt about the correct transmission of the station indicator, inaccurate fix over Curitiba/Bacacheri and finally, setting of the ADF for a previous situation, that is with one ADF on Curitiba NDB - 390 kc/s and the other on ZYM-5 - 560 kc/s.

The distance between the two Paranaguá NDB NX and PG is approximately 20 km. The distance between Paranaguá and Curitiba/Afonso Pena is 67 km, and the distance between Paranaguá (NX) and the point of impact is also approximately 67 km. To cover this distance in 11 min, with the prevailing wind, the aircraft had to fly at an indicated airspeed of 184 kt, giving Vs = 213 kt which is normal for a Dart Herald.

It is also probable that false indications occurred as follows:

- The pilot reported receiving Curitiba/Afonso Pena and initiating the approach at 1126 hours Z.

- The aircraft configuration showed flaps and landing gear extended, but the pre-landing checklist had not been completed.

- The pilot's chronometer, indicating 17 sec, leads us to believe that the inaccurate fix occurred 17 sec before the accident occurred and the direction of the impact 325° shows that the aircraft had completed 45° of turn, corresponding to 15 sec, to enter the downwind leg.

- It was found from statements of the radio operator and surviving crew member that the pilot at 1128 hours Z considered that he had reached the fix.

With respect to the operational procedures it was observed that the pilot did not confirm the fix when turning over Curitiba/Afonso Pena.

- After a maximum of 1 min the pilot found that the fix was inaccurate.

- The pilot did not acknowledge receipt of the message to leave 1 500 m (5 000 ft).

- The extended landing gear and flaps indicate that the speed had been reduced.

- The marks left on the ground by the impact of the aircraft showed that it was turning to the right.

In view of the evidence it was deduced that the impact took place after the inaccurate fix when the pilot turning to the right attempted to intercept the downwind leg.

2.2 Conclusion

(a) Findings

The following facts were established in the investigation:

- The position 030° to Curitiba/Bacacheri was estimated.

- The pilot relied on an incorrect estimation without confirming the fix over Curitiba/Afonso Pena and manoeuvred to intercept directly the downwind leg without flying an aerodrome circuit.

- The distance between the Paranaguá NX NDB and the point of impact is equal to the distance between the Paranaguá PG NDB and the Curitiba CT NDB.

- The VOR was not used.

- Turbulence must have had an influence on the flight conditions.

- All the crew and the passengers, killed and surviving, had fractures in the lower limbs.

- The metal tower located near the accident site had no influence on the accident.

(b) Cause or
Probable cause(s)

Pilot error through improper procedure in instrument flight.

(c) Contributing factors

- Lack of a dynamic programme for aircraft accident prevention.
- Non-confirmation over Curitiba/Afonso Pena NDB.
- Inaccurate position relative to Curitiba/Bacacheri NDB.
- Failure to use VOR equipment.
- Failure to execute all the phases of the descent, with assumed interception of downwind leg without confirmation of position.
- Momentary radio-direction finding indication of inaccurate fix.

3.- Recommendations

The Directorate of Air Routes should review the IFR procedures in Curitiba CTR which have been in force for more than 6 years with complete safety for confirmation of clearance from level 50 to 30° to Curitiba/Bacheri, checking the consequences to the remainder of traffic in the CTR.

The Administrator of the Accident Prevention Programme should require from the Operations Section that the pilots use adequate equipment and navigation facilities and comply with all the phases of the procedure laid down in the Instrument Approach Charts.

Non-scheduled domestic
Landing
Collision - rising terrain
Pilot - Improper IFR operation

