Accident to Indian Airlines Airbus A-300 aircraft VT-EDV on 15th November 1993 near Tirupati

Report of the Court of Inquiry

Air Marshal J.K. SETH (Retd.)
PVSM, AVSM, VM

Assessors

1. **Capt D.S. DATTA**
   Offg. Director Air Safety, Air India

2. **Mr. R.P. SRIVASTAVA**
   Engineering Manager (MM), Air India

Secretary

Mr. R.K. KHANNA
Senior Airworthiness Officer, DGCA

New Delhi
11th March 1994

Ministry of Civil Aviation and Tourism
(Department of Civil Aviation)

DECISION OF GOVERNMENT OF INDIA ON REPORT OF THE COURT OF INQUIRY OF THE ACCIDENT TO INDIAN AIRLINES AIRBUS A-300 AIRCRAFT VT-EDV ON 15TH NOVEMBER, 1993 NEAR TIRUPATI

1. Indian Airlines Airbus A-300 aircraft VT-EDV was involved in an accident in paddy fields near Tirupati on 15th November, 1993. There were 262 persons on board the aircraft including crew members. 8 persons received minor injuries. The aircraft sustained substantial damage.

2. Government had appointed a Court of Inquiry headed by Air Marshal J.K. Seth (Retd.) to investigate the accident. Capt. D.S. Datta, Dy. Director of operations (Safety), Air India and Shri R.P. Srivastava, Engineering Manager (Major Maintenance), Air India were appointed as assessors to assist the Court in the investigation.

3. The court of Inquiry has submitted its report. The Court has concluded that the accident was caused due to (a) The ill-conceived decision of the aircraft's Commander to divert to Madras, without ensuring that adequate fuel was available for reaching there, when he was faced with a flap-jam and poor visibility at Hyderabad, (b) The failure of the aircraft's Commander and his Flight Crew to monitor fuel consumption correctly, and the failure of the Commander to revise his decision accordingly, until it became impossible to reach any airfield and (c) A forced landing due to the eventual shortage of fuel. The Government has accepted the cause of accident.

4. The Court has made 21 findings and 13 recommendations. Government has accepted the report of Court of Inquiry, its findings and all the recommendations. Action taken on each finding and recommendation is annexed.

Accident to Indian Airlines Airbus A-300 Aircraft VT-EDV on 15th November, 1993 Near Tirupati

FINDINGS	*ACTION TAKEN*
5.1 The aircraft was airworthy and fully serviceable for the flight. Other than jamming of its flaps, which occurred during the go-around at Hyderabad, there was no failure or malfunction of any systems during the flight. (Paras 2.6.1, 2.6.2 and 2.6.3 refer).	Noted.
5.2 The Flight Crew held valid licenses and they were fully qualified to undertake the flight. They had undergone the requisite pre-flight medical examination and they had been pronounced as not being under the influence of alcohol. (Paras 2.5.1, 2.5.2 and 2.12.1 refer).	Noted.
5.3 The Meteorological Office at Hyderabad airport failed to make a reasonably accurate forecast of visibility on the day of the accident. It also failed to assess the trend of visibility correctly at the time of issuing special reports at 0640/0645 /0655 hours IST. (Para 4.9 refers).	DGCA will take up the matter with Indian Meteorological Department for taking action against the individuals responsible for the failures and for taking necessary steps to avoid such failures in future.
5.4 The commander of Flight IC-400 made an approach at Hyderabad in visibility conditions below his weather minima. In spite of Indian Airlines unambiguous policy prohibiting any such approach, except in an emergency, similar violations of the weather minima are sometimes made by other pilots also. The operations Department of the Airline makes no worthwhile effort to detect and prevent such occurrences. (Paras 4.2.4, 4.2.5, 4.3.2 and 4.3.3 refer).	Suitable action will be taken against the commander. DGCA has reiterated instructions that operators should have a system to monitor their flights to ensure strict adherence to weather minima. Indian Airlines has reiterated instructions to their flight crew regarding adherence to weather minima as stipulated in the Operations Manual. Indian Airlines has also issued instructions to position senior pilots in the regions to monitor violations of weather minima if any.

5.5 Flight IC-916 made a very injudicious and imprudent transmission to encourage Flight IC-440 to go ahead and make an approach in below-minima conditions. (Para 4.3.2 refers).	DGCA has issued an Air Safety Circular advising all flight crew to avoid such transmissions. Indian Airlines has also issued a circular advising their pilots to avoid injudicious transmissions while giving advice/ assistance to other flights. It is also being monitored through Cockpit Voice Recorders.
5.6 Upon going around at Hyderabad Airport, the flaps of Flight IC-440 got jammed in the fully extended position due to a lock-out. Efforts made by the aircraft's crew to release the lock-out were unsuccessful. (Paras 4.4.1 and 4.13.2 refer).	Noted.
5.7 The ATC at Hyderabad failed to use the stipulated procedure correctly when Flight IC-440 was arriving in visibility conditions below its weather minima. It also failed to obtain weather information about Bidar airfield, when requested by IC-440 for visibility of Air Force Stations, and to inform the aircraft suitably. (Paras 4.8.3, 4.8.4 and 4.8.5 refer).	Suitable action will be taken against the defaulting Air Traffic Controller. Further more, NAA has instructed their Air Traffic Controllers to strictly follow the stipulated procedures in poor visibility conditions. They have also been instructed to provide maximum assistance to aircraft in emergency, should there be a need to divert or force land.
5.8 When faced with a flap jam situation and very poor visibility at Hyderabad, the Commander diverted to Madras without ensuring that adequate fuel was available for completing that flight. In taking this decision, he:-	
(a) Discarded the better option of holding over Hyderabad in the expectation of an improvement in the visibility and, if necessary, eventually making an auto-landing there. He did so in spite of his having been trained in simulated auto-landings and his	(a) & (b) : Suitable action will be taken against the commander. Indian Airlines would incorporate specific guidelines for the use of auto land in the operations manual.

Airline's policy allowing him to make a below-minima landing in the given circumstances. (Paras 4.5.I, 4.5.7 and 4.2.1 refer).	
(b) Failed to seek specific information about the prevalent visibility at Bidar, which was easily within the range of the aircraft, and to consider a diversion to that place. (Paras 4.5.1. and 4.5.5 refer).	
5.9 During the attempted diversion to Madras, the Commander failed to retract the aircraft's slats to minimise drag and, after sometime, he reduced his speed injudiciously from about 165 knots to 135 knots. Had these errors not been made, he could have reached Tirupat easily. (Paras 4.6.2, 4.6.3 and 4.6.4 refer).	Suitable action will be taken against the commander. Indian Airlines have issued instructions to their pilots to follow the recommended procedures regarding optimum speed for different configurations. This aspect would also be highlighted during their refresher courses.
5.10 During the attempted diversion to Madras, the commander and his Flight crew failed to make a timely assessment that the available fuel was inadequate for that flight. The Commander pressed on with his hopeless decision to proceed towards Madras, and missed the opportunity of returning to Hyderabad or diverting to vijayawada while it was still possible to do so. (Paras 4.6.5 and 4.6.6. refer).	Suitable action will be taken against the commander and the flight crew. Indian Airlines has issued instructions to their flight crew to carefully review the fuel quantity on board to ensure that adequate fuel is available to reach the destination keeping in view the aircraft configuration.
5.11 When the Commander realised that the fuel was utterly inadequate for reaching Madras, he decided to head for Tirupati. However, he could not reach even Tirupati and had to forceland the aircraft. (Para 4.5.9 refers).	Noted.

5.12 The Commander filed to caution the cabin crew and passengers, and to take certain other essential steps, before the forced landing. (Paras 4.7.1 and 4.7.2 refer).	Suitable action will be taken against the commander. DGCA has issued an Air Safety Circular to all operators to ensure that in case of a forced landing, the flight crew caution the cabin crew who in turn would brief the passengers and take other essential steps. Indian Airlines have also reiterated instructions in this regard.
5.13 The Commander chose a good area for the forced landing and he handled the aircraft skilfully during the approach and touch down. (Para 4.7.3 refers).	Noted
5.14 The Flight Operations Officer of Indian Airlines failed to appreciate the difficulties faced by Flight IC-440 and to take any helpful action. (Para 4.10.3 refers).	Indian Airlines has issued instructions to their Flight Despatchers to be more vigilant, whenever weather conditions are bad and should obtain weather condition of nearby airfields. Indian Airlines have also initiated action against the erring personnel.
5.15 Operational control over the flights of Indian Airlines, as envisioned in their Operations Manual,is not working effectively. (Para 4.10.2 refers.	Indian Airlines have issued instructions to depute senior pilots for operational control duty at all bases during bad weather.
5.16 As many as four out of the eight escape chutes in flight IC-440 failed to operate satisfactorily. (Paras 4.11.1, 4.11.2 and 4.11.3 refer).	DGCA has issued instructions to all operators to increase the frequency of mandatory checks of slide chutes deployment and for more random checks in the shops.
5.17 In spite of proper maintenance, the Flap system of A-300 aircraft is prone to occasional lock-outs. The trouble shooting procedures for detecting and reinedying the cause of a lock out are too cumbersome and time-consuming. (Para 4.12.6 refers).	DGCA has taken up the matter with DGAC France (Regulatory Authority) regarding flap jamming on Airbus A-300 aircraft.

5.18 In spite of a long history of flap-jams on A-300 aircraft, both aircraft manufacturer and operators had failed to evaluate all possible consequences of such occurrences and to evolve the means to cope with the same. (Para 4.12.7 refers).	Indian Airlines had taken up the matter with Airbus Industries. As per their advice, a circular has been issued to all A-300 flight crew giving guidelines to cope up with such emergencies.
5.19 The Engineering Department of Indian Airlines has not yet adopted the periodicity of servicing of flap system screw jacks as recommended by the manufacturer about six years ago. Its holding of specialist tools needs to be reviewed. Its system of timely servicing of aircraft components is not fool-proof. (Para 4.14.1 refers).	DGCA has since issued instructions to the operators to follow the manufacturers recommended periodicity of servicing the flap system. Indian Airlines has acquired the special tools for servicing the flap system. Indian Airlines is also computerising the Major component overhaul records to ensure timely servicing.
5.20 There is a pressing need to upgrade the effectiveness of the Air Safety Department of Indian Airlines (Para 4.15.1 refers).	Indian Airlines is upgrading and strengthening it's Flight Safety Department to make it more effective.
5.21 The accident was entirely preventable. It was sheer providence that, in spite of many mistakes made by several people, no loss of life or serious injury resulted for it. (Para 4.16.3 refers).	Noted

CONCLUSION	*ACTION TAKEN*
6.1 The accident was caused by:-	Accepted.
(a) The ill-conceived decision of the aircraft's Commander to divert to Madras, without ensuring that adequate fuel was available for reaching there, when he was faced with a flap-jam and poor visibility at Hyderabad. (Paras 4.5.3, 4.5.8 and 4.5.9 refer).	
(b) The failure of the aircraft's Commander and his Flight Crew to monitor fuel consumption correctly, and the failure of the Commander to revise his decision accordingly, until it became impossible to reach any airfield. (Paras 4.5.9, 4.6.5 and 4.6.6 refer).	
(c) A forced landing due to the eventual shortage of fuel. (Para 4.5.9 refers).	

RECOMMENDATIONS	*ACTION TAKEN*
7.1 At airports where the automatic measurement of RVR is not available, procedures for the visual measurement of RVR should be rationalised and streamlined. (Para 4.9.6 refers).	Accepted. DGCA has taken up the matter with Indian Meteorological Department for necessary action.
7.2 Indian Airlines should :-	
(a) Take effective measures for the fool-proof adherence to the applicable weather minima in each and every flight. (Para 4.2.10 refers).	Accepted. DGCA has issued instructions that operators should have a system to monitor their flights to ensure strict adherence to weather minima. Indian Airlines has reiterated instructions regarding adherence to weather minima and have also issued instructions that a senior pilot be positioned in the operations Control to detect any violation of weather minima:
(b) Caution pilots against offering injudicious advice to other aircraft. (Para 4.3.4 refers).	Accepted. DGCA has issued an Air Safety Circular advising all operators to advise their flight crew to avoid such transmissions. Indian Airlines has also issued a circular advising pilots to be more judicious in passing such transmissions to other aircraft.
(c) Enhance the utility and effectiveness of operational control over their flights to comply fully with the provisions in their Operations Manual. (Paras 4.10.1 and 4.10.2 refer).	Accepted. Indian Airlines has issued instructions to depute senior officers to exercise operational control over all flights at the major base stations during bad weather.
(d) Make a thorough review of the maintenance and reliability of aircraft escape chutes of their A-30 and Boeing-737 aircraft, with due involvement of the manufacturers of such chutes. (Para 4.11.3 refers).	Accepted. Indian Airlines is reviewing the maintenance and reliability of escape chutes of A-300 and B-737 aircraft in consultation with vendors.

	DGCA has issued instructions to all operators to increase the frequency of mandatory checks of slide chutes deployment.
(e) Seriously consider the possibility of installing visual indicators on all torque limiters in the flap system of A-300 aircraft to facilitate easier and surer trouble shooting of flap system lock-outs (Para 4.12.6 refers)	Accepted. Indian Airlines has taken up the matter with the Airbus Industries and Lucas, manufacturer of flap screw jacks.
(f) Review the periodicity of servicing of flap system screw jacks of A-300 aircraft. (Para 4.14.1a refers).	Accepted. DGCA has since issued instructions to the operators to follow the manufacturers recommended periodicity of servicmg the flap system.
(g) Review their holding and adequacy of specialist aircraft tools. (Para 4.14.1b refers).	Accepted. Indian Airlines has reviewed the requirement of holding of special tools and has acquired additional special tools needed for flap system servicing. Some special tools whose utility is minimal are acquired on need basis from the manufacturers.
(h) Ensure a really foolproof system of timely servicing of aircraft components. (Para 4.14.1c. refers).	Accepted. Indian Airlines is monitoring all major components with reference to requirements of Components Operations and Storage Limit (COSL)/Components Maintenance Manual (CMM)/Aircraft Maintenance Manual (AMM) and Regulatory requirements. In order to make the system fool proof, Indian Airlines is computerising the Major Component Overhaul records to ensure timely servicing.

