AIRCRAFT ACCIDENT REPORT 1/84

Accidents Investigation Branch

Department of Transport

Report on the accident to Douglas DC-8-51 RP-C830 at London (Stansted) Airport on 5 September 1982

LONDON
HER MAJESTY'S STATIONERY OFFICE

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Department of Transport
Accidents Investigation Branch
Royal Aircraft Establishment
Farnborough
Hants GU14 6TD

14 May 1984

The Rt Honourable Nicholas Ridley
Secretary of State for Transport

Sir,

I have the honour to submit the report by Mr L S H Shaddick, an Inspector of Accidents, on the circumstances of the accident to Douglas DC–8–51RP–C830 which occurred at London (Stansted) Airport on 5 September 1982.

I have the honour to be
Sir
Your obedient Servant

G C WILKINSON
Chief Inspector of Accidents

Contents

Accidents Investigation Branch

Civil Aircraft Accident Report No 1/84
(EW/C799)

Owner and Operator:		Intercontinental Airlines Ltd
Aircraft:	*Type and Model:*	Douglas DC–8–51
	Nationality:	Nigeria
	Registration:	RP–C830 (Philippines)
Place of accident:		London (Stansted) Airport 51° 53′ N 000° 14′ E
Date and time:		5 September 1982 at 0536 hrs All times in this report are GMT

Synopsis

The accident was immediately notified by Air Traffic Control (ATC) at London (Stansted) aerodrome and an investigation by the Accidents Investigation Branch began the same day.

After receiving a series of reports of fog and poor visibility at Stansted, the commander carried out an approach using the Category 1 Instrument Landing System on Runway 23, having received and acknowledged a reported Runway Visual Range (RVR) of 200 metres. On reaching Decision Height the crew were unable to see any approach or runway lights and initiated a missed approach. In the course of the overshoot the aircraft struck another DC–8 which was parked on the cargo apron, causing substantial damage to both aircraft. A diversion was made to Manchester Airport where the aircraft landed safely. No injuries were sustained, either in the air, or on the ground.

The report concludes that the cause of the accident was the commander's faulty technique whilst carrying out a missed approach, combined with his failure to initiate overshoot action immediately on reaching Decision Height. A contributory factor was the commander's lack of understanding of UK legislation regarding approach bans.

1. Factual Information

1.1 History of the flight

The aircraft, which was engaged on a charter flight, made an uneventful departure from Lagos for London (Stansted) at 2318 hrs on 4 September 1982, with 58 passengers and 15 crew on board. Although operated by a Nigerian company, and flown by a crew in the employment of that company, it was still registered in the Philippines, and was using its registration, RP–C830 as call-sign. The two pilots were making their third flight into Europe.

The weather forecast provided by the main meteorological office at Lagos covered London (Heathrow), London (Gatwick), London (Stansted) and Prestwick aerodromes; no forecast was available for Manchester, the alternate aerodrome nominated in the ATC Flight Plan. The forecast for Stansted included the following item:

> Visibility from midnight to 0900 hrs: 8 km, with a 30% possibility of temporary reductions to 300 metres between 0300 hrs and 0700 hrs.

Whilst over Northern France the crew obtained details of UK aerodrome weather reports from the broadcast information on London Volmet (South). They would have heard either or both the 0420 hrs and the 0450 hrs observations for Stansted. The first of these included a visibility of 400 metres in fog, with 8/8 cloud at 100 feet; the second gave 500 metres in fog with the same cloud.

At 0511 hrs on 5 September 1982, with the aircraft at Flight Level 350, and with the co-pilot operating the radios, the flight came under the control of the London Air Traffic Control Centre (LATCC), and the following exchange took place:

LONDON:	RP–C830, THE VISIBILITY AT STANSTED IS FIVE ZERO ZERO METRES IN FOG. DO YOU HAVE AN UP–TO–DATE RVR THERE? (1)
RP–C830:	SAY AGAIN. FIVE HUNDRED METRES IN (unintelligible word)
LONDON:	THE VISIBILITY I HAVE AT STANSTED IS FIVE ZERO ZERO METRES, FIVE HUNDRED METRES
RP–C830:	OK, COPIED SIR

(1) There is a distinction between visibility and Runway Visual Range. The first is the horizontal distance over which an object may be recognised, whilst the second is the maximum distance over which the runway, or the lights defining it, can be seen from a point 5 metres above the centre line.

At 0512 hrs London gave the aircraft descent clearance to Flight Level 120, the controller adding the words 'IF YOU WISH TO MAKE AN APPROACH AT STANSTED'. The aircraft acknowledged the clearance and at 0514 hrs received details of the 0450 hrs observation at Stansted, as follows:

LONDON	RP–C830, THE LATEST WEATHER AT STANSTED. THE WIND VELOCITY IS ONE ONE ZERO AT ZERO SIX KNOTS, THE VISIBILITY FIVE ZERO ZERO METRES IN FOG, AND THERE IS CLOUD EIGHT OKTAS AT ONE ZERO ZERO FEET
RP–C830:	COPIED, THANK YOU VERY MUCH

At 0520 hrs the aircraft misunderstood some instructions regarding its cleared flight level, and when these were clarified it was asked to change frequency to another sector, although still under the control of London. As soon as he was in contact, the new controller offered details of the latest weather at Stansted, as follows:

LONDON:	RP–C830, THE WIND AT ZERO NINE ZERO, ZERO FIVE KNOTS, THE RVR FIVE ZERO ZERO METRES, FIVE HUNDRED, AND THE CLOUD EIGHT OKTAS ONE ZERO ZERO FEET, THAT'S ONE HUNDRED FEET
RP–C830:	THANK YOU VERY MUCH SIR, DO YOU HAVE THE LATEST TEMPERATURE AND QNH?

