

**REPORT
ON
ACCIDENT TO ARCHANA AIRWAYS
L-410 AIRCRAFT VT-ETC
ON 11 JUL 96
NEAR KULLU**

by

The Court of Inquiry

**Air Marshal S S Ramdas (Retd)
PVSM AVSM VM VSM**

**ACCIDENT TO ARCHANA AIRWAYS
L-410 AIRCRAFT VT-ETC
ON 11 JUL 96
NEAR KULLU**

**Report
of
The Court of Inquiry**

**Air Marshal S S Ramdas (Retd)
PVSM AVSM VM VSM**

Assessors

**Shri S N Acharya
Director Projects (Retd)
Indian Airlines Ltd**

**Capt A K Malhotra
General Manager
Short Haul Division
Indian Airlines Ltd**

Secretary

**Shri S N Dwivedi
Senior Airworthiness Officer,
Directorate General of Civil Aviation**

**New Delhi
31 Oct 96**

CONTENTS

CHAPTER	SUBJECT	PAGE
1.	Brief Sequence of Events	1
2.	Factual Information	3
3.	Method of Investigation	29
4.	Analysis of Accident	37
5.	Flight Safety Aspects	46
6.	Findings	57
7.	Recommendations	60
8.	Acknowledgements	64

LIST OF ANNEXURES

- "A" : Government of India, Ministry of Civil Aviation Notification No AV.15013/2/96-SSV dated 15 Jul 96
- "B" : Transcript of Cockpit Voice Recorder (CVR) Recording
- "C" : Transcript of Bhuntar ATC VHF R/T Recording
- "D" : Flight Path of L-410 Aircraft VT-ETC Operating Flight ACY 103 on 11 Jul 96
- "E" : Location of Accident Site
- "F" : Photographs at Accident Site
- "G" : Wreckage Distribution
- "H" : Public Notification
- "J" : Witnesses Examined during Court Hearings
- "K" : Witnesses Interviewed by the Court at Chandigarh, Shimla, Bhuntar and Crash Site
- "L-1" : Weather Satellite Imagery (Visual)
- "L-2" : Weather Satellite Imagery (Infrared)
- "M" : Cockpit Voice Recorder (CVR) Transcript with Corresponding Flight Data Recorder (FDR) Data from 0842 hrs onwards on 11 Jul 96
- "N" : Flight Path of Flight ACY 103 on 10 Jul 96

BRIEF SEQUENCE OF EVENTS

- 1.1 Archana Airways L-410 aircraft, operating Flight ACY 103 from Shimla to Bhuntar (Kullu), was involved in an accident on 11 Jul 96. The Government of India, Ministry of Civil Aviation ordered a Formal Investigation into the circumstances of the accident, under Rule 75 of the Aircraft Rules 1937, vide Notification No AV.15013/2/96-SSV dated 15 Jul 96. A copy of the Notification is placed at Annexure "A".
- 1.2 On 11 Jul 96, Archana Airways Flight ACY 103 took off from Indira Gandhi International Airport (Delhi airport) for Shimla and Bhuntar (Kullu) at 0702 hrs. The aircraft, VT-ETC, was a twin-engine turboprop L-410-UVP, manufactured by M/s LET, Czech Republic. There were three crew members and 16 passengers on board. Capt V M Malik was in command.
- 1.3 The route weather forecast for Delhi-Shimla indicated isolated Cb between Flight Levels 030 and 300, with likelihood of moderate/severe turbulence and icing in Cb. Visibility was expected to be 2500 metres in haze, which was likely to reduce to 1500 metres in thunderstorm associated with rain.
- 1.4 The estimated flying time to Shimla was 1:10 hours, and the designated diversionary airfield was Chandigarh. Thereafter, the flight was scheduled to fly from Shimla to Bhuntar, with an estimated flying time of 25 minutes, and diversionary airfield as Chandigarh.
- 1.5 The flight from Delhi to Shimla was uneventful, with the aircraft landing at Shimla at 0810 hrs. At Shimla, 12 passengers deplaned and another two passengers emplaned. The flight from Shimla to Bhuntar was, therefore, with six passengers.