(i) Set up a small team of non-IA professionals and specially selected personnel from within the Airline for thoroughly reviewing and enhancing the effectiveness of their Air Safety Department. (Para 4.15.1 and 4.15.2 refer).	Accepted. Indian Airlines had constituted an Air Safety Review team which was headed by a senior retired officer of Air India. The report is being implemented.
(j) tighten the implementation of their procedures for checking Flight Crew for presence of alcohol in their blood-stream/breath. (Para 4.16.1 refers).	Accepted. Indian Airlines has issued instructions to all the Regional Medical Officers in this regard.
7.3 The National Airports Authority should :-	Accepted. NAA has issued instructions to their Regional Directors Aerodromes and Dy. Directors (ops) for strictly adhering DARA Circular No. 6 of 1993.
(a) Ensure strict adherence to the procedure laid down in their DARA circular no. 6 of 1993 (Para 4.8.3. refers).	
(b) Investigate the outage of runway lights at hyderabad on 15th Nov., '93 and take suitable measures to prevent any similar recurrence. (Para 4.8.7 refers).	Accepted. NAA has carried out investigation to ascertain the cause of failure of lights at Hyderabad Airport on 15th Nov. 1993. It was found that when visibility was reduced, the controller increased the illumination rapidly to the maximum and as a result the fuse blew off. NAA has issued instructions to Traffic Controllers to ensure that the increase of illumination is done gradually.

CONTENTS

LIST OF ANNEXURES

'A'	:	Map indicating place of forced landing
'B' & 'C'	:	Photographs of aircraft after forced landing
'D'	:	Transcript of Hyderabad ATC's tape recording
'E'	:	Transcript of Madras ATC's tape recording
'F'	:	Transcript of Cockpit Voice Recording
'G', 'H' &'I'	:	Extracts of DFDR data
'J'	:	Previous cases of flap jamming in Indian Airlines
'K' & 'L'	:	Notification of Ministry of Civil Aviation and Tourism
'M'	:	Notification of Court of Inquiry
'N'	:	List of witnesses examined
'P'	:	DARA circular no. 6 of 1993

INTRODUCTION

1.1 On 15th November 1993, Indian Airlines Flight IC-440 took off from Madras for Hyderabad at about 0615 hours. The type of aircraft was Airbus A-300 B2. There were 12 crew members and 250 passengers on board. Capt. R.P. Bhalla was in command.

1.2 The estimated flying time to Hyderabad was 46 minutes. The designated diversionary airfield was the same as the place of departure, i.e. Madras. The requirement of fuel for the flight, including reserves for diversion and contingencies plus 30 minutes of holding, was 14.7 tonnes. The actual quantity of fuel taken was 16.0 tonnes which corresponded to an airborne endurance of 2 hours and 20 minutes.

1.3 On that day, the weather forecast for Hyderabad for the period 0330-1130 hours indicated a visibility of 10 kms reducing temporarily to 3000 metres in mist during 0530-0930 hours. However, according to actual weather reports, the visibility reduced to 2000 metres at 0640 hours, 1500 metres at 0645 hours, 500 metres at 0655 hours and 200 metres at 0710 hours. Thereafter, it improved to 1200 metres by 0810 hours.

1.4 Flight IC-440 made one approach for landing at Hyderabad. Being unable to sight the runway at decision height, its Commander carried out a go-around at about 0705 hours. However, the aircraft's flaps failed to retract from the fully extended position. Being unsuccessful in efforts to free the flaps from their jammed condition, and on finding out that the visibility at two nearby Air Force airfields (Air Force

Academy and Hakimpet) was even worse than at Hyderabad, the Commander decided to divert to Madras. Due to the aircraft's flaps being stuck in the fully extended position, its indicated airspeed had to be limited to a maximum of 180 knots. Flying in this configuration at a height of 15000-17000 feet a.m.s.l., there was a significant increase in the aircraft's fuel consumption. Further enquiries were made by the aircraft about the visibility at Hyderabad and its likely trend but, finding the information to be not encouraging, the Commander continued to proceed towards Madras.

1.5 The aircraft had indicated its estimated time of arrival at Madras as 0820 hours. At about 0809 hours, the Commander decided to proceed to Tirupati airfield as he found the aircraft's remaining fuel to be insufficient for making it to Madras. He sought assistance from Madras Control in navigating the aircraft to Tirupati and this was duly provided. However, with very little fuel left in the aircraft's fuel tanks, the aircraft was force-landed at about 0825 hours in some paddy fields about 26 kms short of Tirupati airfield.

1.6 The nose-wheel of the aircraft broke away almost immediately after contacting the ground. The aircraft decelerated rapidly due to the friction created by the nose section of the fuselage with the ground. Soon after it came to rest, all occupants were evacuated safely. There was no fire. With the exception of 8 occupants, all others were unhurt. No one was injured on the ground.

FACTUAL INFORMATION

2.1 History of Flight

2.1.1 On 15th November 1993, Indian Airlines Airbus A-300 aircraft registration no. VT-EDV was scheduled to operate Flight IC-440 (Madras-Hyderabad-Delhi) under the command of Capt R.P. Bhalla. The flight departed Madras for Hyderabad on schedule.

2.1.2 The crew of the aircraft had been given meteorological and communication briefing at Madras for both sectors of the flight. For the Madras-Hyderabad sector, Madras had been designated as alternate airfield of landing.

2.1.3 Take off from Madras was at about 0618 hours. The aircraft's first contact with Hyderabad Tower was at 0108 hours UTC, when it was asked by the ATC to monitor airfield information. At 0114 hours UTC, the aircraft requested descent clearance to FL 280 when it reported 97 DME from Hyderabad. It was cleared to FL 100 and given the visibility as 2000 metres. About three minutes later, at 0117 hours UTC, the latest visibility of 1500 metres was intimated to the aircraft. At 0124 hours UTC, when the aircraft reported 25 DME from Hyderabad, it was cleared to 4400 feet on QNH 1015 and it was vectored for ILS approach for runway 27. About two minutes later, at 0126 hours UTC, the ATC gave the latest visibility as 500 metres which was acknowledged by the aircraft. At 0127 hours UTC, the request of the aircraft to descend to 3300 feet was not approved by the

ATC and the aircraft was asked to check its minima. In response, the aircraft intimated its intention to make one approach. At 0129 hours UTC, the aircraft reported over HY locator and again requested clearance to descend to 3300 feet. While according this clearance, the ATC asked the aricraft to report when established on the localiser and once again the aricraft was asked to check its minima. At 0130 hours UTC, the aircraft asked for the RVR and the ATC replied that the vehicle was proceeding to Runway 27 for taking RVR. At 0132 hours UTC, the aircraft reported established on localizer and the ATC informed it that RVR for Runway 09 was 240 metres. When the aircraft reported over the outer marker, the ATC asked it to descend to MDA and report runway visual. The aircraft reported going around at 0135 hours UTC and, upon being asked by the ATC about its intention, asked for the weather trend. This was given as 'no significant change'. The aircraft enquired how long the weather was likely to remain unchanged and, at 0137 hours UTC, this was given as half an hour. The ATC again asked for the pilot's intention. At 0139 hours UTC, the aircraft informed that it was joining HHY hold. Almost immeditely thereafter, it informed the ATC that it was having some problem with its flaps and it would call back again.

2.1.4 At 0140 hours UTC, the ATC gave the RVR for Runway 27 as 240 metres which was acknowledged by the aircraft. At 0142 hours UTC, the aircraft informed the ATC that it was diverting to Madras. At 0150 hours UTC, the aircraft asked for the latest visibility and RVR which were given as 200 metres and 240

metres respectively. On further enquiry by the aircraft about the trend, the ATC said that visibility was expected to become 1500 metres in mist by 0210 hours UTC. At 0151 hours UTC, the aircraft asked if any Air Force Station was reporting better visibility than Hyderabad. About 9 minutes later, at 0200 hours UTC, it was informed that the visibility at Air Force Academy and Hakimpet was 50 metres and 100 metres respectively. At 0152 hours UTC, the aircraft reported its positioin as 43 nm out of Hyderabad and it requested another visibility check as it was having a technical problem with its flaps stuck in the down position and cruising speed limited to 165 knots and that it was on marginal fuel for Madras. This message was acknowledged by the ATC. About three minutes later, the ATC informed the aircraft that the visibility was 500 metres and the runway lights were not available. This was acknowledged by the aircraft.

2.1.5 At 0202 hours UTC, Hyderabad ATC asked the aircraft about its endurance. The aircraft gave this as one hour, reported 80 nm out of Hyderabad, and gave its ETA Madras as 0250 hours UTC. While acknowledging this message, the ATC asked the aircraft to confirm if it would be able to make upto Madras. The aircraft replied "Will try". At 0212 hours UTC, when the aircraft reported 105 DME from Hyderabad, the ATC asked the aircraft that it still had to go another 185 miles and to confirm that it would be able to reach Madras. The aircraft replied 'Affirmative'.

2.1.6 The aircraft's first contact with Madras Control was at 0221 hours UTC, when it reported 140 DME out of Hyderabad.

Madras Control enquired about its endurance which was given as about 35 minutes. At 0226 hours UTC, the aircraft informed Madras Control that it was on radial 333 from Madras at FL 170 and 136 DME from Madras. At 0239 hours UTC, the aircraft was identified on Madras radar when it was 100 nm from Madras. At this stage, the aircraft requested Madras Control to get Tirupati airport operational and it indicated its intention of making an approach there. At 0241 hours UTC, the aircraft asked for the heading to Tirupati from its position at that time. Immediately thereafter, the aircraft informed "No way I can make it to Madras, On low fuel, I have to make to Tirupati, that is evident, 40 miles I can glide into Tirupati if you could cooperate." Madras ATC gave the aircraft its heading as 171 degrees to Tirupati and also gave the length of Tirupati runway as 4500 feet. At 0245 hours UTC, upon an enquiry from the aircraft, the ATC informed that it was approximately 32 miles from Tirupati and the heading to Tirupati was 166 degrees.

2.1.7 At 0249 hours UTC, when the aircraft was 30 miles from Tirupati on a bearing of 355 degrees, it gave its endurance as 5 minutes. In reply to an enquiry from the ATC, the aircraft reported passing 3000 feet height and said that it did not have Tirupati airfield in sight. From 0252 hours UTC, the aircraft could not communicate with Madras Control. It made an RT transmission asking any station to relay to Madras and obtain its distance to Tirupati. This message was picked up by Flight IC-439 which relayed it to Madras Control and obtained information that IC-440 was 29 miles from Tirupati on a bearing of 345 degrees.

This message was intimated to and acknowledged by IC-440. At 0254 hours UTC, Madras control lost radar contact with Flight IC-440. It asked IC-439 which was flying in that area to try to raise IC-440. At 0330 hours UTC, Flight IC-439 informed Madras Control that 440 was on the ground in paddy fields near Tirupati and everything was safe.

2.1.8 Flight IC-440 force-landed at 03:55:19 hours UTC in paddy fields about 14 nm due north of Tirupati. Ground marks indicated that the aircraft's nose wheel collapsed almost immediately after touch-down. Due to high friction of the front fuselage with the ground, it decelrated rapidly and came to a stop within 1400 feet. All passengers and the crew members came out of the aircraft safely after it came to a halt. Evacuation was mostly carried out by means of escape chutes except from No. 1R door where several persons jumped out as the escape chute did not deploy and the sill height had diminished due to the collapse of nose landing gear.

2.1.9 An airborne search was launched soon after the accident. A Naval helicopter was the first to reach the site of the accident. Presently, an IAF helicopter with para-medical team landed there and rendered first aid. It also airlifted the personnel requiring medical treatment to Bangalore. Others were taken to Tirupati by helicopter/bus.

2.1.10 A map indicating the place of force-landing is placed at Annexure 'A'.

2.2. Injuries to Persons

2.2.1 The extent of injuries to personnel due to the accident was as follows:

	Injuries	Passengers	Crew	Others
a)	Fatal	-	-	-
b)	Serious	-	-	-
c)	Minor	4	4	-
d)	Uninjured	246	8	N/A
	Total	250	12	N/A

2.3 Damage to Aircraft

2.3.1 The aircraft suffered substantial damage as listed below:

(a) Aircraft Structure

Lower fuselage between sections 11 and 24 severely crushed.

Forward pressure bulkhead buckled.

Cabin floor structure from frame 12 to 22 bent upwards.

Forward cargo compartment cross beams and relevant struts from frame 26 to frame 38 severely damaged.

Forward toilets and galley substantially damaged.

Avionics bay and racks deformed.

(b) Landing Gear

Nose landing collapsed, sheared from its Neo cylinder and got embedded into the forward cargo compartment.

Main landing gear doors, forward vertical frames and inner/outer skils bent and cracked.

(c) Wings

Several leading edge and trailing edge panels punctured/ cracked.

No. 1 RH slat screwjack disconnected from the slat surface due to rupture of attachment bracket.

Punctures in lower skin of LH and RH inboard trailing edge flaps. Tab lower skin buckled.

The actuating bracket of the outboard tab of centre track broken.

(d) Engines and Pylons

Both engines severely damaged by impact and FOD.

Both engine pylons damaged with buckled beam section and torn fairings/panels.

2.3.2 Photographs of the aircraft after the forced landing are placed at Annexures "B" and "C".

2.4 Other Damage

2.4.1 The aircraft landed in water-soaked open paddy fields. The growing crop which came in contact with the aircraft was partially destroyed.

2.5 Personnel Information

2.5.1 The pilot and the copilot were fully qualified on Airbus A-300 B2 aircraft. Their relevant particulars are detailed below:

		PILOT	CO-PILOT
a)	Name	Capt. R.P. Bhalla	Capt. S. Velraj
b)	Date of Birth	25.11.1939	12.11.1964
c)	Date of joining	1.3.1965	19.4.1987
d)	Licence No.	ALTP No. 553/3 valid till 29.1.94	SCPL No. 893 valid till 18.4.94.

e)	Total flying experience	17,344 hours	2,403 hours
f)	Flying experience on A-300	4,707 hours	909 hours
g)	Experience as A300 commander	4,275 hours	-
h)	Type endorsements	B-737 & A 300 as P1	B-737, A320 & A30 as P2
i)	Last Refresher	1-4 Feb 1993	5-8 April 93
j)	Last Route Check	16.10.93	28.3.93
k)	Flying in last one month	48.40 hours	34.35 hours
l)	Flying in last one week	12.30 hours	07.30 hours
m)	Familiarity with Route being flown	Very familiar	Very familiar

2.5.2 Relevant particulars of the Flight Engineer are detailed below:

a)	Name	:	S.K. SEN
b)	Date of Birth	:	28.11.1935
c)	Date of joining IA	:	26.10.1967
d)	Licence No.	:	FE Lic No. 97 valid till 19.9.94.
e)	Total flying experience	:	13,535 hours.
f)	Flying experience on A-300	:	Substantial (Actual figures N/A)
g)	Type endorsements	:	DC-4, Caravelle, A-300 B2, A-300 B4
h)	Last Refresher course	:	1-4 Feb 1993.
i)	Last Simulator Training	:	2.10.1993.
j)	Flying in last one month	:	51.05 hours.
k)	Flying in last one week	:	Nil.