This information was duly provided and a second misunderstanding regarding assigned altitude then occurred, after which, at 0525 hrs, the aircraft was handed over to the control of Stansted Zone, with whom it remained for the approach to land. At this stage the commander was flying the aircraft manually using the guidance of the Flight Director Indicator (FDI), because the autopilot was not generally regarded as capable of a precise coupled approach. At 0527 hrs the Zone controller passed the information that the RVR for Runway 23 was 500 metres, with four oktas of cloud at 100 feet, and received the acknowledgement 'ROGER, COPIED, THANK YOU SIR'. The aircraft continued to receive radar positioning for an approach to Runway 23 using the Instrument Landing System (ILS) and at 0529 hrs was informed that RVR had fallen to 200 metres. This last message was acknowledged with 'RIGHT OH, THANK YOU SIR'. Shortly afterwards it became established on the localiser at 3,000 feet QNH, and began its ILS approach. Landing clearance was received at 0534 hrs, and was acknowledged, and this was the last message before the accident.

Very shortly afterwards the observer at the RVR measurement point close to the threshold of Runway 23, heard the aircraft approach and pass over him out of sight. At first he regarded this as a failure to land and informed ATC accordingly, but on hearing a sharp application of power further up the runway, interpreted the sound as the selection of reverse thrust and revised his first message in the belief that the aircraft had landed. At the cargo apron another DC–8 aircraft, registration N 786 FT, was parked facing at right angles away from the runway centre line, with its tail about 260 metres left of the centre of the runway and 930 metres from the threshold. The loadmaster of this aircraft was seated in the flight deck, but on hearing the loud noise of aircraft engines, went to the forward left freight door in time to see a DC–8 aircraft appear out of the fog

apparently heading straight for him. It was about 30 feet above the ground and its landing gear was down. He stepped back, felt an impact, and looked out again in time to see wreckage from the tail of his own aircraft still falling to the ground. Other witnesses further upwind ran out of a hangar in time to see the aircraft pass over their heads; the visibility was so poor that they were not able to see the damaged aircraft parked 300 metres away. All agreed that the landing aircraft was extremely low, and that visibility was very poor in fog. Later examination established that the parked DC–8 had suffered extensive damage to its fin and rudder.

ATC was rapidly alerted and RP–C830 was informed of the collision. The crew had not felt any major impact but both pilots had seen the fin of the parked aircraft, and the flight engineer subsequently observed that the aircraft was losing hydraulic fluid. Although it was not apparent on the flight deck, the right hand flap system had in fact sustained substantial damage but the landing gear and flaps nevertheless retracted successfully. During the subsequent missed approach the aircraft climbed through the altitude laid down in the published procedure. The commander decided to divert to Manchester and made a successful flapless landing there at 0626 hrs using emergency hydraulic procedures and with ample fuel still remaining.

When interviewed after the accident both pilots stated that the ILS approach had been well flown and that they considered that, in spite of occasional small discrepancies when the Flight Director Indicator gave a fly-left signal which was not in accord with the basic localiser display, neither the radiated signal nor the aircraft instrumentation had any bearing on the accident. All three flight crew were confident that the Decision Height bug on the radio altimeter had been set at 250 feet [(2)], and that the pressure altimeters had been correctly set for a landing on QNH. They recalled seeing the illumination of the warning light for Decision Height, and the initiation of the missed approach which followed after, at worst, a short delay. The co-pilot had no clear recollection of ILS indications at that time, except a general feeling of confidence in the approach; the commander thought there might have been a very small displacement to the left of the localiser. All three crew members insisted that there was no attempt to continue below Decision Height in the hope of seeing the runway lighting. In his statement the commander described the technique which he normally used when carrying out a missed approach. This was to call the executive instruction 'Missed Approach', select 'GA' (i.e. Go-Around) on the FDI controller, increase engine power, and then commence a rotation of the aircraft. As the engines began to respond he would then complete rotation of the aircraft to the pitch attitude demanded by the FDI and call for initial retraction of flap and landing gear. This technique does not comply with the drill laid down in the Aircraft Operations Manual. On this occasion, he employed his usual technique and was still applying power and able to see over the nose of his aircraft when both pilots saw the fin of the parked DC–8 dead ahead. In spite of selecting full power and rotating the aircraft to a steeper attitude, the commander could not prevent the collision. At this point the flaps and landing gear had still not been retracted and as a consequence the Ground Proximity Warning System was unable to respond to the rate of sink.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	–	–	–
Serious	–	–	–
Minor/None	15	58	

(2) Decision Height is explained in detail in paragraph 1.17.1. From the Jeppesen Airways Manual the minima applicable to this approach were a Decision Height of 245 feet and an RVR of 720 metres. The commander elected to use the slightly higher and more practical Decision Height of 250 feet and any reference in the report to Decision Height is based on this figure.

1.3 Damage to aircraft

Damage was confined to the right-hand main landing gear and the right-hand flaps. The mid-wing hydraulic flap operating jack suffered some deformation and was leaking hydraulic fluid.

1.4 Other damage

A DC–8 which was parked on the cargo apron suffered impact damage to its fin and rudder over the top 8 feet of its height.

1.5 Personnel information

(a)	Commander:	Male aged 43 years
	Licence:	Philippine Airline Transport Pilot's Licence with valid rating for DC–8 aircraft
	Medical certificate:	First-class medical certificate dated 22 March 1982
	Total flying hours:	10,405
	Total hours on DC–8:	641

The commander had previously flown the DC–8 in the course of his work with another company, this employment ceasing during 1980. In order to take up his appointment with Intercontinental Airlines he received 8 hours simulator training, and performed four take-offs and instrument approaches during July 1982, in a flight lasting 2 hours. Of his total DC–8 time, 76 hours had been flown with Intercontinental Airlines.