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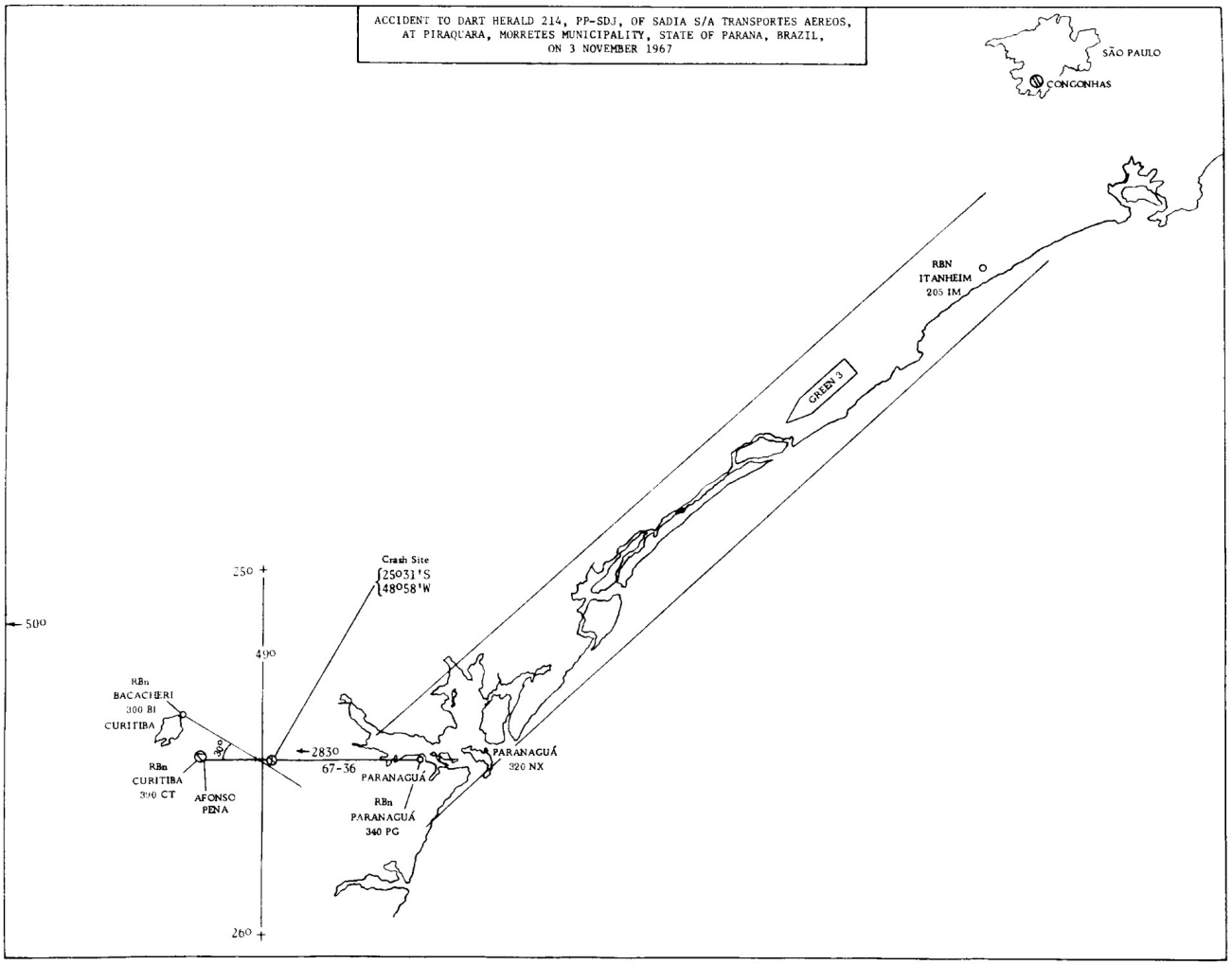
ACCIDENT TO DART HERALD 214, PP-SDJ, OF SADIA S/A TRANSPORTES AEREOS,
AT PIRAQUARA, MORRETES MUNICIPALITY, STATE OF PARANA, BRAZIL,
ON 3 NOVEMBER 1967
SÃO PAULO
CONGONHAS
RBN
ITANHEIM
205 IM
GREEN 3
Crash Site
25°31'S
48°58'W
250
490
260
500
RBn
BACACHERI
300 BI
CURITIBA
RBn
CURITIBA
390 CT
AFONSO
PENA
30°
2830
67-36
PARANAGUÁ
320 NX
PARANAGUÁ
RBn
PARANAGUÁ
340 PG

Fig. 5-1