2.5.3 Relevant particulars of the Cabin Crew are as follows:

a) Mrs. Pushpa Chaganti : Senior-most Cabin Crew of the flight. Flying with IA for about 18 years.

b) Ms. Amia, Air Hostess. Assigned duty on door 1L.

c) Mr. V.R. Raghunathan. Senior Flight Purser on this flight. Assigned duty on 2L door. Flying with IA for about 12 years.

d) Ms. Promilla Devi, Air Hostess. Assigned duty on door 3L. Flying experience about three years.

e) Ms. Pradeep, Air Hostess. Assigned duty on door 4L and also responsible for making cabin announcements on this flight. Flying with IA for about 13 years.

f) Ms. T. Kalpana, Air Hostess. Assigned duty on door 1 R. Flying exprience of about one year.

g) Ms. Padmini Sekhar, Air Hostess. Assigned duty on door 2 R.

h) Mr. P.S. Reddy, Flight Purser. Assigned duty on door 3 R. Flying experience about 13 years

i) Mrs. G. Peer, Air Hostess. Assigned duty on door 4 R. Flying exprience about 3 years.

2.6 Aircraft Information

2.6.1 Airbus A-300 aircraft VT-EDV is a B-2 model bearing sl. no. 034 manufactured by Airbus Industrie, France. It was issued with an Indian Certificate of Registration No. 2128 in category 'A' on 9th November, 1976. The aircraft held certificate of airworthiness no. 1675 which was valid till 11th April, 1994. The aircraft had completed 36,495 flight hours/25,038 cycles, and 17 years since

its manufacture. The major checks carried out on the aircraft in the preceding one year are as follows:-

Check	Date of Check completed	Aircraft hours/landings
'C' (4000 FH/18 months)	29.12.92	34586.55/23867
'A' (500 FH/100 days)	5.4.94	35056.32/24265
'B' (1000 FH/200 days)	19.6.93.	35539.21/24478
'A' (500 FH/100 days)	8.9.93	36034.45/24797

2.6.2 The aircraft had flown 1908 FH/1221 landings since its last check 'C'. Its Flight Release Certificate after last check 'A' inspection was valid till 17.12.93.

2.6.3 On 14th November 1993, the aircraft had operated flights from Madras to Hyderabad and back, Madras to Bombay and back, and Madras to Delhi and back. The maintenance records do not reveal any snags on the flap/slat or any flight control system during these flights. The aircraft had undergone fortnightly inspection of 100 FH/15 days at Madras on 13/14.11.93 and had flown 09.05 hours since then. The aircraft was released for the flight after carrying our a pre-flight check at Madras.

2.6.4 The aircraft had uplifted 8,200 litres of fuel at Madras before operating flight IC-440. The total fuel in the tanks at the time of

departure was 16000 kg. The load and trim sheet prepared at Madras indicated a total traffic load of 25389 kg which comprised of 1805 kg of baggage, 4966 kg of cargo, 143 kg of mail and the weight of 247 adult passengers, three infants and 12 crew members.

2.6.5 A-300 aircraft of various airlines have been involved in occasional cases of flap jamming. A list of such cases pertaining to Indian Airlines since 1.1.1990 is placed at Annexure 'J'. Cases of flap-jam compiled by Airbus Industrie include two instances in which the aircraft had to divert with flaps extended. These occurred on 14.9.1992 at Canberra and 6.6.1993 at Orly.

2.7 Aerodrome Information

2.7.1 Hyderabad airport, which was the intended destination and from where the flight diverted, has one runway with 09/27 orientation. There is a simple approach lighting system for RWY 09 and CAT I approach lighting system for RWY 27 upto a distance of 630 metres from the displaced threshold. This runway is also equipped with standard lighting of variable intensity. RWY 27 is equipped with ILS with a glide angle of 3 degrees with ILS reference datum of 50 feet. The ILS includes outer and middle markers.

2.7.2 There are three Air Force airfields in the vicinity of Hyderbad airport. These are Air Force Academy, Hakimpet and Bidar. The Academy is located about 17 n.m. NNW of Hyderabad, Hakimpet is about 6 n.m. NNE of Hyderabad and Bidar is

about 61 n.m. NW of Hyderabad. All these airfields are in regular and intensive use by jet trainer aircraft.

2.8 Pre-Flight Briefing

2.8.1 A summary of the flight plan filed for flight IC-440 on 15th January 1993 is given below:

a)	Time of filing	: 2300 UTC on 14.11.93.
b)	Addressees	: Hyderabad Tower, Madras FIC, Delhi Tower, Delhi FIC, Lucknow Tower, Nagpur Area Control, Bombay FIC, Ahmedabad Tower.
c)	Flight No.	: IC-440
d)	Flight Rules	: IFR
e)	Type of Flight	: Scheduled
f)	Type of Aircraft	: A-300
g)	Wake Turbulence Category	: H
h)	Departure Aerodrome	: Madras
i)	ETD	: 0030 UTC
j)	Cruising Speed	: 483 Knots
k)	Flight level	: 280
l)	Route	: W-20
m)	Destination Aerodrome	: Hyderabad
n)	Total estimated elapsed time	: 00:46 hours
o)	Alternate Aerodrome	: Madras
p)	Registration	: VT-EDV
q)	Selcal	: KLEG
r)	Endurance	: 02:22 hours
s)	Aircraft colour marking	: IA white and orange
t)	Pilot in Command	: Capt R.P. Bhalla

2.8.2. The Met. Office at Madras airport had issued terminal area forecasts for Flight IC-440. The salient features of these were:–

a) Madras 2330 UTC : Surface wind 050/2-10 kts. Vis 8 km, temp 0003 UTC 1500 metres in fog

b) Hyderabad 2330 UTC : Wind Calm Vis. 3000 m in haze

c) Delhi 2330 UTC : Wind Calm Vis. 600 m in smoke.

2.9 Meteorological Information

2.9.1 The local weather forecast issued by the Met. office Hyderabad at 2200 hours UTC on 14th November 1993 valid until 0600 hours UTC on 15th November 1993 indicated a visibility of 10 km, reducing temporarily to 3000 metres in haze during 0000-0400 hours. The same information was repeated in the additional notes and warning.

2.9.2 The actual weather reports of Hyderabad on that day were as follows:–

	Time (UTC)	Nature of Report	Visibility	Trend
a)	0010	Metar	6 km	Vis. reducing to 3000 metres in haze
b)	0040	Speci	3000 m	Nosig
c)	0110	Speci	2000 m	Nosig
d)	0115	Speci	1500 m	Nosig
e)	0125	Speci	500 m	Nosig
f)	0140	Speci	200 m	Vis. becoming 1500 m in mist

g)	0210	Speci	500 m	Vis. becoming 1500 m in mist
h)	0240	Speci	1200 m	Vis. becoming 1500 m in mist
i)	0310	Speci	2000 m	Vis. becoming 3000 m in haze

2.10 Communications with ATC

2.10.1 Transcripts of the aircraft's communications with ATC Hyderabad and ATC Madras are placed at Annexures 'D' & 'E' respectively.

2.11 CVR/DFDR

2.11.1 The aircraft was equipped with Fairchild A-100 Cockpit Voice Recorder sl. no. 54482. Conversations are recorded on the pilots' channel, Copilot's channel, Flight Engineer's channel and an area channel which records conversations/other sounds in the Cockpit.

2.11.2 The Cockpit Voice Recorder was recovered from the aircraft in an undamaged condition and brought to Delhi for replay. The quality of recording was found to be satisfactory. With the help of Indian Airlines authorities, voice identification of crew members was carried out. A transcript of the Cockpit Tape recording is placed at Annexure 'F'.

2.11.3 The aircraft was equipped with Sundstrand Flight Data Recorder sl. no. 3659. It was removed from the aircraft in an undamaged

condition. It was played at the Indian Airlines facility in Bombay and a read-out was prepared. Three plots of relevant parameters for the period 0132-0145, 0135-0145 and 0140-025519 are placed at Annexures 'G', 'H' and 'I' respectively.

2.11.4 Salient observations made from the DFDR print-out are given below:-

a)	0132-0133 UTC	Normal operation of undercarriage, flaps and slats in preparation for landing.
b)	0134-0135 UTC	Flaps stuck in fully extended position while slats move to 20 degrees.
c)	0136-0145 UTC	Limit IAS of 180 kts exceeded.
d)	0138 UTC (approx)	Changes in slat position indicating recycling of flaps.
e)	0137-0255 UTC	Slats kept at 20 degrees/25 degrees, except for brief periods of recycling of flaps. Flaps remained stuck in fully extended position.
f)	0202-0255 UTC	IAS reduced to 135-140 Kts.

2.12 Medical Information

2.12.1 All three members of the Flight Crew had undergone a pre-flight medical check before departure from Madras and they had been declared to be 'not under the influence of alcohol". This check did not include a breathlyser test.

2.12.2 Contrary to stipulated procedures, blood samples of the flight crew were not taken after the accident, either by the police

authorities or by the Medical Officers of Indian Airlines, for detection of alcohol presence if any.

2.13 Fire

2.13.1 The aircraft and its engines did not catch fire as a result of the accident.

METHOD OF INVESTIGATION

3.1 This formal investigation was ordered by the Government of India, Ministry of Civil Aviation and Tourism, under Rule 75 of the Aircraft Rules 1937, vide notification number AV.15013/17/93-SSV dated 23rd November 1993. A copy of the same is placed at Annexure 'K' and 'L'. The procedure adopted by me for carrying out the investigation is briefly stated below:-

a) Rule 75 of the Aircraft Rules 1937 stipulates that the Court shall hold the investigation in such manner and in such conditions as the Court may think fit for ascertaining the circumstances of the accident and for enabling the Court to make its report. Thus, the nature of my task was quasi judicial, and I was free to choose the method which was best suited for fulfilling my mandate. I could obtain information for my investigation from all sources and make use of it without being fettered or hindered by the rigidity of the procedures which govern proceedings in Courts. This understanding is in full conformity with the ruling of the Supreme Court (case no. AIR 1963, SC 365) on the scope of such inquiries as also with the procedures followed during the investigation of some earlier accidents.

b) It is also stipulated in the said Rule 75, and spelt out in the above-mentioned ruling of the Supreme court, that all affected parties must be given a fair opportunity to explain their conduct if any information is to be made use of against them. This was duly complied with.

c) Throughout the investigation, I and my assessors were guided by the objective of aircraft accident investigation as given in ICAO Annexure 13, i.e. "The fundamental objective of the investigation of an accident or incident shall be the prevention of accidents and incidents. It is not the purpose of this activity to apportion blame or liability". However, this did not mean that we would turn a blind eye to any mistakes made by people which may have caused the accident or contributed towards its occurrence. To do so would have negated the very purpose of our investigation because, unless we could establish the wrong actions which led to the accident, we could not suggest any preventive measures for the future. Thus our general approach may be summed up by saying that we were determined to find out everything which was relevant to the accident but we were not so much interested in "who did it" as we were keen to ascertain "why it happened". Our comments in this report on the errors of individuals and deficiencies in organizations are not intended to suggest any punitive action but to focus attention on areas needing preventive measures in the interests of Flight Safety.

3.2 Immediately upon being appointed to conduct this formal investigation, I had a meeting with the Director General of Civil Aviation who had been designated as the authority for making administrative arrangements for the Court's functioning. He informed me that, on the day of the accident, Mr. K. Gohain had been appointed as the Inspector of Accidents under Rule 71 of the Aircraft Rules 1937. He briefed me on the progress made by Mr. Gohain and sought my directions on whether the Inspector's investigation should be continued

or not. I informed him that it should continue but I stipulated a target date for his report to be finalised. I also indicated some specific areas to be probed.

3.3 My meeting with the DGCA was immediately followed by a briefing of tentative technical findings of the Inspector of Accidents as well as represetatives of the aircraft manufacturer (i.e. Airbus Industrie) and flap system manufacturer (i.e. Lucas Aerospace).

3.4 Thereafter, my assessors joined me and we visited the accident site near Tirupati for a thorough inspection of all relevant material evidence. We made use of this visit to stop over in Hyderabad for discussions with officers of the Central Training Establishment of Indian Airlines, and for carrying out simulations of the ill-fated flight's configuration in the A-300 simulator. In addition, this visit gave us a first-hand acquaintance with the ATC and meteorological facilities at Hyderabad airport.

3.5 I got a public notification issued on 6th December 1993 inviting persons having personal knowledge of the causes or circumstances of the accident to make such knowledge available to the Court. A copy of the same is placed at Annexure 'M'. In addition, interested parties like Indian Airlines, National Airports Authority, Airbus Industrie, Lucas Aerospace, India Meteorological Department, Indian Commercial Pilots' Association, Air Traffic Controllers' Guild (India) and the Association of Flight Engineers were specifically offered the opportunity to be admitted as interested parties in our proceedings. With the exception of the ICPA and the AFE, all of them accepted the offer.

3.6 Whilst continuing the process of sifting all material evidence which had a bearing on the accident, persons having direct knowledge of the accident's circumstances were asked to appear before the Court and to give their evidence. Legal representatives of the interested parties were called on 17th December 1993 and briefed on the following general lines:–

(a) The report of the Inspector of Accidents, which had become available by then, was supplied to them along with statements of some persons connected with the accident and a list of the witnesses summoned. They were informed that further relevant material would also be supplied to them as it became available.

(b) The interested parties could suggest the summoning of more witnesses and, if their relevance to our investigation was established, such witnesses would be summoned.

(c) They could submit affidavits to indicate the basic position of their clients on any aspect concerning the accident.

(d) The procedure of examining and cross-examining of witnesses was explained to them.

(e) After the hearings, they would be given the opportunity to make final written submissions as well as to present oral arguments to refute the written submissions of other parties.

3.7 Shortly before our public hearings were due to begin, one of my assessors had to be replaced due to unavoidable reasons. This

necessitated a short delay to acquaint the new assessor with the details of all the work done by us till then.

3.8 A list of all the witnesses examined by us is placed at Annexure 'N'.

3.9 The open sittings of the Court commenced on 17th January and these concluded with the oral arguments of all interested parties on 16th February 1994.