It was not possible to establish exact duty times and flying hours in the period preceding the accident, but when he reported for the flight which led to the accident, this was his first flying duty for approximately two weeks.

(b)	Co-pilot:	Male aged 40 years
	Licence:	Philippine Airline Transport Pilot's Licence with valid rating for DC–8 aircraft
	Medical certificate:	First-class medical certificate dated 12 April 1982
	Total flying hours:	7,850
	Total hours on DC–8:	407

The co-pilot, like the commander, had not flown the DC–8 between 1980 and his employment with Intercontinental Airlines. His re-validation on type had consisted of 8 hours on the simulator and one hour on the aircraft. His experience with Intercontinental Airlines amounted to 43 hours, and his recent duty time and experience were similar to the commander's.

1.6 Aircraft information

1.6.1 General information

(i)	Manufacturer:	Douglas Aircraft Company Long Beach, California, USA

(ii)	Type:	Douglas DC–8–51
(iii)	Date of Manufacture:	1964
(iv)	Constructors No:	45688
(v)	Certificate of Airworthiness:	Issued by the Bureau of Air Transportation Republic of the Philippines, Manila. Transport Category
	Date of issue	18 June 1982
	Date of expiry	17 June 1983
(vi)	Maintenance Clearance Certificate:	Issued by Ministry of Aviation Federation of Nigeria, Lagos
	Date of issue	25 August 1982
	Date of expiry	17 June 1983
(vii)	Record of Major Maintenance:	
	'C' check (350 hr period)	
	Date performed	30 June 1982
	Time since check	71 hours
	'D' check (1,200 hr period)	
	Date performed	30 June 1982
	Time since check	71 hours
	'E' check (15,000 hr period)	
	Date performed	28 February 1979
	Time since check	1,716 hours
(viii)	Total airframe hours:	44,217
(ix)	Weight and centre of gravity: (CG)	At the time of the accident the aircraft was below its maximum authorised landing weight and the CG was within limits.

1.6.2 Aircraft History

The aircraft was manufactured in 1964 and saw initial service with Delta Airlines. In 1977 it was acquired by Philippine Airlines and prior to being bought by Intercontinental Airlines it had been removed from service and stored at Manila International Airport, for approximately 18 months. The aircraft was subjected to 'C' (350 hour) and 'D'(1,200 hour) checks and was test flown by Philippine Airlines before being ferried to Lagos, Nigeria and handed over to Intercontinental Airlines on 10 July 1982. The formalities for transferring the aircraft to the Nigerian register had yet to be completed.

At the time of the accident, the aircraft had completed 52 hours service with the new operator. The last flight before the accident had been 13 days earlier on the 22 August 1982, the aircraft being stationed at Lagos during the intervening period.

The technical records show that 'lay-over' and 'pre-flight' checks were carried out before the accident flight and a 50 hour service check had been carried out 12 days previously. No defects were recorded as being outstanding at the time of the accident.

1.7 Meteorological information

1.7.1 Pre-departure forecast

The forecast provided by the main meteorological office at Lagos, at 2130 hrs on 4 September 1982, included the following items for Stansted:

Period of validity:	midnight to 0900 hrs on 5 September 1982
Surface wind direction and speed:	170°/08 knots
Surface visibility:	8 km, with a 30% probability of temporary reduction to 300 metres between 0300 hrs and 0700 hrs.
Weather:	Nil
Cloud:	5/8 altocumulus at 3300 metres 2/8 stratocumulus at 600 metres 6/8 stratus at 300 metres

1.7.2 Actual weather

Stansted was affected by a moist south easterly airflow at low levels, giving rise to the following observations:

0520 hrs:	
Surface wind:	090°/06 knots
Visibility:	300 metres
Weather:	Fog
Cloud:	4/8 stratus at 100 feet
0550 hrs:	
Surface wind:	070°/04 knots
Visibility:	300 metres
Weather:	Fog
Cloud:	2/8 cirrus at 25,000 feet

1.7.3 Runway Visual Range (RVR)

During the relevant period the Runway Visual Range for runway 23 at Stansted was recorded as follows:

0500 hrs:	450 metres
0510 hrs:	500 metres
0529 hrs:	200 metres
0539 hrs:	200 metres
0540 hrs:	150 metres
0550 hrs:	150 metres

1.8 Aids to navigation

1.8.1 Surveillance radar

The surveillance radar positioned the aircraft on a heading to intercept the ILS. Once the aircraft was established there was no requirement for the radar controller to continue observing the radar, but since there was no other traffic he continued to do so. Even with the known imprecision of the equipment at short ranges, the controller considered that he would have noticed any substantial displacement of the aircraft from the localiser down to 0.5 nautical miles from the threshold, but no deviations were observed.

1.8.2 Instrument Landing System

Stansted is equipped with an ILS system on Runway 23 employing a localiser frequency of 110.5 MHz and a glide path frequency of 329.6 MHz. This installation meets ICAO Category 1 specifications, has a 3° glide path and an Obstacle Clearance Limit (OCL) of 210 feet. The significance of OCL is fully discussed in Para 1.17.1. The terrain on the approach is suitable for the use of radio altimeters. Immediately after the accident checks were made on the ILS ground monitors, which indicated that transmissions were normal. An airborne flight check was made on the day of the accident, and a full categorization check, with bend measurement, the day after. All checks were satisfactory.