- 1.6 The satellite cloud imagery, at 0830 hrs, showed complete cloud cover in the Shimla/Mandi/Bhuntar area, with convective cloud clusters.
- 1.7 After takeoff from Shimla, at 0832 hrs, the aircraft was intended to be routed via Sundernagar, Pando and Largi, en route to Bhuntar.
- 1.8 The CVR (Cockpit Voice Recorder) transcript indicates that the aircraft reported abeam Bilaspur. Thereafter, the co-pilot informed the Captain that they were over Sundernagar. The aircraft then reported approaching Pando.
- 1.9 Some 2 mins 20 secs thereafter, the aircraft crashed into a steep hill at a height of 7380 feet AMSL (Above Mean Sea Level), near Village Kanda, at Lat 31° 43.643' North and Long 77° 07.996' East. The aircraft was totally destroyed, and all personnel on board were killed.

Note: All timings given in this report have been converted to IST for easy reference

FACTUAL INFORMATION

- 2.1 History of Flight
- 2.1.1 L-410-UVP aircraft VT-ETC was owned by Archana Airways Ltd. On 11 Jul 96, the aircraft was scheduled to operate from Delhi to Shimla and Bhuntar under the command of Capt V M Malik (PIC), with Capt S Gupta as co-pilot (P2).
- 2.1.2 Archana Airways normally operates Flight ACY 131 on the Delhi-Shimla sector, and Flight ACY 103 on the Delhi-Bhuntar (Kullu) sector. On 11 Jul 96, both these flights were combined to operate on the Delhi-Shimla-Bhuntar route, as Flight ACY 131 on the Delhi-Shimla sector and Flight ACY 103 on the Shimla-Bhuntar sector. The scheduled time of departure from Delhi was 0615 hrs. The departure was, however, delayed and the aircraft took off from Delhi at 0702 hrs. There were three crew members and 16 passengers on board. The take off weight of the aircraft, as shown on the Trim Sheet, was 6422 kgs, with 950 kgs of fuel. The Centre of Gravity (CG) was shown as 27% MAC.
- 2.1.3 A through flight plan (Delhi-Shimla-Bhuntar-Delhi) was filed at Delhi, with the route for the first sector given as W35-SP-VICG-DCT-VISM. The Flight Level, upto SP, was given as 110 and then to VICG as 105. As per the flight plan, the flying time from Delhi to Shimla was 1:10 hrs. On the Shimla-Bhuntar sector the flight plan showed the route as VISM-DCT-VIBR at Flight Level 090. The flying time was expected to be 25 mins. The endurance of the aircraft was shown as three hours. The Shimla-Bhuntar sector was to be flown under Visual Flight Rules (VFR).
- 2.1.4 The flight plan was signed by Capt S B Singh, who was scheduled to operate this flight as the Pilot-in-Command (PIC), and submitted to Briefing Officer Delhi airport

the previous evening (10 Jul 96). However, the Flight ACY 131/103 on 11 Jul 96 was actually operated by Capt V M Malik as PIC and Capt S Gupta as P2.

- 2.1.5 The flight took off from Delhi at 0702 hrs. and landed at Shimla at 0810 hrs. The flight to Shimla was uneventful.
- 2.1.6 The aircraft was on ground at Shimla for about 22 minutes and was refuelled. The take off weight from Shimla, as shown on the Trim Sheet, was 5862 kgs. The aircraft was shown as carrying 1000 kgs of fuel, the trip fuel being 300 kgs. The CG was shown as 27.5% MAC. There were six passengers from Shimla to Bhuntar, three of them being Japanese nationals. Four of these passengers had boarded the aircraft at Delhi and two of them had joined at Shimla. The aircraft took off from Shimla at 0832 hrs, bound for Bhuntar (Kullu). The aircraft was to climb to 9000', outbound from Shimla, and then proceed direct to Sundarnagar, entering the Kullu valley at Pando and flying, via Largi, to Bhuntar. The aircraft was in HF R/T contact with Bhuntar from 0837 hrs, and in VHF R/T contact from 0852 hrs, when it reported approaching Pando. The last R/T contact was just after 0854 hrs.
- 2.1.7 When the aircraft was overdue at Bhuntar, and did not respond to repeated R/T calls, Bhuntar ATC contacted Chandigarh ATC and Alpha Control who confirmed that they too were not in contact with the aircraft. Bhuntar ATC immediately initiated search and rescue operations. All aircraft flying in the area were asked to give calls to ACY 103. Indian Air Force and Civil authorities were also alerted. Information was soon received, through Mandi police, that an aircraft had crashed south of Bhuntar airfield, near village Kanda, in Jwalapur area. A ground rescue team of police, airport authorities and Archana Airways representatives immediately left for the site of the accident.