ANALYSIS

4.1 General

4.1.1 All factual information about the ill-fated flight has already been detailed in an earlier part of this report. In this part, an effort is being made to analyse that information along with the relevant documentary evidence, oral evidence and other material presented before us or collected by us.

4.2 Weather Minima

4.2.1 It has been brought out in para 2.1.3 that, just before Flight IC-440 commenced its ILS approach for landing at Hyderabad, it was apprised by the ATC that the latest visibility was reported as 500 metres. Since the weather minima applicable to this flight was a visibility of 800 metres, and it was not faced with any emergency, it was not permissible for the pilot to make an approach under the circumstances. In this context, para 1.38.5 of Indian Airlines Operations Manual, Volume I, refers and the same is reproduced below:-

"Prohibition of Landing Below Minima

All operations below the filed minima are strictly prohibited. No aircraft shall commence or continue an approach to landing at an airfield if the reported visibility/RVR is below minima. Landing below the minima is only permissible in an emergency. In such cases a report shall be made to the DO/OM within 24 hours."

4.2.2 Various parties produced evidence or presented their arguments before us whether the action of the aircraft's Commander in

making an approach for landing at Hyderabad under the given circumstances was justified or not and whether this action on his part was a cause of the accident or not. In his own forthright and candid testimony before us, Capt R.P. Bhalla explained among other things that :-

a) Reduced visibility at Hyderabad airport in the morning during winter is not uncommon.

b) It had been his experience during numerous flights on Madras-Hyderabad-Delhi sector that, on such occasions of reported low visibility at Hyderabad, the actual observed visibility is generally much better than the reported visibility. This is especially so on the approach of Runway 27.

c) The areas affected by reduced visibility are variable due to moving patches of fog.

d) To make an approach in low visibility upto the decision height is not dangerous or against his company's interest.

e) Stipulations in the Rule Book do not hold good at all times. If we go by the Rule Book, we would not be able to land on so many occasions.

4.2.3 Counsel for NAA produced before us an extract from the submissions made by the ICPA before Mr. M.R. Srivaraman,

DGCA, in 1992/93 for arbitration of the dispute between the ICPA and Indian Airlines. The same is reproduced below:-

"In Para 1.38.0 Aerodrome Operating Minima has been elaborately laid down and filed with National Airports Authority. In this instance again, the Airline has again fulfilled the requirements of complying with the regulations in the books but no effort is made to understand the logic behind the regulations and enforcing their compliance. Meteorological minima is seen by IA as impeding "on time performance". Pilots are not discouraged from below minima operations just to ensure "on time" departures and arrivals. The biggest offender in this regard are the Senior Pilots by which we mean Director of Operations, Regional Directors, Operations Managers and Examiners. Instead of setting high standards and good examples, their unprofessional behaviour in this regard is perceived as a very high risk factor."

4.2.4 The statement of Capt. Bhalla was indicative that this was not an isolated or solitary occasion on which he had attempted to land in visibility conditions below his weather minima. The material presented by Counsel for NAA showed that similar violations are made by other pilots also, including senior Executive Officers of Indian Airlines. In an effort to determine the reality, we questioned officers from the Training/ Operations/Air Safety departments of Indian Airlines. All of them confirmed the rule position on the subject i.e. strict adherance to the applicable weather minima and no scope for

any deviation from it except in an emergency. They also confirmed that if any violation of the weather minima comes to light, appropriate corrective action is taken as deemed necessary in each case. Usually, this is in the form of extra refresher training. We tried to ascertain the incidence of weather minima violations and the possibility that some such cases might be going undetected or unrecorded. We found that the NAA has placed a responsibility on their ATC officers to report every infringement of the weather minima to their higher authorities and the DGCA. However, no such responsibility has been enjoined by Indian Airlines on any of their officers. They have established an elaborate mechanism for monitoring and controlling their flights viz. designated Operations Controllers, Deputy Managers Flight Operations, Assistant Managers Flight Operations and Flight Operations Officers. This mechanism can be easily utilised, if desired, to monitor the occurrence of weather minima violations but this is not being done. Indian Airlines reacts to such violations only if these are brought to its notice by the NAA or the DGCA.

4.2.5 From all the information that we could gather, we were not left in any doubt that:–

a) Violations of weather minima by Pilots of Indian Airlines do take place.

b) There is no effective mechanism at present to ensure that every such case is positively detected by the Airline.

c) Even if any case of weather minima is detected, the action taken is unsuccessful in curbing the tendency for such violations.

4.2.6 At this stage, it is advisable to examine the importance of weather minima, the consequences of its violation and the responsibility for the present state of affairs. The weather minima is a set of weather conditions adopted by every operator of civil aircraft in India, and approved by the DGCA, below which flying operations are not permitted except in an emergency. It is based upon an assessment of the degree to which the safety of flying is affected during approach and landing by the limitations of the landing aids available, aircraft performance and airfield peculiarities. It is clearly and unmistakebly intended to enhance flight safety by prohibiting any deliberate or inadvertent excursion into the realm of known safety hazards in a very critical phase of flying unless there is an emergency in which the pilot may take a conscious decision to ignore it. However, it is not a line beyond which every intruder will face definite disaster. It is only a line beyond which the operator has chosen not to run any unwarranted risk. It is incumbent upon every pilot to scrupulously observe his weather minima for the following reasons:-

a) To ignore such a well-considered limitation and to put the safety of the aircraft, along with that of its occupants, in joepardy is utterly irresponsible and foolhardy.

b) Non-compliance with clear standing orders of the operator is an act of indiscipline.

4.2.7 It follows from the foregoing that the direct consequence of violating the weather minima is a reduction in the margin of safety. Pilots who indulge in such violations know this very well but they tend to think that their superior skill or their vast experience or their familiarity with the airfield's approaches etc will make up for this. These factors are indeed very important and these do offer a considerable shield of protection to the pilot which is quite effective most of the time. However, while such protection can save them most of the time, it cannot do so always. This is because, some day, something else may also go wrong and then there might be no safe way out from their difficulties because of the compounded reduction in the margin of safety.

4.2.8 In every phase of flying, flight safety can be achieved only by the efficient and coordinated functioning of several agencies. For instance, during an instrument approach in marginal weather conditions, safety depends upon the pilot being properly trained and mentally alert, his crew rendering full assistance in accordance with standard operating procedures, the aircraft equipment functioning correctly, the pilot observing his weather minima, the Meteorological Office providing correct weather information, the ATCO providing correct information/ clearance, ground landing aids/lighting systems functioning correctly etc etc. If each one of these agencies works to perfection,

as it is expected to do, not only is a safe approach ensured but there is also a reasonable safety margin to cater for any unexpected occurrence. However, if any of these inputs are defective or deficient, the margin of safety is reduced and accident proneness results. It would be absurd for anyone to perform his duties inefficiently or indifferently in the hope that his deficiency would be made up by full and proper inputs from others concerned. To do so would inevitably impair the marign of sefety in day-to-day flying operations. This should be prevented by the fullest professional involvement of everyone who is engaged in these activities as well as by those who have a monitoring or controlling function over such persons.

4.2.9 In the aforersaid submissions of ICPA, it has been said that violations of the weather minima are not discouraged for ensuring "on time" departures and arrivals, and that the biggest offender in this regard are senior pilots. Here it must be said that while "on time" performance is undoubtedly very important for an airline, it should be achieved solely by enhanced efficiency and never by compromising flight safety e.g. by turning a blind eye towards the possibility of, or towards actual instances of, the infringement of weather minima.

4.2.10 We can now address the question of Capt. Bhalla's justification for making an approach that day in weather conditions below his minima, the degree of his responsibility in this respect and the corrective action required. As brought out above, the rules on the strict observance of weather minima need to be implemented implicitly in every single approach. No laxity or

liberty in this regard can be condoned, and we find no acceptable justification for Capt Bhalla's decision to make an approach in below-minima conditions. However, we do not believe that the responsibility for his action lies only with him. It seems to us that he is only one of the weak links in the chain. Every such weak link has to be strengthened if the objectives of flight safety are to be achieved. Our considered view is that the present unsatisfactory state of affairs has come about due to managerial laxity over several years. The responsibility for this lies squarely with the senior officers of the Operations Department of Indian Airlines. They have allowed a situation to be reached in which weather minimas are not adhered to scrupulously and no worthwhile effort is made to detect and prevent instances of weather minima infringement. The operations Manual of Indian Airlines does contain a sound policy on the subject, but a good policy by itself is not enough. There must also be the will and the ability to enforce it. This is not the case at present. It is imperative that the Airline should evolve a fully effective mechanism to ensure that there is no violation of its own policy in the observance of weather minimas. Unless this is done, a serious flight safety hazard will continue to exist. In specific terms, the Airline should:-

a) Inculcate in the minds of their pilots a better understanding of the reasons for stipulating weather minimas and the consequences of violating these.

b) Institute an effective in-house mechanism to detect each and every infringement of the weather minima. (Flight

Operations Officers could be charged specifically with the duty of reporting every such case. Besides, whenever weather conditions in any region or any airport are known or expected to be marginal, the designated Operational Controllers/Flight Managers should particularly watch out for instances of weather minima violation.)

c) Take very firm and deterrent action against violators of weather minima, especially if they hold any position of high responsibility in the Airline.

4.3 Role of Flight IC-916

4.3.1 We must make a mention here of the role played by Flight IC-916 in the approach made by Capt Bhalla in below-minima conditions. To understand this better, the following relevant information has been extracted from the ATC tape transcript:-

(a) At 0111 hours UTC, the ATC gave approval to Flt. IC-916 to start engines and informed that visibility was 2000 metres.

b) At 0117 UTC, when Flight IC-916 was taxying to the runway, ATC informed that latest visibility was 1500 metres.

(c) At 0120 hours UTC, Flight IC-916 took off for Bangalore.

d) At 0125 hours UTC, the ATC informed Flight IC-440 that latest reported visibility was 500 metres. At 0126 hours UTC, Flight IC-440 asked the ATC for the visibility as observed from the Flying Control. The ATC replied "Visibility is very poor, Sir. All the approaches are being covered." Immediately thereafter, Flight IC-916 called Flight IC-440 and said "IC-916 calling IC-440, go ahead Sir, 09 side is better. 27 the patch of fog was moving." Flight IC-440 acknowledged this message and thanked Flight IC-916.

(f) At 0127 hours UTC, the ATC asked Flight IC-440 to check his minima. Flight IC-440 replied to say "We will make one approach."

4.3.2 In his testimony before us, Capt Bhalla stated that his decision to make an approach was based partly on the information given by Flight IC-916 that the visibility on runway 09 was better and that the patch of fog on 27 was moving. While we are unable to condone Capt Bhalla's action of making a below-minima approach in spite of this input from Flight IC-916, we want to highlight that, though the information volunteered by Flight IC-916 was obviously well-intentioned, it was actually unwarranted and utterly ill-conceived. It was well known to Flight IC-916 that the reported visibility had been deteriorating very rapidly as it was 2000 metres at 0111 hours UTC, 1500 metres at 0117 hours UTC, and 500 metres at 0126 hours UTC. It was most imprudent for Flight IC-916 to offer advice on the

basis of the visibility which had been observed at 0120 hours UTC duing its take-off because that had become redundant in the light of significant subsequent events at 0125/0126 hours UTC viz. latest meterological report of visibility being 500 metres and the ATC's observation from the Control Tower that "Visibility is very poor, Sir. All the approaches are being covered." Worse still, there can be no justification whatsoever for Flight IC-916 to encourage IC-440 to make an approach in below-minima conditions by saying "Go ahead, Sir, ...", knowing fully well that the reported visibility was below the stipulated weather minima.

4.3.3 Incidently, this message from IC-916 to Flight IC-440 is indicative that IA pilots show scant regard to the observation of stipulated weather minimas. In this context, our conclusion in para 4.2.5 (a) also refers.

4.3.4 In bringing out the foregoing, it is not our intention to blame the Commander of Flight IC-916 in any way or to suggest that exchange of weather or traffic information between aircraft should be prohibited. We are quite aware that at times such communications can be very important and useful. However, pilots should be careful to ensure that information passed by them to other aircraft is not based upon redundant parameters and that it is clearly in furtherance of Flight Safety. While the communication of Flight IC-916 in this case was unwarranted and absolutely injudicious, it would be perfectly in order and in fact advisable for an aircraft which has just landed to inform

another aircraft on the approach (directly or through the ATC) about the presence of wind-shear or fluctuations in ILS indications etc if any.

4.4 Reaction of Crew to the Crisis

4.4.1 Soon after going around, the Commander of Flight IC-440 discovered that the aircraft's flaps were stuck in the fully extended position. He ordered the flaps to be recycled but this did not help in any way. The flaps continued to remain stuck at 25 degrees but the slats responded correctly to all movements of the Flap-Slat lever. He was now faced with a rather unusual situation in that :-

(a) The weather at Hyderabad was far below his minima and he had just made an unsuccessful approach there.

(b) With the flaps stuck in the fully extended position, further flight would have to be restricted to a maximum IAS of 180 knots and it would not be possible to climb upto normal cruising altitude. In consequence of these factors, he knew that the aircraft's fuel consumption would be much higher than normal. However, he had no reference available from which he could find out the best range speed and the absolute range of the aircraft in that configuration.

4.4.2 From an examination of DFDR tape and the statements of the crew, we observed that the jamming of the flaps was not noticed by them for some time initially. Even after they discovered it,

the maximum permissible IAS of 180 knots was exceeded for about eight minutes in spite of the clacker warning having sounded. We cannot help commenting that undue delay in detecting the flap jam does little credit to the perfomace of the First Officer and Flight Engineer who are required to monitor all flap movements. Similarly, the prolonged speed exceedance does little credit to the performance of the Commander who should promptly have reduced the speed to less than 180 knots when the flaps were found to be stuck and the clacker sounded. However, we do not intend to labour further on these points because these factors did not have any effect on the rest of the flight and especially on the chances of freeing the jammed flaps. Instead, we intend to anaiyse two issues which are of crucial importance to our investigation and which attracted a great deal of interest from all parties in our proceedings. These are :-

(a) Capt Bhalla's decision to divert to Madras under the given circumstances.

(b) Flight management during the diversion.