1.9 Communications

1.9.1 Communications with the aircraft

RP–C830 first made contact with the Dover Sector of the London Air Traffic Control Centre on frequency 134.9 MHz, transferred to the Clacton Sector on frequency 129.6 MHz and to Stansted Zone on frequency 125.55 MHz. All communications were technically satisfactory, but on two occasions the co-pilot had to have significant instructions or clearances repeated to him. On one of these occasions, concerning a cleared altitude, the co-pilot never succeeded in giving a correct acknowledgement and the controller finally decided to let the aircraft continue at its incorrect altitude, since this was not actually incompatible with the ATC situation.

1.9.2 Weather broadcasts

London Volmet (South) was transmitting satisfactorily on frequency 128.6 MHz throughout the relevant period.

1.10 Aerodrome ground facilities

London Stansted Airport is operated by the British Airports Authority (BAA), with the Civil Aviation Authority (CAA) providing Air Traffic Services and telecommunications. Runway 23 has a declared landing distance of 2936 metres, with a further 122 metres available on request. The approach lighting system for Runway 23 consists of 914 metres of high intensity centre line lights, with five crossbars, and the threshold is marked by high intensity green lights. The Visual Approach Slope Indicating System (VASIS) are set to 3°. At the time of the accident all lighting was serviceable, and at maximum intensity.

Runway Visual Range is measured by eye from a tower close to the threshold of Runway 23. By counting the number of lights visible on the starboard side of the runway the observer is able to read from a table the corresponding value of RVR, and pass it by direct land line to the Aerodrome Controller. The system was last checked by the Meteorological Office, Bracknell, on 25 May 1982.

The position of the parked DC–8 with which RP–C830 collided conformed with the regulations applying to obstacles on aerodrome surfaces.

1.11 Flight recorders

1.11.1 Flight data recorder

The aircraft was equipped with a Lockheed 109 engraved foil flight data recorder. The unit was fitted in the tail cone of the fuselage, aft of the pressure bulkhead. When the recorder was examined it was found that the input drive shaft had sheared and it was evident that the recorder had not functioned since the installation of a new foil. No flight data could, therefore, be obtained.

The cockpit controls for the FDR comprised only an 'ON/OFF' switch. There was no indication available to the crew of the unit's serviceability. The malfunctioning of the recorder could only have been discovered during a subsequent maintenance check.

1.11.2 Cockpit voice recorder

The aircraft was equipped with a Collins 642 C cockpit voice recorder. It was located in the rear of the cabin forward of the port toilet. When the CVR was examined it was found that the tape had become entangled with the spool mechanism. The recorder was, therefore, unserviceable and no voice recording was obtained.

The CVR control unit, located in an overhead cockpit control panel had a 'press to test' facility. The aircraft's 'Before starting' check list included a check for the serviceability of the CVR.

1.12 Wreckage and impact information

1.12.1 Site and impact information

The aircraft suffered damage to its right-hand main landing gear and its right-hand flaps. The two outboard tyres on the right side main gear were scuffed and scored but neither deflated. The right-hand flaps had received severe impact damage at the intersection of the inboard and outboard sections. The mid-wing hydraulic flap operating jack had suffered some deformation and was leaking hydraulic fluid. Examination showed that the flaps had not completely housed following the overshoot at Stansted because of the damage sustained during the collision with the other aircraft.

A DC–8 aircraft, registration N 786 FT, was parked for loading on stand 45 at a cargo terminal south east of runway 23 at Stansted and was facing away from the runway at 90° to the centre line. The tail of the aircraft was approximately 260 metres from the centre line of the runway at a distance along the runway of 930 metres. The top 8 feet of its fin and rudder had suffered impact damage. Scrape marks on the damaged fin indicated that the colliding aircraft, RP–C830, was heading 208° (M) at the time of impact.

No evidence was found that RP–C830 had collided with anything other than the fin and rudder of N 786 FT. Ground level fell from the runway threshold to the collision point and beyond such that the lowest collision point on the fin was 5.5 metres above the threshold height. There were no obstructions above the height up-track of the collision point. Down-track, and directly ahead of RP–C830 at a distance of 200 metres, a lighting tower projected 6 metres above the collision height but this was untouched.

1.12.2 Detailed aircraft examination

The aircraft instruments and avionics systems which were considered relevant to the accident were examined in detail.

(a) Altimeters

Both pressure altimeters were calibrated up to 5,000 feet. Both altimeters generally indicated low within ± 20 feet of the calibrated altitude below 500 feet, and +5, -60 feet above 500 feet. Their operation was considered satisfactory although the co-pilot's instrument showed a slight instability.

A test of the radio altimeter at the test-set check height of 480 feet was satisfactory as was the function of the antenna.

(b) Radio navigational and approach equipment

The aircraft was fitted with an integrated flight instrument system. Approach information was presented in two forms. Localiser and glide-slope information from the NAV–1 VHF navigational radio was displayed on the commander's Pictorial Deviation Indicator (PDI) and that from the No 2 set on the co-pilot's PDI. Approach data from the co-pilot's PDI was then processed by the single channel Flight Director Computer and displayed as a programmed demand by both Flight Director Indicators.

When the radio-navigational and approach equipment was tested after the accident, with electrical power supplied by a ground power unit, both FDI's produced an almost permanent half-scale 'fly-left' demand. This demand was not reflected in the unprocessed data on either PDI and it was suspected that there was a fault in the Flight Director Computer. Bench tests failed to uncover such a fault and when the computer was re-installed the fault did not reappear. It was concluded that the fault may have arisen from a poor contact between the computer's multi-pin plug and the corresponding socket in the avionics rack.