2.1.8 On reaching the scene of the accident, the team found that the aircraft had crashed into a hill and caught fire. All persons on board had been killed.

The accident occurred near village Kanda at Latitude 31°43.643' North and Longitude 77°07.996' East, at 0855 hrs, at an altitude of 7380'. The aircraft had hit the hill about 60' below the saddle of the hill which was at 7440'.

2.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	3	6	-
Serious	-	-	1
Minor	-	-	2
None	-	-	-
Total	3	6	3

2.3 Damage to Aircraft

The aircraft was totally destroyed

2.4 Other Damage

A small hut, containing food grains, was damaged and burnt due to flying debris from the aircraft.

2.5 Personnel Information

2.5.1 Pilot-in-Command

Name : Capt V M Malik
Date of birth : 22 Oct 47
Licence No : ALTP No 1399 valid upto 19 Oct 96

FRT0 No 3481 valid upto
19 Oct 96

RTR(A) No 5469 valid
upto 11 Feb 98

Endorsements As PIC : DC-3 01 Dec 87
HS-748 29 Jun 89
L-410 10 Nov 94

As Co-pilot : L-410 28 Sep 94

Flying experience : 8912:25 hrs, including
(As on date of accident) 1705 hrs on L-410

	<u>Day</u>	<u>Night</u>
Total	8327:25 hrs	585:00 hrs
On type	1648:00 hrs	57:00 hrs
Last technical/ performance refresher done on	:	06 Mar 96
Last IR/LR check	:	06 Mar 96
Last route check done	:	26 Mar 96
Last medical done on	:	01 Mar 96
Flying done in last 90 days prior to accident	:	154:05 hrs
Flying done in last 30 days prior to accident	:	35:40 hrs
Flying done in last 7 days prior to accident	:	03:30 hrs
Flying done in last 24 hrs prior to accident	:	03:30 hrs
Rest period before accident	:	Full night's rest

Capt Malik passed the DGCA pilot's technical examination for L-410 aircraft on 08 Sep 94. His co-pilot's training on Aircraft L-410 was carried out by Capt M Srenec (a Czech national) and his endorsement check was carried out by Capt V Mehta. Capt Malik was given a co-pilot's

endorsement on L-410 aircraft on 23 Sep 94. He flew 150 hrs as a co-pilot. His route checks were carried out by Capt Mehta and Capt Srenec. Capt Malik was given a Pilot-in-Command endorsement for L-410 on 10 Nov 94. His route checks to Bhuntar were carried out by Capt Srenec and Capt Mehta. Capt Malik had operated about 149 flights to Bhuntar. The last time he had landed at Bhuntar was on 10 Jul 96, when he operated the Delhi-Shimla-Bhuntar-Delhi flight. Capt Malik was not involved in any accident earlier.

2.5.2 Co-pilot

Name : Capt S Gupta
 Date of Birth : 10 Sep 67
 Licence No : CPL No 2223 valid upto
 09 Nov 97
 FRT0 No 4103 valid upto
 09 Nov 97
 FTR(A) No 6740 valid
 upto 09 Nov 97
 Endorsements As PIC : Pushpak Mk-I 15 Mar 90
 Cessna 152 03 Jul 91
 As co-pilot : L-410 12 Dec 94
 Flying experience : 1789:15 hrs including
 (as on date of accident) 828:35 hrs on L-410

	<u>Day</u>	<u>Night</u>
Total	1739:15 hrs	50:00 hrs
On type	798:55 hrs	29:40 hrs
Last technical/ performance refresher	:	15 May 96
Last IR, LR check	:	26 Nov 95
Last route check	:	03 Jan 96
Flying done in last 90 days prior to accident	:	138:05 hrs