4.5 Decision to Divert to Madras

4.5.1 Capt Bhalla was questioned by all parties in detail about the reasons for his diversion to Madras and about other options which were available to him. In general, he explained that he had asked for the weather trend for Hyderabad airport. Initially, he was advised that the low visibility was likely to last for about half an hour but later this was revised to one hour. He

also enquired from the ATC if any Air Force airfields were reporting better visibility than Hyderabad. In response, he was given the visibility of Air Force Academy and Hakimpet which was worse than that at Hyderabad. Thus, the area affected by fog that morning seemed to be quite widespread. He said that, in view of this, holding over Hyderabad would have been a very questionable decision and in fact it would have been bad airmanship on his part. He added that he had "no regrets about his decision against holding over Hyderabad. Neither then, nor now". Regarding the advisability of diverting to Bidar, he said that he did not specifically ask for the weather at that place as the fog seemed to be quire widespread and Bidar was also likely to be affected by it. However, in answer to a question later, he said that if Bidar weather had been given to him by the ATC, and if the visibility there had been satisfactory, he could have diverted there. He emphatically rejected the option of using "auto-land" at Hyderabad saying that he had little confidence in the use of this facility because ILS equipment at most Indian airports is not sufficiently dependable and that, if he was ever confronted with a situation in which a landing had to be made in very poor visibility, he would prefer to carry out a manual ILS approach and visual landing rather than an auto landing. He also said that he did not doubt that a diversion to Madras was possible as initial calculations made by his crew indicated that there would be 1.4 tonnes of fuel on board at TOD for Madras. However, as the flight progressed, this was revised to 1.2 tonnes and 1.0 tonnes before it was realised that Madras could not be reached at all. Regarding a possible diversion to

Vijaywada when he was about 80-100 nm out of Hyderabad, he said that there was no doubt at that stage about reaching Madras. Besides, he added, Vijaywada is not suitable because it is virtually an unmanned airfield since Indian Airlines stopped operating there and, being near a river and the sea, ther would be the possibility of fog. Besides, there were chances of people in fishing villages being killed on the ground in the event of a forced landing in that area.

4.5.2 Before any comment can be passed on the decision of Capt Bhalla to divert to Madras, it is advisable to examine all the options which were available to him at that time. Broadly speaking, these were:-

(a) Diversion to the designated diversionary airfield i.e. Madras.

(b) Holding over Hyderabad.

(c) Diversion to some other suitable airfield.

(d) Declaration of an emergency. (This could be done in addition to any of the aforesaid options).

4.5.3 The general policy of Indian Airlines on flight diversions is that the alternate airports to be used for diversions are specified in the Navigation Flight Plan but, with due regard to the considerations of fuel on board and weather, the Commander

may divert to any suitable airfield if in his opinion it is prudent to do so. (Para 1.29.0 of Indian Airlines Opertaions Manual, Volume I, refers). In the case of IC-440, the flaps got stuck in the fully extended position. It was evident to the Commander that in this configuration, the aircraft's fuel consumption would increase due to the extra drag, lower speed and lower flight level. The exact extent of such increased fuel consumption was neither known to him from his past experience and training, nor was it given in the flight manuals/documents carried on board. However, before committing himself to a diversion to Madras, it was imperative for him to be sure that the available fuel would be sufficient for that trip in spite of the increased fuel consumption due to jammed flaps. If such an assurance could not be obtained somehow, the proposed diversion would be clearly hazardous as it would entail the risk of running out of fuel during the flight. Without such assurance, it would be most imprudent to set course for Madras unless:-

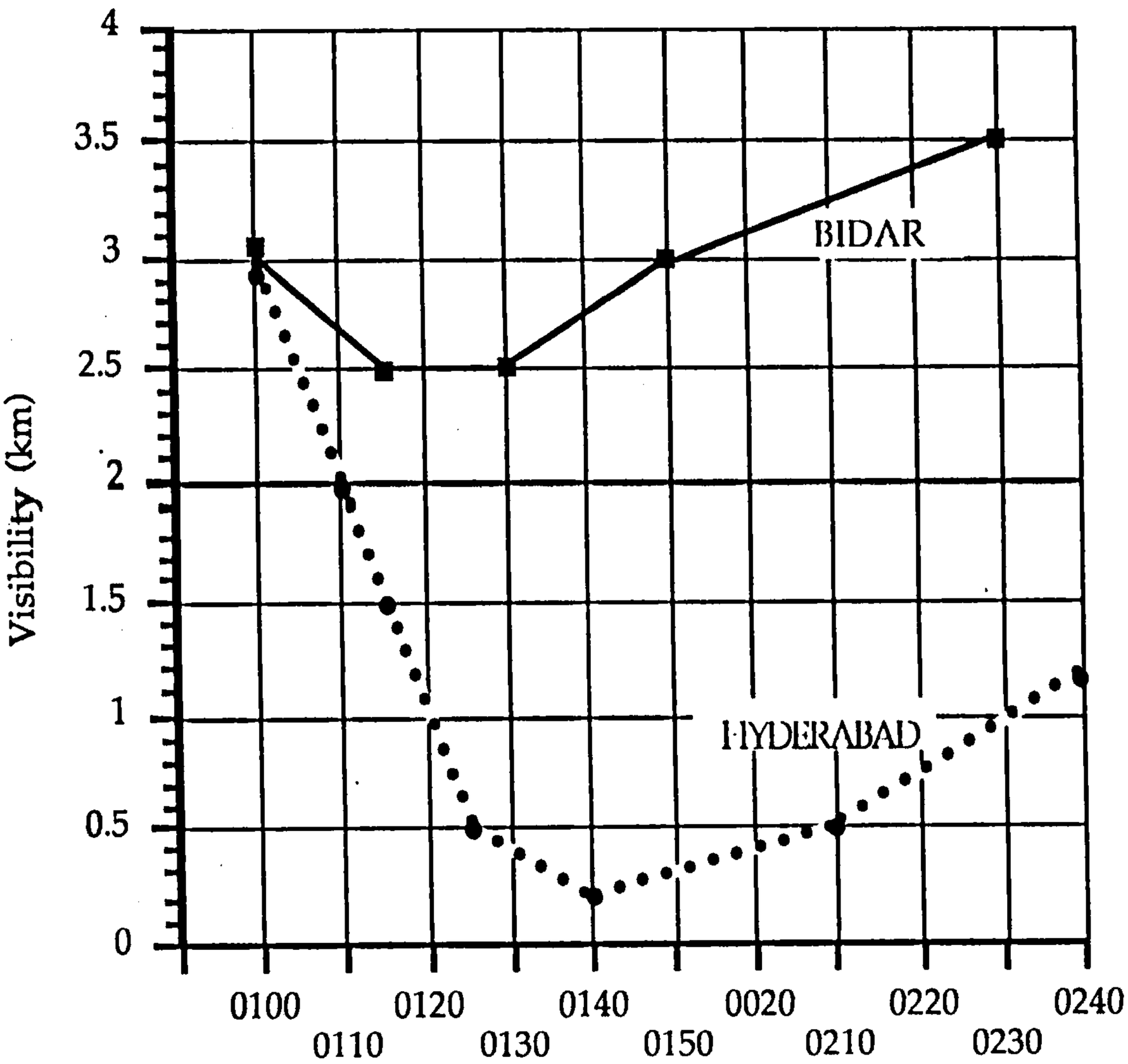
(a) It was a tentative course of action by which the adequacy or inadequacy of fuel was intended to be confirmed by actual navigational observations for a short period of say 5-10 minutes at the chosen flight level after which this option would be confirmed or revised, and

(b) It could be ensured that at least one out of the other viable options would not be joepardised while the above-mentioned observations were being made.

4.5.4 If the flight was to hold over Hyderabad, the crucial factor to consider was the expected duration of low visibility due to fog. In response to an inquiry from the aircraft, the ATC had said at 0130 hours UTC that the Met. Office expected this to be half an hour. In response to another enquiry, the aircraft was informed at 0137 hours UTC that this would be one hour. In response to yet another enquiry about the weather trend, the aircraft was informed at 0150 hours UTC that the trend was "visibility becoming 1500 metres in mist" by 0210 hours UTC. Based upon all these inputs, the visibility could be expected to improve sufficiently for a normal landing to be made by about 0210-0240 hours UTC. However, if the aircraft had decided to hold overhead and the visibility did not actually improve sufficiently, there would be no choice but to make an auto-landing in below-minima conditions.

4.5.5 Any decision to divert to an airfield other than the designated diversionary airfield would have to be with due regard to its distance from Hyderabad, prevalent weather and facilities available. In comparison to Madras, there are four suitable airfields which are located much nearer to Hyderabad. These include three Air Force airfields viz. Dundigul (Air Force Academy), Hakimpet and Bidar which are in regular use and which are at approximate distances of 17 nm, 6 nm and 61 nm respectively from Hyderabad. The fourth is the civil airfield at Vijaywada which is 144 nm from Hyderabad but its watch hours are irregular as no scheduled services operate from there at present. After encountering the flap jam, Flight IC-440 had asked

Hyderabad at 0151 hours UTC "Is any Air Force Station reporting better visibility than yours". In response, it was given at 0200 hours UTC the visibility figures of Academy and Hakimpet which were even worse than that at Hyderabad. The ATC did not convey the visibility of Bidar and, when this was not provided, the aircraft did not ask for it specifically. This was very unfortunate because Academy and Hakimpet are very close to Hyderabad and, therefore, these were likely to be affected by local fog whereas Bidar was far away and likely to be unaffected by it. Our investigations confirmed that the visibility in Bidar was significantly better than at Hyderabad as reflected in the below:-



4.5.6 Regarding the declaration of an emergency by the aircraft, especially if it were to hold over Hyderabad or if it were to divert to an airfield other than Madras, we are quite aware that pilots are generally reluctant to take such a step due to their apprehension that it may give an impression that they are no longer in control of the situation. However, it is not difficult to see that any such reluctance is quite unwarranted and against their own interest. The declaration of an emergency would immediately attract greater involvement of the ATCO and the FOO in the search for a solution and/or useful information. We are of the view that, if an unusual or uncertain situation is encountered in flight, the pilot would generally stand to gain an advantage by informing the ATC unambiguously that he is in an emergency.

4.5.7 We visited the Central Training Establishment of Indian Airlines to see at first-hand the facilities and methods used for the basic and refresher courses for pilots. Later in our proceedings, we had the occasion to question at length Capt S.N. Reddy, Director of Training (Operations) in the CTE. He is a highly experienced pilot, instructor and examiner on A-300 aircraft. He was very frank and forthright in telling us about the policies/practices of flying training for normal procedures as well as emergency procedures. We asked him what a pilot should do, based upon his training, in the circumstances which Capt Bhalla had faced in flight IC-440. He told us that every A-300 pilot (including Capt Bhalla) carries out during initial training as well as during

every refresher course one auto-landing in the simulator in a simulated visibility condition of about 100 metres. This experience is expected to enable the pilot to carry out an auto-landing confidently if he is faced with an emergency and the visibility is very low. He said that, if he were in the situation in which Capt Bhalla was placed, he would hold over Hyderabad in the expectation of the visibility improving, as it was bound to do, but if this did not happen he would have gone ahead with an auto-landing without any hesitation. He also said that an auto-landing approach is always more stable and accurate because of inputs from two autopilots instead of one. He was questioned further about what he would do if he had already set course for Madras and then discovered that the fuel was insufficient for reaching there. He said that this was a purely hypothetical proposition and the answer depends upon the aircraft's position at the time of discovering the inadequacy of fuel. However, in any such case, he would calculate his range and divert to the most suitable airfield within that distance. We found all his answers to be well-reasoned, logical and convincing. We are also very satisfied with what we saw of flying training in the CTE.

4.5.8 Having considered all the options which were available to Capt Bhalla, we can now address the validity of his decision to divert to Madras. As in all such cases, it was his prerogative to take such actions as he deemed to be best under the circumstances. However, it is necessary that his actions should be analysed objectively and constructively to derive suitable lessons for the

enhancement of flight safety. We tried our best to visualise, as realistically as possible, the circumstances in which Capt Bhalla was placed. He was over a fog-bound airport and the aircraft's flaps were jammed in the fully extended position. There was no difficulty in flying or controlling the aircraft but its indicated airspeed had to be maintained below the limit of 180 knots. It was evident that under these parameters, the aircraft's range as well as endurance would be substantially curtailed but the exact extent of such curtailment was not known. Nor were the best speeds for range and endurance known. In these circumstances, the most critical factors were the limited time for which the available fuel could sustain the aircraft's flight and the limited distance to which it could be flown. It was essential to choose a course of action which would enable a safe landing to be made within the limits of these factors. The only practical way to ascertain whether Madras was within reach or not was to fly towards it for a few minutes and to make accurate navigational calculations. However, this had to be done without jeopardising at least one out of the other viable options and, if the calculations indicated that Madras was not within reach, it would be essential to revise the chosen course of action immediately.

4.5.9 From all available evidence, it is abundantly clear to us that at no stage did Capt Bhalla establish that the available fuel would be adequate for reaching Madras. He was in doubt about it at the very outset, and his doubts kept increasing as the flight progressed. This is also confirmed by the fact that, even after he had set course for Madras, he inquired if any Air Force Station

was having better visibility than Hyderabad and he made repeated inquiries about the latest visibility/weather trend at Hyderabad. We believe that the possibility of diverting to Bidar had not occurred to him and it is a pity that he discarded the option of holding over Hyderabad followed by an auto-landing if necessary. Worst of all, he failed to appreciate the futility of pressing on towards Madras when the available indications were that Madras was clearly beyond reach but it was still possible to divert to Vijaywada or to return to Hyderabad. Even when the ATC asked him at 0204 hours UTC, "Confirm you will be able to make upto Madras", he failed to assess the criticality of the situation and eventually he made a forced landing at 0255 hours when the aircraft nearly ran out of fuel.

4.6 Flight Management during Diversion

4.6.1 In every diverted flight, fuel conservation is very important and it is advisable to fly at the Mach No./IAS corresponding to maximum range. As against this, if it becomes necessary to hold over an airfield for an extended period of time, this is done at the speed for maximum endurance. Pilots are taught all the basics of the theory applicable to range flying and endurance flying.

4.6.2 When Capt Bhalla diverted from Hyderabad to Madras, there were good reasons for him to be seriously concerned about the fuel state and to try and fly the aircraft for maximum range. In this context, we had been surprised to read in his written statements to the Inspector of Accidents dated 15 November 1993 and 26/27 November 1993 respectively "Initially the speed

of around 170 knots was maintained. However, keeping in view the very high fuel consumption, speed was reduced to 132-135 kts for better *endurance*" and "At about 80 miles out of Hyderabad, I decided to for *range and maximum endurance...*" In answer to our questions about his understanding of range flying and endurance flying, he said in his testimony before us that there was no great importance to range flying as the difference is very small. We were astonished and concerned at such a response. We consider it very important for airline pilots to clearly understand the principles of range flying and endurance flying and to implement these at appropriate times during their flying.