Further testing revealed that the Flight Director mode selector switch was faulty in that an active display was obtained with the switch in a position between 'Approach' mode and 'Go-around' mode. It was also found that, in the 'Go-around' mode, the wrong 'fly-up' demand was displayed on the FDIs; the commander's FDI gave 16 degrees pitch-up and the co-pilot's 20 degrees pitch-up whereas the specified value is 8 to 10 degrees. This defect was traced to a faulty adjustment within the Flight Director Computer. Circuit breakers for the commander's compass, the co-pilot's compass and the NAV–2 instrumentation unit were found to be erratic in operation but produced correct fault-indications on the displays.

Although both navigational radio receivers and instrumentation units, when bench tested, did not meet specification they were functional and it was considered that they would have performed satisfactorily in the circumstances of the accident.

1.13 Medical and pathological information

Not applicable.

1.14 Fire

There was no fire.

1.15 Survival aspects

Not applicable.

1.16 Tests and research

None.

1.17 Additional information

1.17.1 Calculation of weather minima

At the time of the accident the published Obstacle Clearance Limit (OCL) for the Stansted ILS was 210 feet. An OCL can be calculated for each combination of runway and approach aid, in accordance with agreed procedures, and is defined as the height below which the prescribed separation from obstacles cannot be maintained. Decision Height (DH) is the minimum height specified by an operator to which an approach to

landing can safely be made without visual reference to the ground, and the consequence of this definition is that an aircraft which reaches Decision Height without achieving the necessary visual reference should carry out a missed approach. Because there will be a small height loss even when the missed approach is properly executed, the Decision Height appropriate to a particular runway, approach aid, and type of aircraft will, for precision approaches, always exceed the relevant OCL by a small margin. For reasons unconnected with the accident, a slightly different system of determining minima has been recently adopted, although the basic principles are unchanged.

For precision approaches, the lower that the Decision Height is set, so the aircraft will be correspondingly nearer to the runway when it has descended to that height. The Decision Height therefore becomes one of the factors employed in determining the minimum acceptable RVR for an approach, with the lower values of RVR generally accompanying the lower Decision Heights, for any given system of aerodrome lighting.

1.17.2 UK legislation on weather minima

At the time of the accident, the United Kingdom Air Navigation Order 1980 (ANO 1980) stated in Article 30 that a public transport aircraft registered in another country should not commence an approach to landing if the RVR was less than the operator's specified minima for the runway and approach aid in use. 'Approach to landing' was defined in Article 93 as that portion of the flight in which the aircraft was descending below a height of 1,000 feet above its Decision Height.

The detailed requirements regarding the provision of specified minima by foreign operators are described in the United Kingdom Aeronautical Information Publication (UK AIP) on page FAL 1–3, paragraph 1.7 Aerodrome Operating Minima. This makes it necessary for an operator to provide the CAA with details of his specified minima for the aerodromes concerned, at least seven days before a proposed public transport flight into the UK, and also requires the operator to acquaint his crews with the UK prohibition on approaches if the RVR is below the specified minima. Dealing with this latter point, the AIP reads as follows: 'A copy of the prohibition, which must be included in instructions to crews, must be submitted to the Authority with aerodrome operating minima.' In the case of this flight the operator, like many other applicants, stated to the Authority that it would meet the requirements of FAL page 1–3, paragraph 1.7 by operating to the minima specified in the Jeppesen Airways Manual. No copy of the required prohibition was submitted, but since the Manual contains a summary of UK legislation, the Authority, in accordance with its usual practice, accepted that by submitting the Jeppesen Airways Manual as the company document on weather minima, the operator had met both the requirements of paragraph 1.7. From the Jeppesen Airways Manual the minima applicable to the ILS approach being flown were a Decision Height of 245 feet and an RVR of 720 metres.

Under Article 80 of the ANO the operator wishing to perform the flight must also obtain a permit from the Department of Trade. (This responsibility has now passed to the Department of Transport). Before the Department considers the application for a permit it requires a summary of the relevant weather minima from the Civil Aviation Authority with a statement that the Authority is satisfied with these minima, and from the State of Operation a certificate of competence regarding the airline's operating standards. These documents were duly received and the Department granted the appropriate permit.

1.17.3 ICAO Standards and guidance

Part 1 of Annex 6, to the Convention on International Civil Aviation describes the international standards which apply to the operation of aircraft engaged on international commercial air transport. Chapter 3.2 says that 'An operator shall ensure that each of his pilots is familiar with the regulations and procedures, pertinent to the performance of his duties, prescribed for the areas to be traversed, the aerodromes to be used and the air navigation facilities relating thereto'.

As a means of assisting States to ensure that airlines for which they are responsible comply with the provisions of Annex 6, the International Civil Aviation Organisation (ICAO) has produced Doc 8335 – AN/879/2, Manual of Procedures for Operations Certification and Inspection, a major part of which is devoted to the information and instructions which should be provided in Operations Manuals. Where operating minima are concerned, Doc 8335 says that the Operations Manual should state 'specific company policy with respect to these minima'.

1.17.4 Flight deck documentation

The manuals available to the pilots on the flight deck included the Jeppesen Airways Manual, and volumes of the Aircraft Operations Manual (AOM) for DC–8 aircraft, Philippine Airlines (PAL) edition. The AOM volumes provided details of procedures and equipment specifically related to the DC–8 aircraft and described operating techniques and check lists, including detailed instructions for items to be covered in the commander's approach briefing. In section 2.10 Operating Limitations, the following item appeared:

> 'Outlined hereunder is the basic weather minima policy in terms of crew qualification, experience and status. Under no circumstances shall operations be conducted to minima lower than those dictated by the Captain's qualification, or to minima below CAT 1 under manual control.
>
> | CAT 1 Minima | |
> |---|---|
> | Lowest Minima | 200 ft/800m or RVR authorisation' |