Flying done in last : 18:35 hrs
30 days prior to accident

Flying done in last : 03:15 hrs
7 days prior to accident

Flying done in last : 00:00 hrs
24 hrs. prior to accident

Rest period before : More than 3 days rest
accident

Capt Gupta passed the DGCA pilot's technical examination on L-410 aircraft on 08 Sep 94. His co-pilot's training was done by Capt M Srenec and Capt V Mehta and his check for endorsement was carried out by Capt V Mehta. Capt Gupta got his co-pilot's endorsement on 12 Dec 94. His route checks to Bhuntar were done by Capt Mehta and Capt Srenec. Capt Gupta had operated about 80 flights to Bhuntar. The last time he had landed at Bhuntar was on 07 Jul 96 when he operated a Delhi-Shimla-Bhuntar-Delhi flight. Capt Gupta was not involved in any accident earlier.

2.5.3 Cabin Crew

There was one air hostess on board.

Name : Smt Sunita Mishra

Date of Birth : 09 Mar 68

Type of aircraft on : L-410
which technical done

Last technical : Apr 95
refresher done on

Smt Mishra was not involved in any accident earlier.

2.5.4 Pre-Flight Medical Examination

As per the medical register maintained by Archana Airways, the crew were subjected to medical examination,

at 05:15 hrs on 11 Jul 96, by Dr L M Narula. Both the pilot and co-pilot were subjected to alcometer checks, the results of which were negative.

However, as per the affidavit submitted to the Court, on behalf of Archana Airways Ltd, the co-pilot and air hostess arrived at the airport at 0530 hrs, and Capt Malik arrived at 0540 hrs. Thus a doubt exists as to whether the medical examination was actually carried out.

2.6 Aircraft Information

Manufacturer	:	M/s LET Aeronautical Works Kunovice, Czech Republic
Type	:	L-410-UVP-E9D
Constructor's Sl No	:	942703
Year of manufacture	:	1994
Certificate of Airworthiness (C of A)	:	No 1999 issued on 01 Aug 94 and valid upto 03 Aug 96
		Category : Normal
		Sub-division
		i) Passenger aircraft
		ii) Mail aircraft
		iii) Goods aircraft
Certificate of Registration (C of R)	:	No 2509 issued in favour of M/s Archana Airways, New Delhi on 01 Aug 94
Minimum Crew required	:	Two : Pilot and Co-pilot
Maximum authorised All-up-Weight	:	6400 kgs, but later revised to 6600 kgs in 1995
Total hours/cycles done	:	3297:21 hrs/2556 cycles since new 1392:35 hrs/933 cycles since C of A

Last Major inspection done : Check II inspection at 3210:01 hrs/2492 cycles on 26 Jun 96

Last Minor inspection done : Check I inspection at 3269:00 hrs/2534 cycles on 04 Jul 96

Flight Release : Issued on 04 Jul 96 after Check - I inspection at 3269:00 hrs and valid upto 13 Jul 96 or 3344:16 hrs.

Last Pre-Flight inspection : On 11 Jul 96 certified by Shri Raj Choudhary authorisation No.303/95

2.6.1 **Engines**

Manufacturer : M/s Walter MotorLet a s Prague, Czech Republic

Type : Walter M601E(8)

Maximum Thrust : 560 Kw (751 SHP)

2.6.1.1 Engine No 1

Sl No : 913032-E

Hours done : 1299:35 hrs/864 cycles since new

The engine was installed on the aircraft on 20 Nov 95 and was not removed prematurely since then.

2.6.1.2 Engine No 2

Sl No : 913033-E

Hours done : 1299:35 hrs/864 cycles since new

The engine was installed on the aircraft on 20 Nov 95 and was not removed prematurely since then.

2.6.2 Radio Apparatus

The aircraft was issued with an aircraft station licence by Ministry of Communication, on 20 Oct 94, which was revalidated upto 31 Dec 96.

The aircraft was fitted with the following avionics:

- HF/VHF communication
- ADF
- VOR
- DME
- ATC Transponder for navigation
- ILS (with Localiser, Glide Path and Marker)
- Weather Radar
- Radio Altimeter
- ELT
- CVR
- GPS

The last radio checks were carried out along with the Check I inspection on 04 Jul 96.