4.6.3 Notwithstanding the foregoing, Flight IC-440 was in an unusual configuration due to its flap jam and there was no ready reference of the best range speed in that configuration. Capt Bhalla climbed to 15000/17000 feet and chose a speed of about 165 kts IAS. This was a very good choice under the circumstances. The DFDR analysis of the entire diverted flight shows that the highest figure of nm per tonne of fuel was obtained as long as this speed was maintained. However, Capt Bhalla would have got still better results if he had retracted the slats which were kept mostly at 20 degrees and, for as much as about 35 minutes, at 25 degrees. It is well known that slats, like flaps, reduce the lift:drag ratio and thus the aircraft's range. In simulations on the A-300 simulator, we found that by retracting the slats a fuel-saving of over 10 per cent could have been achieved in Flight IC-440's diversion towards Madras. While this would not have been enough to stretch the aircraft's range

upto Madras, we have no doubt that Tirupati airfield could have been reached very safely.

4.6.4 We were unable to find any acceptable reason for Capt Bhalla to reduce the aircraft's speed from 165 knots IAS to about 135 knots during the diversion. Even when this was done, he ought to have realised in a very short time that this was worse, rather than better, for the aircraft's range. He reduced the speed when the aircraft was about 80 nm out of Hyderabad. In his testimony before us, he said that did so for the sake of staying closer to Hyderabad to facilitate a return in case the weather improved. We do not believe that he was telling the truth when he said this but, if he was, this was certainly a very irrational action on his part.

4.6.5 Let us now take a look at the flight planning and navigation during the diversion of Flight IC-440. After the accident, the Inspector of Accidents had found no flight Engineers' log or record of fuel calculations in the aircraft. We were very anxious to learn why this diversion had been persisted with in spite of very doubtful adequacy of fuel. In our proceedings, the Commander, the First Officer and the Flight Engineer were all questioned at length by all interested parties. We discovered that the First Officer and the Flight Engineer had played the main role in determining the adequacy of fuel for the diversion. Neither of them had kept any written record of their calculations. Of the two, the Flight Engineer gave us very precise figures of time, position and fuel contents, and he seemed to be very sure of these. However, on further questioning, he said that these

were not based upon any real-time written record but on his recollection from memory two days after the event. Both of them said that their initial calculations indicated that they would make Madras with a fuel state of 1.4 tonnes at TOD 50 nm short of Madras, but, as the time went by, the situation kept changing slowly for the worse until they realised at a distance of about 136 nm out of Hyderabad that it was impossible to reach Madras. We reconstructed the fuel state from the DFDR data and the ATC tape transcript and we found the following:

	Time	Position	Fuel Contents	Distance to Madras
(a)	0135 UTC	Going Round	10.4 tonnes	285 nm
(b)	0152 UTC	43 nm from Hyderabad	7.15 tonnes	242 nm
(c)	0203 UTC	80 nm from Hyderabad	5.86 tonnes	180 nm
(d)	0212 UTC	105 nm from Hyderabad	4.71 tonnes	180 nm
(e)	0215 UTC	115 nm from Hyderabad	4.37 tonnes	170 nm
(f)	0223 UTC	140 nm from Hyderabad	3.43 tonnes	145 nm

4.6.6 From the foregoing, we feel that it should have been clear at a very early stage in this flight, and definitely by the time the aircraft was 80 nm out of Hyderabad, that the available fuel was just not sufficient for reaching Madras. The First Officer

and the Flight Engineer were not only callous in carrying out their respective duties of navigation and fuel calculations but they displayed a high degree of incompetence as well. Instead of being an asset to the Commander, they proved to be liabilities. While the Commander cannot be absolved of his own lapses and his overall responsibility, professional conduct and timely advice by either of these two officers could easily have saved this accident.

4.7 The Forced Landing

4.7.1 If a forced landing becomes inevitable, and if time permits, certain important actions are required to be taken by the aircraft's crew. These are listed in the aircraft Check List. In our proceedings, the Flight Crew as well as some members of the Cabin Crew were questioned by various interested parties about these actions. It was quite evident, and it was not contested by anyone to the contrary, that sufficient time had been available for carrying our these actions.

4.7.2 From the responses of the crew, we were surprised to discover that some of actions which are listed in the Check List for forced landing, and even some of the normal procedures, were not carried out at all. This reflects adversely on the Commander of the aircraft and on the training standards of simulated emergency drills in Indian Airlines. Our observations are as follows:-

(a) The Flight Crew of Flight IC-440 conveyed to Madras Control at about 0239 hours UTC (i.e. about 16-17 minutes

before the forced landing) their intention of proceeding to Tirupati. However, no such intimation was given at any stage to the Cabin Crew or to the passengers. Right until the forced landing, they remained under the impression that they were returning to Madras.

(b) The aircraft commenced its descent from FL 170 without any permission from, or intimation to, the ATC.

(c) The Cabin Crew were not informed about the impending forced landing and to prepare the passengers for it. In the absence of such preparation, it is not possible for passengers to adopt the appropriate posture to minimise the chances of injury during forced landing. The Flight Crew said that this had done deliberately to avoid any panic among passengers. We totally disapprove of this kind of ill-advised departure from well-considered practices which are included in the Check List for implicit compliance.

(d) After the aircraft came to rest, no notification or direction was given by the Flight Crew to the Cabin Crew to initiate the evacuation of passengers.

4.7.3 We also wish to make a few general observations about the forced landing. These are:-

(a) Out of the very few choices available, the Commander

selected a very good spot and a very good alignment for the forced landing.

(b) DFDR data indicates that the Commander maneouvred the aircraft very skillfully while making last-minute adjustments in his approach. The touch-down was very well-controlled and fairly gentle.

(c) The landing gear was lowered too late. It locked in the down position only 4 seconds before touch down.

(d) In spite of there being no prior intimation or subsequent direction from the Cockpit Crew, the Cabin Crew performed well and generally gave a good account of themselves in the evacuation and care of passengers after the forced landing.

4.8 Role of ATC

4.8.1 In all flight operations, and especially during periods of bad weather, the ATC plays a very important role. We shall now examine how the ATC performed in respect of Flight IC-440.

4.8.2 Before Flight IC-440 commenced its ILS approach at Hyderabad, the visibility had reduced to 500 metres. In such conditions, there used to be until June 1993 a very long-standing practice that the ATCO had to ask the aircraft to "check his minima". This used to be a polite reminder to the pilot to continue the approach only with due regard to the applicable weather minima. However, in the light of certain violations of the weather

minima, it was decided to modify this procedure. Consequently, with the intention of exerting a stronger influence on the pilot in such cases and to eliminate any misunderstanding of weather information, a revised instruction was issued by the National Airports Authority vide DARA circular No. 6 of 1993 dated 25th June 1993. This brought about a more stringent procedure whereby whenever the RVR/visibility is 2000 metres or less, arriving aircraft are required to "*report* their minima" instead of "*checking* their minima". Further, if the RVR/visibility is less than the minima, they are to be asked for their intention. In case they express the intention to land, they are to be given conditional clearances to approach and to land (according to a stipulated format). Further, this occurence is to be logged as well as reported to the Member (Ops) NAA and to the DGCA. A copy of the said revised instruction is placed at Annexure 'P'.

4.8.3 From a scrutiny of the ATC tape transcript, we found that the duty officer had used the old and redundant procedure instead of the new revised procedure. We questioned him if he was aware of the new instruction and he confirmed that he was. We asked him why he did not follow it. There was no satisfactory explanation from him. We asked him if he knew or if he had been able to discern the reason for the issue of the revised instruction. His answers were vague and meaningless. Later, Counsel for NAA in his submissions argued that, though the new instruction had not been complied with in letter, its intended purpose had been served substantially. We are unable to accept this contention. In our view, this failure to use the

revised procedure reflects very poorly on the performance of the concerned officer, especially since this was in spite of full awareness of the revised instructions. Equally, it is a sad reflection on his superiors for their failure to ensure that such instructions are understood and complied with by all concerned.

4.8.4 One of the issues which attracted a great deal of interest during our proceedings was that the ATC had not provided to the aircraft the visibility of Bidar airfield when it had been asked if any Air Force station was reporting better visibility than Hyderabad. From the log books maintained in the ATC, we found that there were entries to confirm that the visibility at Air Force Academy and Hakimpet had been ascertained and recorded, but in respect of Bidar there was an entry of "NRH" i.e. no response heard. In view of this, it was contended by the NAA and the ATC Guild that an attempt had been made to obtain the visibility at Bidar but it was unsuccessful. Others argued that, under the circumstances, more attempts should have been made directly as well as through Hakimpet. In any case, the aircraft should have been informed that Bidar could not be contacted by telephone. Had this been done, the aircraft might have called up Bidar directly on R/T. These arguments led to assertions that the ATC seemed to have played a somewhat passive role without the expected degree of involvement as envisioned in one of the objectives of Air Traffic Services in ICAO Annexure 11 para 2.2 (d) i.e. "To provide advice and information useful for the safe and efficient conduct of flights." In response to this, it was argued that the ATC has

no responsibility for generating weather information and that it acts only as the communicator of such information if and when the same is supplied/available. It was also said that, since Bidar is an Air Force airfield, its weather is not routinely pased to or readily accessible at Hyderabad which is a civil airport.

4.8.5 We have applied our minds in detail to these lines of reasoning with due regard to the principles and recommendations in ICAO Annexure 11. As a result, we have no hesitation in saying that the request of the aircraft for the visibility at Air Force stations was perfectly valid and the ATC was fully duty-bound to obtain it. Considering the bad weather and the flap jam faced by the aircraft, this should have been done with speed and diligence. In reality, only a casual and feeble attempt was made. The ATCO apparently failed to appreciate that this was a not a routine enquiry but it indicated the aircraft's desire to abandon its just-notified intention to divert to Madras in favour of a suitable place to land nearby. It also indicated the Commander's willingness to use an Air Force airfield in spite of the commonly known and obvious lack of requisite ground handling facilities there. Since Academy and Hakimpet were found to be unusable due to poor visibility, Bidar was the only airfield of interest in the context of the aircraft's enquiry. It is a common practice for ATCOs to use alternate means of communication when the primary means fail to evoke a response. It was well known to the ATCO that Bidar's visibility could have been obtained not only on their direct telephone to Bidar ATC but through their direct telephone lines to Academy ATC and Hakimpet ATC also. In any case, the aircraft should have been informed if

Bidar's weather was not obtainable.

4.8.6 In our proceedings, there was considerable discussion of whether the ATCO could not assess from the aircraft's transmissions that it would be unable to reach Madras and whether the aircraft should not have been advised very clearly in this respect. After assessing all relevant evidence, we are satisfied that the ATCO showed sufficient anticipation and concern in this regard and no further action in this respect was called for.

4.8.7 We found from the ATC tape transcript and the ATCOs log book that runway lights at Hyderabad were not available between 0715 hours and 0743 hours. During our proceedings, it was brought out that the approach lights had also gone off during this period. We found that, to cater for the contingency of power failure, a stand-by generator has been provided to operate these lights. The change-over from mains power to generator power takes only a few seconds. Accordingly, these lights should have been restored within a few seconds. Our enquiries in this respect brought forth the reply that it had not been a case of power failure but one of a cable fault. We made further inquiries about the time needed for locating and rectifying a cable fault. The replies were most unsatisfactory. We were left in no doubt that, the occurrence could not have been due to a cable fault but, in all likelihood, it was just negligence in manning and operating the generator which had resulted in the restoration of lights in 28 minutes instead of a few seconds. The critical effect of this outage would be evident

from the fact that the visibility was very low at that time and the visibility minima for ILS depends upon whether the approach lights are available or not. Thus the non-availability of approach lights in such a situation was a serious hazard to flight safety. The NAA authorities at Hyderabad should take positive steps to prevent such occurrences.

4.9 Role of Met. Office

4.9.1 The starting point of the overall situation, which finally led to the accident in which IC-440 was inolved, was the low visibility at Hyderabad airport on the morning of 15th November 1993. Inevitably, many questions were raised in our proceedings on the weather forecast, weather reports, measurement of RVR and the weather information communicated to the aircraft. An attempt is being made now to put these matters in the correct perspective.

4.9.2 Hyderabad is a major, important and busy airport. Its meteorological office is manned round the clock and it is headed by an Officer of Director's rank. It has all requisite facilities for weather forecasting. For weather observations, is is generally well-equipped but facilities for the automatic measurement of RVR have not been installed so far. Consequently, RVR readings are assessed visually by a Meteorological Observer. Whenever the visibility reduces to 1500 metres, the Met Observer uses an ATC vehicle to go to the two ends of runway. It takes about 5-10 minutes to observe the RVR at the two runway ends. As each reading is taken, it is intimated to the ATC instantly

through the R/T set in the ATC vehicle.

4.9.3 Hyderabad airport is affected on a few occasions, by the prevalence of fog during winter mornings. Climatology notes in Indian Airlines Operations Manual, Volume II, para 1.38, read "Visibility is generally 10 kms or more. In the winter, however, it may be between 3-6 kms due to mist in the morning. Radiation fog occurs on an average on 2-4 occasions during the winter and may reduce the visibility to nil. It, however, disperses in an hour or so, and the visibility improves rapidly."

4.9.4 On the morning of 15th November 1993, a local weather forecast was issued by the Hyderabad Meteorological Office at 0330 hours IST (i.e. 2200 hrs UTC 19931114) and it was valid for a period of 8 hours i.e. until 1130 hours IST. It indicated the visibility as 10 kms, reducing temporarily to 3000 metres in haze between 0530 and 0930 hours IST. The actual weather reports that morning were as follows:–

	Time (IST)	Type of	Visibility	Trend
(a)	0540	Metar	6 km	Nosig
(b)	0610	Speci	3000 m	Nosig
(c)	0640	Speci	2000 m	Nosig
(d)	0645	Speci	1500 m	Nosig
(e)	0655	Speci	500 m	Nosig
(f)	0710	Speci	200 m	Vis becoming 1500 m in mist
(g)	0740	Speci	500 m	Vis becoming 1500 m in mist
(h)	0810	Speci	1200 m	Vis becoming 1500 m in mist
(i)	0840	Speci	2000 m	Vis becoming 3000 m in haze

4.9.5 It may be seen from the above-mentioned figures that there was a major disparity between the forecast visibility (i.e. 10 kms. reducing temporarily to 3000 metres) and the lowest actual visibility (i.e. 200 metres in fog). This extent of variation between forecast weather and actual weather can make a very crucial difference to aviation. We questioned the Director Meteorology and we examined the various parameters on which the forecasting of fog is based. We found that there was a weather system under whose influence there had been some incursion of moisture in the region. There was a light wind in the earlier part of the night and calm wind later. The sky was mostly clear. The dew point was only two degrees below the prevailing temperature. These conditions are generally conducive for the formation of radiation fog. However, weather forecasts are based not only on objective data but also on some degree of subjective judgement and anticipation acquired from knowledge and experience. Whatever may be the reason for it, there can be no doubt that on this occassion there was a failure to provide a reasonably accurate weather forecast. Worse wtill, when the visibility dropped suddenly resulting in the issue of special weather reports at 0640/0645/0655 hours, there was a failure to assess the trend of weather correctly whereby the indicator Nosig (i.e. No significant change) was used. Had a further drop in visibility been anticipated at these stages, as it should have been done, it is quite likely that the aircraft would not have made the approach.