The AOM contained no general references to company operating policy but crews were referred to the 'BOM' for details of the rules and regulations governing the operation of aircraft. It is presumed that Intercontinental Airlines Operations Manual Part 1 was the equivalent volume to the 'BOM' of Philippine Airlines. Part 1 stated that commanders must be familiar with the operating rules of any state outside Nigeria over which they were flying, and that aerodrome weather minima were to be found in the Route Guides. The Route Guide employed by the company was the Jeppesen Airways Manual which in addition to weather minima gave the following information:

> 'UNITED KINGDOM AIRPORT OPERATING MINIMA
>
> Runway Visual Range/Meteorological Visibility
>
> Under U K Legislation an approach ban is in force:
>
> Precision Approaches:
>
> If the reported RVR is below the applicable charted RVR, except if the aircraft is below the DH and the specified visual reference has been established'

Part I of the airline's Operations Manual also stated that:

> 'At any aerodrome at which runway visual range, established in accordance with the definition given in paragraph 5 above, is provided by the aerodrome authority, descent shall be commenced or continued below 1,000 feet above the relevant critical height only if the runway visual range is reported as at or above relevant minimum for landing'.

No copy of Part 1 was found on the aircraft.

1.17.5 ATC Procedures

As already explained, under existing regulations, before making an approach to landing at an aerodrome in the UK the commander of a public transport aircraft is required to check weather minima specified by his company, and to decide against an approach if the RVR is below limits. In the relatively straightforward circumstances of this accident, where an aircraft made an approach on a Category 1 ILS installation with the weather obviously below usual Category 1 limits, it might seem that ATC were in a position to make a judgement and refuse permission to land. At present, however, the United Kingdom, like nearly all members of ICAO, adopts the philosophy expressed in ICAO Document 4444, Rules of the Air and Air Traffic Services, which in Part II Para 10.1.5 states:

> 'Clearances issued by controllers relate to traffic and aerodrome conditions only and do not relieve a pilot of any responsibility whatsoever in connection with a possible violation of applicable rules and regulations'.

Accordingly the UK AIP, in Section RAC 3–2–1, includes the following statement:

> 'Pilots will not be refused permission to land or take off at CAA and public-licensed aerodromes solely because of bad weather conditions. Pilots of public transport aircraft should bear in mind, however, that Articles 29(5) and 30(2) of the Air Navigation Order 1980, require that they do not infringe the aerodrome operating minima specified by their operators.
>
> The only circumstances in which a public civil aerodrome will be closed to normal aircraft are:
>
> (a) When the surface of the landing area is unfit
>
> (b) At times and in conditions specified in NOTAM
>
> (c) If essential aerodrome facilities are unserviceable'

In accordance with ICAO doctrine and national procedures, ATC had therefore no powers to close the aerodrome, or to instruct RP–C830 to divert elsewhere.

1.17.6 Crew's interpretation of regulations and instructions

When the pilots were interviewed it was apparent that they fully understood the concept of Decision Height, but less clear that they grasped the significance of RVR. Both were able to extract from the Jeppesen Airways Manual the figure of 720 metres RVR as

applicable to the Stansted ILS, but the commander added that whilst he realised the RVR was reported as 200 metres just before he began the approach, he also regarded the message that he was cleared for the approach as an invitation to continue. He stated that he was used to operations in the Far East, and was accustomed to a concept of state minima, in which ATC instructed aircraft to divert whenever the weather fell below the limiting values. The co-pilot was under the impression that the reported weather had consisted of RVR 500 metres and 'cloud ceiling' 200 metres, although in the UK cloud height is reported in feet. In discussion, after some hesitation, the co-pilot expressed the opinion that the RVR laid down in the Jeppesen Airways Manual ought to be regarded as the minima in which an approach should be attempted. Like the commander, he did not appreciate that in the UK aerodrome authorities would not advise a crew on the suitability of the weather.

The pilots' understanding of Philippine legislation was not entirely right, although they were apparently correct in saying that they were not accustomed to receiving an immediate landing clearance in limiting conditions. Philippine practice is to inform the pilot when the weather falls below specified minima, and to ask him for his intentions. The fact that he has not received routine permission to make the approach will thus have drawn his attention to the weather conditions, and will have forced him to make a definite decision regarding his proposed landing.

The Vital Data Card which the crew had prepared for landing at Stansted recorded that their Decision Height was 250 feet above Runway Threshold Elevation but there was no space allocated on the card for minimum RVR, and no RVR had been recorded. The space for noting the Missed Approach Procedure was blank.

1.17.7 Overshoot procedure

The Aircraft Operations Manual detailed the initial actions for an overshoot as follows:

Pilot flying call:	Overshoot. Spoilers Flaps 25°
Simultaneously:	Disengage auto pilot
	Rotate 8° nose-up, prompt and positive
	Apply take-off thrust
	Select GA on Flight Director mode selector
	Command 'Check take-off thrust'
Positive climb:	Command 'Gear up'

The commander had adopted a technique which differed from this procedure. (See Section 1.1 History of the flight).

1.17.8 Radar information

A plot of the aircraft's approach was constructed using data from recorded radar information held at the London Air Traffic Control Centre (LATCC). This showed steady localiser tracking to the point near the outer marker where the returns were lost. Because the altitude mode of the aircraft's ATC transponder was unserviceable, this point was

assumed to coincide with the radar horizon which, near the outer marker, lay at approximately the height of the glide path. After the impact the radar returns reappeared abeam the upwind end of the runway at approximately 650 feet above aerodrome elevation. This showed a track divergence of some 20° to the left of the runway centre line. The ground speed on the approach was steady at an average 141 knots, and on the first 4 miles of the visible overshoot was 180 knots. The first of these figures suggested an Indicated Air Speed (IAS) very close to the correct figure extracted from the Flight Manual for the approach, and the second demonstrated an acceleration to approximately the correct speed for the retraction of all flaps.