2.6.3 The aircraft was maintained as per the following approved maintenance schedules and all inspections and maintenance was carried out accordingly:

Transit Check	-	After each landing
Daily Inspection	-	Pre-Flight inspection/ Last Flight inspection
Check I	-	Every 75 flying hrs or 10 days, whichever is earlier
Check II	-	Every 300 flying hrs or 6 months, whichever is earlier

- Check III - Every 1200 flying hrs or 24 mths,
whichever is earlier
- Check IV - Every 2400 flying hrs or 48 mths,
whichever is earlier

2.6.4 Incidents

According to the aircraft records, the aircraft was involved in the following four incidents during the last year:

VHF transmission distorted
Weather Radar unserviceable
High ITT on left engine
GK I & II failed after take off

None of the incidents can be considered as major or serious incidents. All these incidents had been investigated by the Permanent Investigation Board of Archana Airways, in association with the Director of Air Safety, Delhi Region.

There were no in-flight engine shut downs or any incidents of smoke/fire.

2.6.5 Snags/Defects

A scrutiny of the aircraft records revealed that, during the last year, VHF transmission being distorted or having poor range had been reported a number of times, mostly by ATC. The equipment was however usually reported to be serviceable on ground. The antenna cable connector was found broken on one occasion and the Tx/Rx was replaced on another. Alternator switch tripping off and hydraulic warning coming on was reported twice on the aircraft. Throttle stagger and gas generator speed dropping below acceptable limits and IELU intervention light coming on were the only engine snags reported during the period. However, these defects were not confirmed on ground.

2.6.6 Maintenance Records

Scrutiny of the maintenance records of the aircraft revealed the following:

- No mandatory modification/inspection was outstanding at the time of accident
- Life limited components of the aircraft and engine were within the prescribed/approved limits
- The aircraft was maintained by the operator as per approved maintenance schedules
- The TBO for many components, including the CVR and FDR, is "On Condition".

2.6.7 Global Positioning System (GPS)

The aircraft was fitted with a Garmin 100 GPS. The system is a satellite based navigation system which indicates a precise position of the aircraft. If four or more satellites are acquired, the GPS will operate in the 3D mode, in which latitude, longitude and altitude are computed and indicated. If only three satellites are acquired, it will operate only in the 2D mode, in which only latitude and longitude are computed and indicated.

The GPS contains a Jeppesen data base which provides comprehensive navigation data and information on airports, VORs, NDBs, etc.

The system, however, has the following limitations:

- The Jeppesen data base in the system is required to be updated every 28 days.
- The GPS is not to be used as a primary navigation system.

- The GPS altitudes are not to be used for vertical navigation in place of pressure altimeters.

The Jeppesen data base in the GPS of Archana Airways has never been updated nor have any maintenance checks been carried out on the GPS.

2.7 Meteorological Information

Prevailing at Delhi

At the time of take off from Delhi, weather conditions prevailing, as per the METAR issued by meteorological department Palam, were as follows:

METAR 0700 hrs

Visibility	-	3500 m HZ
Winds	-	230/10 kts
Clouds	-	FEW 040 SCT 200
Temperature	-	31°C
Dew point	-	27°C
QNH	-	996 Hp
Trend	-	NOSIG

Prevailing at Shimla

There is no Meteorological Department representative at Shimla. As per the ATCO's observation, the weather at Shimla was as follows :

0630 hrs

Visibility - 4 km
Sky clear in patches.
No rain

0751 hrs (prior to landing of Flight ACY 131)

Surface wind - Calm
Visibility - 5 km, Kasauli hill partially visible.

Clouds - Medium height.
Temperature - 22°C

Prevailing at Chandigarh

Weather conditions prevailing at Chandigarh, as per METAR issued by the Air Force meteorological department, were as follows:

0630 hrs

Wind - 070/03 kts
Visibility - 6 kms
Weather - Cloudy
ISC- 3,000 ft
ICU- 3,000 ft
IAC-10,000 ft
SCI-25,000 ft.
Total 6/8
Temperature - 26.6°C
QNH - 996 Hp
Trend - NOSIG

Prevailing at Bhuntar

Weather conditions prevailing at Bhuntar Airfield, as per METAR issued by the Meteorological Department, were as follows:

SPECI 0730 hrs

Winds - Calm
Visibility - 5000 m
Clouds - SCT 003
BKN 030
OVC 080
Temperature - 23°C
Dew point - 20°C
QNH - 1003 Hp

METAR 0830 hrs

Winds	-	Calm
Visibility	-	5000 m
Clouds	-	SCT 002 BKN 030 OVC 080
Temperature	-	23°C
Dew point	-	21°C
QNH	-	1004 Hp

Route Forecast Given at Delhi

A route forecast, was issued by the Meteorological Department, Delhi, for Delhi-Shimla, valid upto 1100 hrs. The Co-pilot was orally briefed on the route forecast for the Shimla-Bhuntar sector. Winds and temperatures between Delhi and Shimla were expected to be :

FL 100	310/20 kts	13°C
FL 070	300/20 kts	17°C
FL 050	310/20 kts	24°C

Isolated Cb were expected between FL 030 and FL 300 and broken clouds at FL 090. There was likelihood of moderate/severe turbulence and icing in Cb. Visibility was expected to be 2500 m in HZ, which was likely to reduce to 1500 m in thunder storm with rains.

Terminal Aerodrome Forecast Given at Delhi

As per the Terminal Aerodrome Forecast for Shimla-Bhuntar issued by Meteorological Department Delhi, and valid from 0530 hrs to 1730 hrs of 11 Jul 96, weather conditions expected in that area were:

Winds	-	120/05 kts
Visibility	-	3000 m HZ
Clouds	-	SCT 030 BKN 100

From 0830 hrs to 1030 hrs, it was expected to become

Winds - 120/10 kts

Visibility - 5000 m HZ

Temporary changes from 0530 hrs to 1730 hrs expected were

Visibility - 1500 m in thunderstorm associated with rains

Clouds - SCT 025
FEW 025 Cb
BKN 080

Satellite Cloud Imagery

The satellite pictures of 0530 hrs, on 11 Jul 96, show a deep layer of convective clouds over North Western part of Himachal Pradesh Mandi/Bhuntar area with squall clusters. At 0830 hrs, the deep layer cloud convection drifted toward the East/South-East and covered the Shimla area. Convective cloud clusters over Shimla-Bhuntar-Mandi area became compact and organised.

2.8 Aids to Navigation

Shimla

Shimla has a low powered NDB which was reported to be serviceable at the time of accident.

Bhuntar

The only navigational aid available at Bhuntar airfield is an NDB. The NDB was reported to be working normally at the time of the accident. However, due to location of the NDB, and the surrounding terrain, the performance of NDB is not satisfactory. It has poor range with fluctuations in bearings.

2.9 Communication

Bhuntar ATC

Bhuntar airport is equipped with HF and VHF communications. The aircraft was initially in contact with Bhuntar on HF R/T and had later also established contact on VHF R/T. The last R/T contact with the aircraft was at 08:54 hrs. Though HF communication was reported to be serviceable at the time of accident, it was distorted and unreadable at times. Due to the surrounding terrain, Bhuntar VHF has very poor range and aircraft came in contact with Bhuntar ATC only in the vicinity of Pando.

Ground Communication between Bhuntar and Other Stations

There is no direct communication link between Bhuntar ATC and Delhi FIC, ATC Chandigarh or Alpha control. Bhuntar ATC can only contact these places on the normal P&T telephone line. The AFTN link is through Amritsar, which has to retransmit all messages.

2.10 Aerodrome Information

Shimla

Shimla airport is under the control of the Airports Authority of India. It is located 25 Kms from the city at Latitude 31°04'40" N and Longitude 77°04'22" E. The elevation of the airport is 5000'. There is only one runway, designated as 14/32, which is 3700' long and 75' wide. The surface of the runway is asphalt with LCN of 10. There are 12' shoulders on both sides of the runway. There are no runway lights, taxi lights or approach lights. Obstructions are also not marked. One fire tender is available.

A low power NDB is installed at Shimla. However, no instrument approach and let down procedure has been established.