4.9.6 There was one other thing which was not done correctly by the Met Office that day and which we consider to be significant. It

may be seen from the data given in para 4.9.4 above that visibility was observed to be 1500 metres at 0645 hours IST (i.e. 0115 hours UTC). Therefore, at that time, it was necessary to check the RVR. A Met Observer was sent in the ATC vehicle to do so. The ATC told Flight IC-440 at 0132 hours UTC that the RVR for runway 09 was 240 metres. Later, at 0140 hours UTC, it informed the aircraft that RVR for runway 27 was also 240 metres. The runway in use was 27 which is also the precision approach runway. From the time when conditions were reached for an RVR check to be necessary, it took 17 minutes for the aircraft to receive the irrelevant RVR of the runway not in use and it took 25 minutes for it to get RVR of the correct runway. We could find no satisfactory answer as to why the RVR had not been checked faster and, more importantly, why the RVR of the runway in use was not checked first. We are of the firm view that whenever the RVR is required to be checked, it is a matter of urgency to do so and no delay or laxity can be acceptable. We also believe that all officers should ensure that the work output of their offices fulfills, effectively and completely, all the purposes for which it is intended. It is bad enough that the Met Observer did not realise that the RVR of runway 27 should have been checked first. It is more unacceptable that officers in the Met Office at Hyderabad had not prescribed, monitored and ensured that the RVR check is always carried out in the correct sequence. Further, it is our considered view that at airfields where automatic measurement of RVR is not available, there is no need to make visual RVR checks of runway(s) which is/are not in use. These should be

made primarily for the beginning of the runway in use (TDZ) and, if feasible, for the mid-runway position also. As long as the visibility remains 1500 metres or less, and flight arrivals/ departures are expected, the meteorological observer should stay on near the runway beginning so that any changes in RVR (TDZ) can be intimated by him to the ATC as soon as these occur. Needless to say, the ATC vehicle must also remain there to enable the meterological observer to communicate with the ATC.

4.10 Operational Control

4.10.1 The advisability of establishing and maintaining a method of supervision of flight operations is elaborated in ICAO Annexure 6 Part I and in ICAO document 8335-AN/879/2. This is required to be done by the Operator in a manner approved by the State of Registry of its aircraft. Indian Airlines have laid down in Chapter 9 of their Operations Manual, Volume I, the definition of Operations Control and the duties of designated Operations Controllers, Flight Managers, Deputy Managers Flight Operations, Assistant Managers Flight Operations and Flight Operation Officers (Paras 9.12.0, 9.5.0, 9.5.1, 9.5.2, 9.5.3 and 9.5.3.1 of the said manual refer).

4.10.2 In our proceedings, we made enquiries about the role played by designated Operations Controllers because these officers are charged with exercising Operations Control over aircraft, being conversant with weather minimas, being aware of weather conditions at departure/arrival/diversionary airfields and diverting IA aircraft whenever weather conditions fall below

the operating minima. We were informed that such controllers are designated only at Delhi, Bombay, Madras and Calcutta where there is heavy traffic of IA aircraft. At other airports, there are duty Flight Operations Officers who monitor aircraft movements and, if necessary, obtain further orders from their superiors who can be contacted in their offices/homes. We made a random check on two different days at Delhi airport to find out who the designated Operations Controller was and where he could be contacted. Our findings left no doubt in our minds that the system of designated Operations Controllers, as envisioned in para 9.12.0 of Indian Airlines Operations Manual, Volume I, is not working smoothly or effectively. There is a need to ensure that, no matter where an Indian Airlines aircraft may be operating, there is a suitable mechanism somewhere which has the ability and the responsibility to monitor it and to assist it in respect of any operational problem.

4.10.3 We questioned the Flight Operations Officer who was on duty at Hyderabad on the morning of 15th November 1993. We particularly wanted to know if he was able to, or had any responsibility to, influence the Commander's decision of making an approach in below minima visibility conditions, or render advice about the flap jamming faced by the aircraft and its effect on the parameters of the aircraft's flight planning for its diversion to Madras. Virtually nothing had been done by him in these respects. We have the following comments to make:-

(a) The FOO must have at all times the latest weather reports of airfields of interest. If he does not get such reports, he

and his superiors must do something to remedy the situation. He told us that the arrangement between his office and the Meteorological Office is that a person from his office has to go to the Meteorological Office evey half an hour to pick up the latest weather report. Consequently, any special weather report issued at a non-scheduled time does not become available until a man from his office goes to pick up the next scheduled weather report. For this reason, weather reports issued at 0115 hours UTC and 0125 hours UTC on 15th November 1993 did not become known to him immediately. His attention was drawn to the sudden drop in visibility only when he heard Flight IC-440 going around at about 0135 hours UTC. We are not sure if this is a true reflection of reality. However, if it is, the FOO and his superiors in Indian Airlines must carry full responsibility of having instituted such an obviously defective arrangement, having lived with it day in and day out, and having failed to remedy it.

(b) In spite of his training and experience of aircraft performance and flight planning, the FOO failed to take any action concerning the difficulties faced by the aircraft. The least that he should have done was to inform his superiors about these and to apprise them that the aircraft's fuel state might be critical. Further, instead of being a bystander, he should have taken interest in the obtaining and provisioning of Bidar's latest visibility to the aircraft.

4.11 Operation of Escape Chutes

4.11.1 Out of the eight escape chutes with which the aircraft is equipped for emergency evacuation, three failed to deploy satisfactorily. These were at door positions 2L, 3R and 4L. In addition, the escape chute at door 1R did not deploy at all. We could not conclusively establish the reason for this because of tampering of evidence before the arrival of the Inspector of Accidents at the accident site. By any reckoning, this is an alarming rate of failure of an important safety device.

4.11.2 In the Engineering base of Indian Airlines in Bombay, we had occasion to see the facilities for packing and maintenance of escape chutes. We found that at the time of annual airworthiness checks of all aircraft, one escape chute is operated to confirm its reliability. To avoid excessive infructuous work due to such tests, the escape chute which is closest to its overhaul time is chosen for this purpose. We got one escape chute operated for such a random check. The operation was only a partial success because the pneumatic device to assist the door opening was ineffective and, although the chute inflated alright, it stayed doubled up until it was freed by manipulation of its velcro fasteners.

4.11.3 We could not pin-point any malpractice or any deficiency in the escape chute maintenance bay. However, we have no hesitation in saying that the performance of escape chutes in Flight IC-440 and in the random check of an A-300 aircraft by us, was far from reassuring. The occassions for using escape chutes are extremely rare but, when these occur, their prompt

and correct operation can well make all the difference between the survival and death of the aircraft's occupants. Indian Airlines should thoroughly review, at least on their A-300 and Boeing 737 fleets which happen to be the oldest assets in their aircraft inventory, the maintenance and reliability of their escape chutes, so as to detect and remedy such deficiencies as may come to light. This should be done with due involvement of the manufacturers of the relevant excape chutes.

4.12 Flap System of A-300 Aircraft

4.12.1 During our proceedings, may questions were raised about the reliability and maintainability of this system. Accusations were made that it does not have fail-safe design. M/s Airbus Industrie were blamed for the large number of occurrences of flap-jamming and for the lack of any advisory bulletin to caution operators against the extent of high fuel consumption in case of a diversion with jammed flaps. We shall now examine these issues in detail on the basis of available material evidence and the arguments of various parties.

4.12.2 The flaps of A-300 aircraft are an extraordinarily large aerofoil which experiences very considerable aerodynamic loads during flying. Due to engineering considerations, there is a virtually inescapable compulsion to build these in sections. Consequently, a mechanism has been provided to ensure the synchronised and symmetrical movement of all the sections. To preclude any adverse effect of flap system malfunction on the aircraft's controlability, the system is designed to lock-out in case of asymmetry or in case excessive torque is required for its

movement. Such lock-outs are essentially safety features which give the system a high degree of fail-safe capability. The basic design reflects the philosophy, as well as the limitations of the technology, of early 1970s.

4.12.3 Almost right since the introduction of A-300 aircraft in commercial service, the flap system has been affected by occasional instances of jamming. Consequently, M/s Lucas Aerospace have brought out certain modifications and detailed trouble shooting procedures. M/s Airbus Industrie too have laid down in the aircraft Check List a procedure for dealing with flap jams. This procedure is intended to release the trapped torque by reverse movement of the flaps. It offers a fair chance of undoing the lock-out, but no guarantee of normal operation thereafter. We find that the instructions in the Check List seem to have been composed without due care because, in case of a lock-out at 25 degrees position, it is not possible to carry out the suggested action of moving the Flap/Slat lever to "detent beyond the flap position" as there is no detent beyond 25 degrees.

4.12.4 M/s Airbus Industrie have a system of collecting from all operators data on the unserviceabilities and malfunctions of various aircraft systems. This is analysed and fed back to the operators for their information. Where considered necessary, appropriate technical advice is also offered. In addition, any specific technical questions from operators are answered satisfactorily and promptly. The accuracy of the analysed data is dependent upon the inputs from operators. It seems that

some operators do not report those occurrences in which there is no resultant disruption of their flight schedules. Conseuquently, it is quite possible that, if the flaps get jammed during a flight but are found to operate normally after landing, the aircraft may be relased for flying without any disruption of schedules and such an occurrence may excape being reported. We are not trying to justify such a practice, and in fact we find it to be very improper, but we believe that at times such things do happen.

4.12.5 M/s Lucas Aerospace presented to us data on the incidence of flap system lock-out due to various causes. This indicated that such occurrences due to problems with the screw jacks have diminished since the introduction of modified screw jacks in mid-1980s. According to their data, the current incidence is about 2 per 1,00,000 cycles, which they say is quite nomlnal. From a study of actual cases, we found that in some cases the lock-out got released during landing and, thereafter, neither the occurrence could be recreated nor could its cause be determined. Presumably, the jolting of the flaps during landing can cause the trapped torque to be released. Such occurrences indicate that the actual incidence of flap jams may be higher than what the recorded figures indicate. It is well known that almost all approaches of commercial aircraft are followed by landings and it is in extremely rare cases that these are followed by a go-around. If an aircraft's flaps get jammed at 25 degrees, and the lock-out is released during the landing, the occurrence of the flap jam would not be detected. This may happen repeatedly

without detection until a go-around takes place. Of course, this type of undetected cases can occur only of the lock-out takes place at 25 degrees and if it always gets released during the landing.

4.12.6 M/s Lucas Aerospace have done well to bring out good illustrated documents and video films to explain the causes of flap jams, procedures for system maintenance and the trouble shooting sequence. However, due to basic complexity of flap system design, trouble shooting is far too laborious and time-consuming. This may be seen from the fact that, in the case of aircraft VT-EDV, even after three months of dedicated activity to pin-point the component which had caused the lock-out, it has not been possible to reach a final conclusion so far. This is in spite of top-class technical advice having been available readily all the time from M/s Airbus Industrie and M/s Lucas Aerospace. Had the aircraft not been involved in an accident, and landed safely somewhere, it is very unlikely that any operator could have afforded to devote so much time or energy to locate the defective item for replacement. Of course, it is quite possible that this case just happened to be particularly difficult to resolve while others may be generally less elusive. It is also possible that, in some respects, faster progress might have been made if an on-line aircraft had been involved. However, there can be no doubt that trouble shooting procedures are far too cumbersome and these should be simplified if possible. After considering various possibilities, we strongly suggest the incorporation of visual indicators on all torque limiters in the flap system so that the one which

causes a lock-out can be detected by a mere look at the visual indicator. Such indicators are already in use on A-310 aircraft.

4.12.7 It is quite evident that A-300 aircraft have been experiencing flap jams for many years and, in spite of all reasonable care in maintenance, such occurrences cannot be prevented. In view of this, the aircraft manufacturer ought to have examined all contingencies and consequences of flap jams and forewarned all operators accordingly. One such obvious contingency is having to divert with jammed flaps and to fly in a configuration in which fuel consumption is increased very substantially. Such a diversion could be due to weather or airfield closure necessitated by a blocked runway or the failure of lights at night etc. It is quite surprising that this was not thought of by Airbus Industrie. It is even more surprising that when actual occurrences of flap jam and diversion took place on 2nd September 1992 and 6th June 1993, still no suitable advisory bulletin was issued to operators. However, there was also a failure on the part of operators like Indian Airlines to apply their own minds to anticipate various contingencies and to seek the appropriate solutions or inputs from M/s Airbus Industrie.

4.12.8 Incidently, Airbus Indsutrie do have a fuel consumption cautionary advice for flap jam situations in the Check List of A-320 aircraft. Apparently, their A-320 department had better anticipation in this respect (even though the A-320 can well do without such a caution bcause of its advanced Flight Management System) than their A-300 department.

4.13 Cause of Flap Jamming

4.13.1 We had to devote a great deal of effort towards the determination of the cause of the flap jam in Flight IC-440. In this task, an invaluable role was played by the Inspector of Accidents as well as representatives of Lucas Aerospace and Airbus Industrie. Indian Airlines rendered all possible help.