2. Analysis

2.1 Actions at Decision Height

During the approach to land at Stansted the aircraft descended below Decision Height, 250 feet, without the required visual reference being established. In fact the visibility was so poor that the crew saw the parked DC–8 only just before their aircraft struck its fin and rudder. In the absence of any evidence of a technical defect or malfunction relevant to the accident, there are two possible reasons why the aircraft came to be in such close proximity to the ground. Either the commander, who was handling the aircraft himself, deliberately continued the approach below Decision Height in the hope of being able to complete a landing or else he initiated an overshoot but failed to prevent the aircraft's further descent.

Since both the FDR and the CVR were unserviceable, there is no conclusive evidence regarding the crew's actions when the aircraft reached Decision Height. The commander insisted that he had not persevered with the approach in the hope of seeing the aerodrome lights, although he admitted that his decision to overshoot may not have been made instantaneously at Decision Height. However, he maintained, as did the rest of the crew, that any delay before missed approach action was started was very short. The sound of the aircraft's engines was heard on the aerodrome, but the evidence on this point is not completely consistent, possibly because of the differing positions of the witnesses. There is some evidence, however, from witnesses who were well placed, which suggests that there was approximately 30 seconds of high engine power before the tail of the parked aircraft was struck. This correlates very closely with power being applied at approximately Decision Height for an aircraft positioned on the ILS glide slope. The balance of the evidence, therefore, indicates that some action to discontinue the approach was taken at, or near to, Decision Height. However, the commander's technique for carrying out a missed approach was not in accordance with that published in the Operations Manual and it is particularly significant that he failed to apply an immediate, positive rotation to the aircraft. In fact the aircraft's attitude just before the collision was still shallow enough for the pilots to see in front of them the fin of the parked aircraft. It is considered that the combined effects of factors such as the gentle rotation, the slow application of power, and the failure to select go-around flap would result in an excessive loss of height after it had been decided to initiate a missed approach, and that this, coupled with the delay in taking positive action at Decision Height, was the probable explanation as to why the aircraft descended to almost ground level.

The DC–8 on the ground was properly parked in an area where it would not normally constitute a hazard to landing aircraft and the collision occurred because RP–C830 was not aligned with the runway. The discrepancies between the demands of the FDI and the basic presentation of the localiser, which was reported by the commander and confirmed in the post-accident examination of the aircraft, do not seem enough to account on their own for the major displacement to the left of the centre line at the point of impact, particularly bearing in mind that the crew had monitored the FDI by means of the basic indicator, and that the latter was fully serviceable in the post-accident checks. There is thus no obvious reason for the displacement to the left. Since no aerodrome lights were seen, it was not an attempt to land using the wrong lights. There was no significant wind-shear, the ILS was radiating satisfactorily, and the pilots were confident that only typically minor departures from the localiser occurred during the approach.

The evidence of the radar controller at Stansted, and the outcome of the plotted data from the London ATCC radar tend to support the pilot's evidence that there were no serious deviations from the localiser during the approach. Since it is likely that the aircraft was correctly placed at Decision Height, the departure to the left most probably occurred during the missed approach, whilst the commander was increasing power with his right hand and holding the control column with his left. In these circumstances it would be relatively easy to apply unintentionally a small amount of left aileron; this effect could be aggravated by asymmetric thrust in the course of the slow application of power.

2.2 Conduct of the flight

The accident occurred because the commander operated the aircraft incorrectly during an overshoot which was the almost inevitable consequence of the weather conditions. It is difficult to understand how both pilots could have been so unaware of the weather that the commander chose to make an approach whose chance of success was negligible. Although the pilots had not flown for fourteen days before the accident and were therefore thoroughly rested, it was, of course, a time of day when alertness and vitality are at a low ebb, when it is easy to misinterpret information or fail to grasp its significance. However, the crew had ample warnings about the conditions at Stansted but they seem simply to have relaxed and to have been carried along by the momentum of the flight. The co-pilot's replies as successive controllers provided him with consistently discouraging weather reports, can only be described as nonchalant. The manner of his acknowledgements combined with his stated belief that the final RVR of 200 metres was actually a cloud base, shows not only his own lack of operational knowledge but also suggests that the commander, who had a better grasp of English, was not monitoring communications effectively. Moreover, there appears to have been little realisation that there was only a negligible chance of landing for there was little preparation for a missed approach and diversion. Clearly the conduct of the approach was unprofessional, but the investigating team could see no evidence of wilful irresponsibility on the part of the crew, and accepted that the accident did not arise because of a conscious decision to continue the approach below Decision Height. In the circumstances the approach only becomes comprehensible in the light of the pilots' belief (mistaken though it was) that ATC would inform them if the weather was unacceptable for an approach to be permitted.

If the commander had observed the requirements of the UK approach ban or had followed the instructions in both the company Operations Manual and the Jeppesen Airways Manual he would not have made the approach in the first place. However, Part I of the Operations Manual was not carried on the aircraft and the pilots therefore did not have access to the information explaining company policy on weather procedures. Even if they had, it is considered that the manuals did not make it readily apparent how UK legislation is implemented. It is considered, therefore, that although the company provided reasonable documentary information, the Operations Manual should have included a more comprehensive discussion on UK legislation in order to ensure complete crew understanding. Moreover, it was quite apparent from interviews with the pilots that they did not have a working knowledge of the company instructions that did exist. It was, of course, the responsibility of the airline to ensure that its standards were satisfactory, and in particular that crews on international flights understood the procedures and regulations applying to the aerodromes they used. However, RP–C830 was the first aircraft in a new DC–8 fleet which was being established with its commander as Chief Pilot. He had recently joined the company and had presumably been recruited because of his DC–8 experience with the airline of another state since the operating state had no DC–8 aircraft

on its register and there was therefore no local background of DC–8 knowledge to draw upon. The low operating standards were thus at least partly the result of a situation which may be repeated elsewhere. As relatively small airlines acquire heavy jet aircraft and start to operate them on international routes, the introduction of a new type may require knowlege and experience which are not readily available locally.

The task of monitoring airline standards, which must include ensuring that aircrews are properly briefed and are conversant with company instructions, lies with the State authorities. In this instance there seems to have been some uncertainty within the Operating State as to when it should assume responsibility for the crew's standards since the aircraft was still foreign registered and therefore being flown by foreign licensed crews. It had in fact been laid down by the State of Registry that they regarded the aircraft's retention on their register after its delivery to the airline as an administrative convenience while the formalities of re-registration were being completed, and that they took no responsibility for the aircraft's operation. This clearly illustrates the problems which can arise when an airline seeks help when setting up a new operation from resources which lie within another state. Since this assistance can take many forms, it may not be entirely clear when the Operating State should impose its own supervisory authority on the operation although obviously this should be done at the earliest possible time.

2.3 Legislation and ATC procedures

The philosophy underlying the present system of approach bans in the United Kingdom is that the place for operational decisions is the flight deck and that ATC should accede to pilot's requests whenever traffic allows. It follows that the best way to eliminate the possibility of wrong decisions is to improve flight deck procedures and equipment, and for operators to maintain a high standard of training and supervision of their crews. However, this imposes a responsibility on operators and their regulatory authorities which may be discharged with varying degrees of competency. Accordingly in the UK a number of administrative procedures must be followed before a foreign airline can operate a public transport service into the country. The Air Navigation Order, the Air Pilot, the weather minima which the operator has to provide to the CAA, and the Certificate of Competency which he must obtain from his state authority are all designed to confirm that high operating standards are being maintained. Although these may not always succeed in their objective, it is difficult to see what more can be done, administratively, to improve the situation.

Article 30 of the Air Navigation Order was introduced so as to place upon foreign operators the responsibility of operating to the same standards as UK airlines. The intention was to deter operators from using lower standards and implicit in the legislation is the presumption that action will be taken against offenders. Although the CAA is not in the same position to monitor directly the standards of foreign operators as it can for UK airlines, it should be possible, by actively administering the measures available, to maintain some controlling influence over both aircrews and operators who infringe the requirements of UK legislation.

The failure of the commander to make a correct decision in the circumstances of this approach was partly attributable to differences in national procedures. Although both pilots should have known about these differences they did not, and it must be accepted that similar cases may arise in the future. ATC was aware that the aircraft was making an approach on a Category 1 ILS in thick fog, and the RTF conversations were strongly indicative of a crew not fluent in the English language. Short of giving formal warnings, the controllers were doing all in their power to draw the crew's attention to what they

clearly saw as unsuitable weather. Their actions were therefore completely in accord with the philosophy of the system, which decrees that ATC will provide a service for pilots to use, without becoming involved in their decisions. Whilst this principle makes for a clear separation of responsibilities, one must question whether it makes the fullest use of all the facilities which might contribute to safe operation. In particular, in the circumstances of this accident, intervention by ATC, had the procedures allowed it, might have been helpful to the crew, and therefore might have made a contribution to the safety of the flight.

A detailed discussion of ATC procedures is outside the scope of this inquiry. It is recognised that there are difficulties in making ATC responsible for operating approach bans, not least the problem of simply ensuring that the controller knows the precise limits to which any particular aircraft should be operating. It is nevertheless recommended that there should be a study into the feasibility of extending the role of ATC in such a way as to enhance the awareness of air crews in conditions of bad weather. In this respect existing facilities for broadcasting information such as the Automatic Terminal Information Service (ATIS) might be used with effect. It is also recommended that efforts be made to achieve an internationally agreed system of approach bans.

3. Conclusions

(a) *Findings*

(i) The crew were properly licensed.

(ii) The aircraft had a valid Certificate of Airworthiness and its documentation was in order; its transfer to the Nigerian register was still in progress.

(iii) Whilst carrying out a missed approach in instrument conditions, the aircraft struck an aircraft parked on the ground.

(iv) The commander used an operating technique for the overshoot which differed from that specified in the aircraft's Operations Manual and, although the delay was short, failed to initiate overshoot action immediately on reaching Decision Height.

(v) The reported RVR was below company minima, circumstances which under UK legislation prohibited the continuation of an approach below 1,000 feet above Decision Height.

(vi) Before commencing the approach, the aircraft was advised several times of the poor weather conditions at its destination.

(vii) Both pilots were unaware of UK practices concerning approach bans and did not have a working knowledge of the instructions on weather minima which were contained in the company's Operations Manual.

(viii) The operator had not fulfilled his obligations to ensure that his crews were adequately briefed on UK procedures regarding weather minima.

(ix) The Operations Manual carried in the aircraft at the time of the accident was incomplete; the volume containing guidance on company policy concerning weather minima was missing.

(x) The parked aircraft was positioned in such a way that it conformed with the criteria regarding obstacles on aerodromes.

(b) *Cause*

The accident was caused by the commander's faulty technique whilst carrying out a missed approach, combined with his failure to initiate overshoot action immediately on reaching Decision Height. A contributory factor was the commander's lack of understanding of UK legislation regarding approach bans.

4. Safety Recommendations

4.1 It is recommended that the feasibility of operating state imposed approach bans should be actively examined and attempts made to achieve common international practices.

L S H Shaddick
Inspector of Accidents
Accidents Investigation Branch
Department of Transport

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