4.13.2 Soon after the accident, all components of the aircrafts' flap system were inspected and examined thoroughly. No deficiency was found in control inputs or their transmission. There was no obstruction/restriction in the operation of any linkage or flap section. Thus everything pointed towards a lock-out due to the operation of at least one of the torque limiters. However, it seemed that trapped torque in the system, if any, had been released by the jolting of the flaps during the forced landing. A detailed examination of all screw jacks and torque limiters was then carried out at the engineering facilities of Indian Airlines in Bombay and Thai Airways in Bangkok. This revealed low efficiency of screw-jack at position 2LH and a reduced setting for torque limiter activation in 4RH screw jack. The former was found to be on account of excessive friction in its ball-nut caused by swollen seals due to hydraulic oil contamination. All other screw-jacks and torque limiters were found to either comply with applicable parameters or to have deviations too small to result in a lock-out. At the time of writing this report, it has been established that the flap jam occured due to a lock-out. However, the specific torque limiter which caused the lock-out has not been identified conclusively so far. Further tests are being carried out by the Inspector of Accidents to determine

this. This work should continue until finality is reached.

4.13.3 The ball nut of 2LH screw jack is located close to hydraulic circuitry. The swelling of its seals due to hydraulic oil contamination is virtually certain to have occurred due to spillage during component removal/installation or leakage from an inadequately tightened connector. Indian Airlines should evolve suitable measures to prevent any similar occurrence.

4.14 Engineering Practices in Indian Airlines

4.14.1 We had the occasion to visit the engineering facilities of Indian Airlines in Bombay and to see their activities relating to the maintenance of A-300 aircraft. On the whole, we were quite satisfied with the engineering organisation and the maintenance of their records. However, we have the following observations:–

(a) We found that, during the early life of A-300 aircraft, the maintenance checks of its flap system components were mostly based upon "on condition" status. At that time, Indian Airlines adopted a soft life programme for flap system screw jacks. It entailed a bench check at 7000-7500 cycles and a full overhaul at 14500-15000 cycles. Subsequently, about six years ago, the manufacturers advised all operators that in their opinion a TBO of 12000 cycles would be most suitable. From the material presented before us, it seems that this advice did not receive in Indian Airlines the importance that it deserved. Consequently, the overhauls of flap system screw jacks are still scheduled

at 14500-15000 cycles which is much in excess of the manufacturer's recommendation. This periodicity should be reviewed by the Airlins.

(b) At one stage in our investigation, there was a considerable hold-up in the testing of flap screw jack torque limiters due to the non-availability of the special tool required for this purpose. It was contended by Airbus Industrie that Indian Airlines did not seem to possess the said tool and its lack was indicative of the Airline having been cutting corners in earlier cases of trouble shooting of flap system problems. Indian Airlines rebutted this inference and asserted that it very much possessed the said tool. It also explained that the tool had been sent to another base, as it was required there, and it was not available for some time due to that reason. We did not find the explanation of Indian Airlines to be convincing. We urge the Airline to review its holdings of tools and to remedy deficiencies if any.

(c) As brought out in sub-para (a) above, Indian Airlines have adopted a programme for carrying out bench checks of flap system screw jacks at 7000-7500 CSN/CSO. However, during our proceedings, we found that the screw jack which had been installed at position 4RH on aircraft VT-EDV had undergone 10,068 cycles without having been subjected to the bench check which was due at 7000-7500 cycles. While this was the solitary case of its type to come to our

notice, such a lapse cannot be ignored because of its implications on the reliability of the flap system. Indian Airlines should pin-point the reason for this check not having been carried out when it was due, and take effective measures to prevent such slip-ups in future.

4.15 Flight Safety in Indian Airlines

4.15.1 A number of our observations in this report are generally indidcative that, in the Operations and Engineering Departments of Indian Airlines, there is a need to enhance the level of flight safety consciousness of most personnel. Reports of some earlier aircraft accident investigations have also contained similar comments. We strongly advocate a concerted search for the means to substantially upgrade the effectiveness of the Airline's Air Safety Department which, we feel, is presently concerned more with routine work than with the prevention of hazards which may lead to accidents/ incidents in future. There is also some evidence of indifferent working at functional levels and laissez-faire or laxity at supervisory levels. Since many of the weaknesses are deep-rooted or widespread, remedial measures should be evolved by the involvement of a few professional people from outside the Airline with a few carefully chosen persons from within. Apart from identifying specific thrust areas in flying and engineering operations, this team should also develop specific orientation programmes to bring about a high degree of flight safety consciousness all round.

4.15.2 We understand that Indian Airlines had formed a Group in October 1993 to evaluate the implementation and utility of CVR/

DFDR monitoring as a means of random detection of incorrect procedures in flight. This Group has had a few meetings under the chairmanship of Capt B.S.Gopal, Director Air Safety (Retd), Air India. It seems to us that by virtue of his vast experience and professional distinction, he is well-suited to lead the team of experts proposed in para 4.15.1. However, his charter would have to be enlarged considerably and he may have to devote a period of about 4–6 months to this task on a virtually full-time basis. It would be advisable to include in his team two more persons from outside Indian Airlines of whom one should have a background of flying operations and the other of aeronautical engineering.

4.16 General

4.16.1 In the course of our investigation, we should normally have been able to confirm whether or not the Flight Crew of Flight IC-440 were under thc influence of alcohol at the time of the accident. However, in view of Indian Airlines medical authorities having failed to carry out an analysis of blood samples of the Flight Crew immediately after the accident, as brought out in para 2.12.2, we are unable to do so. Under tlie circumstances the concerned crew members are given full benefit of doubt and deemed to have been free from the influence of alcohol. Indian Airlines should examine why their stipulated procedures were not carried out in this instance and to take effective steps to prevent such situations in future.

4.16.2 Soon after our visit to the accident site, the court had the occasion to meet the CMD of Indian Airlines. It was suggested to him

that, instead of awaiting any compensation claims from the farmers whose crops were damaged as a result of the accident, it would be advisable for Indian Airlines to discharge its social responsibility in this matter voluntarily and graciously. We are quite aware that, in the normal course, such compensation cases are generally subject to gross delays due to lengthy procedures and indifferent authorities. We are very happy to note that Indian Airlines responded to our suggestion admirably and completed this task in a most laudable manner. We particularly compliment Shri Brijesh Kumar, then CMD, for his able guidance in this matter and Shri D.B.S. Gujral, Deputy Manager Flight Safety, for his very painstaking efforts in seeing it through in record time. As a result of the timely and vigorous action taken by the Airline, the affected farmers were saved from any hardship or difficulty because they received the compensation even before than they would have reaped the harvest which got damaged.

4.16.3 We want to place on record that this accident was caused by human failure and it was totally preventible. It was sheer providence that it did not result in any loss of life or serious injury to any person. There should be no complacence in attending to the deficiencies brought out or in instituting the remedial measures necessary.

FINDINGS

5.1 The aircraft was airworthy and fully serviceable for the flight. Other than the jamming of its flaps, which occured during the go-around at Hyderabad, there was no failure or malfunction of any systems during the flight. (Paras 2.6.1, 2.6.2 and 2.6.3 refer).

5.2 The Flight Crew held valid licenses and they were fully qualified to undertake the flight. They had undergone the requisite pre-flight medical examination and they had been pronounced as not being under the influence of alcohol. (Paras 2.5.1, 2.5.2 and 2.12.1 refer).

5.3 The Meteorological Office at Hyderabad airport failed to make a reasonably accurate forecast of visibility on the day of the accident. It also failed to assess the trend of visibility correctly at the time of issuing special reports at 0640/0645/0655 hours IST. (Para 4.9.5refers)

5.4 The Commander of Flight IC-440 made an approach at Hyderabad in visibility conditions below his weather minima. In spite of Indian Airlines' unambiguous policy prohibiting any such approach, except in an emergency, similar violations of the weather minima are sometimes made by other pilots also. The Operations Department of the Airline makes no worthwhile effort to detect and prevent such occurences. (Paras 4.2.4, 4.2.5, 4.3.2 and 4.3.3 refer).

5.5 Flight IC-916 made a very injudicious and imprudent transmission to encourage Flight IC-440 to go ahead and make an approach in below-minima conditions.(Para 4.3.2 refers).

5.6 Upon going around at Hyderabad airport, the flaps of Flight IC-440 got jammed in the fully extended position due to a lock-out. Efforts made by the aircraft's crew to release the lock-out were unsucessful. (Paras 4.4.1 and 4.13.2 refer).

5.7 The ATC at Hyderabad failed to use the stipulated procedure correctly when Flight IC-440 was arriving in visibility conditions below its weather minima. It also failed to obtain weather information about Bidar airfield, when requested by IC-440 for visibility of Air Force Stations, and to inform the aircraft suitably. (Para 4.8.3, 4.8.4 and 4.8.5 refer).

5.8 When faced with a flap jam situation and very poor visibility at Hyderabad, the Commander diverted to Madras without ensuring that adequate fuel was available for completing that flight. In taking this decision, he :-

(a) Discarded the better option of holding over Hyderabad in the expectation of an improvement in the visibility and, if necessary, eventually making an auto-landing there. He did so in spite of his having been trained in simulated auto-landings and his Airline's policy allowing him to make a below-minima landing in the given circumstances (Paras 4.5.1, 4.5.7 and 4.2.1 refer).

(b) Failed to seek specific information about the prevalent visibility at Bidar, which was easily within the range of the aircraft, and to consider a diversion to that place. (Paras 4.5.1 and 4.5.5 refer).

5.9 During the attempted diversion to Madras, the Commander failed to retract the aircraft's slats to minimise drag and, after some time, he reduced his speed injudiciously from about 165 knots to about 135 knots. Had these errors not been made, he could have reached Tirupati easily. (Paras 4.6.2, 4.6.3 and 4.6.4 refer).

5.10 During the attempted diversion to Madras, the Commander and his Flight Crew failed to make a timely assessment that the available fuel was inadequate for that flight. The Commander pressed on with his hopeless decision to proceed towards Madras, and missed the opportunity of returning to Hyderabad or diverting to Vijayawada while it was still possible to do so. (Paras 4.6.5 and 4.6.6 refer).

5.11 When the Commander realised that the fuel was utterly inadequate for reaching Madras, he decided to head for Tirupati. However, he could not reach even Tirupati and had to force-land the aircraft. (Para 4.5.9 refers).

5.12 The Commander failed to caution the cabin crew and passengers, and to take certain other essential steps, before the forced landing. (Paras 4.7.1 and 4.7.2 refer).

5.13 The Commander chose a good area for the forced landing and he handled the aircraft skillfully during the approach and touch down. (Para 4.7.3 refers).

5.14 The Flight Operations Officer of Indian Airlines failed to appreciate the difficulties faced by Flight IC-440 and to take any helpful action. (Para 4.10.3 refers).

5.15 Operational control over the flights of Indian Airlines, as envisioned in their Operations Manual, is not working effectively. (Para 4.10.2 refers).

5.16 As many as four out of the eight escape chutes in flight IC-440 failed to operate satisfactorily. (Paras 4.11.1, 4.11.2 and 4.11.3 refer).

5.17 In spite of proper maintenance, the Flap system of A-300 aircraft is prone to occasional lock-outs. The trouble shooting procedures for detecting and remedying the cause of a lock-out are too cumbersome and time-consuming. (Para 4.12.6 refers).

5.18 In spite of a long history of flap-jams on A-300 aircraft, both aircraft manufacturer and operators had failed to evaluate all possible consequences of such occurences and to evolve the means to cope with the same. (Para 4.12.7 refers).

5.19 The Engineering Department of Indian Airlines has not yet adopted the periodicity of servicing of flap system screw jacks as recommended by the manufacturer about six years ago. Its holdings of specialist tools needs to be reviewed. Its system of timely servicing of aircraft components is not fool-proof. (Para 4.14.1 refers).

5.20 There is a pressing need to upgrade the effectiveness of the Air Safety Department of Indian Airlines. (Para 4.15.1 refers).

5.21 The accident was entirely preventible. It was sheer providence that, in spite of many mistakes made by several people, no loss of life or serious injury resulted from it. (Para 4.16.3 refers).

CONCLUSION

6.1 The accident was caused by :-

(a) The ill-conceived decision of the aircraft's Commander to divert to Madras, without ensuring that adequate fuel was available for reaching there, when he was faced with a flap-jam and poor visibility at Hyderabad. (Paras 4.5.3, 4.5.8 and 4.5.9 refer).

(b) The failure of the aircraft's Commander and his Flight Crew to monitor fuel consumption correctly, and the failure of the Commander to revise his decision accordingly, until it became impossible to reach any airfield. (Paras 4.5.9, 4.6.5 and 4.6.6 refer).

(c) A forced landing due to the eventual shortage of fuel. (Para 4.5.9 refers).

RECOMMENDATIONS

7.1 At airports where the automatic measurement of RVR is not available, procedures for the visual measurement of RVR should be rationalised and streamlined. (Para 4.9.6 refers).

7.2 Indian Airlines should :-

(a) Take effective measures for the fool-proof adherence to the applicable weather minima in each and every flight. (Para 4.2.10 refers).

(b) Caution pilots against offering injudicious advice to other aircraft. (Para 4.3.4 refers).

(c) Enhance the utility and effectiveness of Operational Control over their flights to comply fully with the provisions in their Operations Manual. (Paras 4.10.1 and 4.10.2 refer).

(d) Make a through review of the maintenance and reliability of aircraft escape chutes of their A-300 and Boeing-737 aircraft, with due involvement of the manufacturers of such chutes. (Para 4.11.3 refers).

(e) Seriously consider the possibility of installing visual indicators on all torque limiters in the flap system of A-300 aircraft to facilitate easier and surer trouble shooting of flap system lock-outs. (Para 4.12.6 refers).

(f) Review the periodicity of servicing of flap system screw jacks of A-300 aircraft. (Para 4.14.1a refers).

(g) Review their holding and adequacy of specialist aircraft tools. (Para 4.14.1b refers).

(h) Ensure a really fool-proof system of timely servicing of aircraft components. (Para 4.14.1c refers).

(i) Set up a small team of non-IA professionals and specially selected personnel from within the Airline for thoroughly reviewing and enhancing the effectiveness of their Air Safety Department. (Para 4.15.1 and 4.15.2 refers).

(j) Tighten the implementation of their procedures for checking Flight Crew for presence of alcohol in their blood-stream/breath. (Para 4.16.1 refers).

7.3 The National Airports Authority should :-

(a) Ensure strict adherence to the procedure laid down in their DARA circular no. 6 of 1993 (Para 4.8.3 refers).

(b) Investigate the outage of runway lights at Hyderabad on 15th November 1993 and take suitable measures to prevent any similar recurrence. (Para 4.8.7 refers).

(J.K. SETH), Air Marshal (Retd)
Presiding Officer, Court of Inquiry

(D.S. DATTA), Captain
Offg. Dir., Air Safety
Air India
Assessor

(R.P. SRIVASTAVA),
Engineering Manager (MM)
Air India
Assessor