Bhuntar (Kullu)

Bhuntar airport is under the management of the Airports Authority of India. Bhuntar airfield is situated in the Kullu valley, on the Western bank of the Beas river. There are steep hills on both sides of the airport. The aerodrome is located 10 kms South of Kullu town at an elevation of 3556'. The airport reference point is located at Lat 31°50'38" N and Long 77°09'24" E. There is only one runway, designated as 34/16. The runway is 3700' long and 100' wide. The runway surface is of tarmacadam with LCN of 14. Bhuntar is a unidirectional airfield. Landing is permitted only on Runway 34 and take off only from Runway 16. The declared distances are:

Runway 16

TORA	3450 ft
TODA	3870 ft
ASDA	3450 ft

Runway 34

LDA	3450 ft
-----	---------

There are no approach lights, runway lights, threshold lights or taxi lights. The Signal Area is unlighted. The threshold of Runway 34 is displaced by 180' due to obstruction of overhead wires on the approach. The over-run areas at both ends of the runway need improvement. Cat IV fire fighting facilities are available. The airfield is cleared for only VFR operations.

2.11 Cockpit Voice Recorder (CVR)/Flight Data Recorder (FDR)

2.11.1 Cockpit Voice Recorder

A Fairchild Cockpit Voice Recorder (CVR) Model A-100A was installed on the aircraft. This equipment continuously records and preserves a record of the cockpit conversation/communication during the last 30 mins of flight. The voice recorder system has four separate

inputs for simultaneous recording on a four-track tape. Channel 1 is free, Channel 2 receives input from the pilot's audio selector panel, Channel 3 receives input from the co-pilot's audio selector panel and Channel 4 input is taken from an area microphone in the cockpit. The bulk erase facility in the CVR had been made inoperative, as required by the DGCA. The "hot mic" modification was carried out on this aircraft.

CVR S1 No 56655 was retrieved, along with its housing, from the wreckage at the accident site. Both male and female connectors were in good condition. The CVR casing had suffered impact damage. The CVR was fitted with an under water Acoustic Beacon S1 No 0038081, with battery life upto Feb 98.

The CVR was installed new on the aircraft on 21 Dec 95 at 1998:11 aircraft hrs. It was removed on 11 Apr 96 at 2644:01 aircraft hrs and 645:50 component hrs, as it was reported to be unserviceable. During repairs, the fly wheel was found jammed due a defective bearing assembly and worn out belt. The CVR was repaired and certified on 7 May 96 by Max Aerospace Aviation Division. On 24 May 96, the CVR was installed on aircraft VT-ETC at 2964:21 aircraft hrs.

During dismantling of the CVR, after the accident, it was observed that:

- The mounting screws of the tape and ring assembly were loose
- The condition of flywheel belt was satisfactory
- All mountings and their insulations were broken
- Bulk erase card was found installed but isolated

The audio tape was removed and replayed. A transcript of the CVR recording was prepared (Annexure "B") after repeated hearings. The following salient points were noted:

- Cockpit Check Lists were not carried out according to the required "Challenge and Response" system. The check lists were only read out by the co-pilot.
- The pilots appeared to be using GPS, as the coordinates of Sundarnagar and Pando were checked by the co pilot.
- The co-pilot reported abeam Bilaspur and over Sundarnagar lake.
- The PIC decided to make one circle over Sundarnagar to find out if he could go ahead.
- The HF R/T transmission with Bhuntar was so distorted that the pilots could not understand the correct QNH given by Bhuntar.
- There is no discussion, between the PIC and the P2, regarding any defect, malfunction or failure.
- The Radio Altimeter warning came "ON" about one second prior to impact.
- The CVR has recorded an impact sound, after which it stopped working
- The CVR recording does not have any personal conversation which could have distracted attention of the pilots

- The pilots had not shown any anxiety or panic throughout the flight. They appeared to be very calm and cool in their cockpit conversation and R/T transmissions.

2.11.2 ATC Recorders

Communications between aircraft and Bhuntar ATC, on VHF frequency 122.3 MHz, is recorded on a single channel tape recorder. There is no time code available on the tape. After the accident the tape was replayed and a transcript made (Annexure "C"). The time was correlated with that of the CVR. The transcript does not reveal much useful information. However the following observations are made:

- The aircraft came in contact with Bhuntar ATC at 0852 hrs
- Bhuntar ATC passed the 0830 hrs weather report to the aircraft
- The last contact with the aircraft was at 08:54:53 hrs, when the pilot wanted to know whether there was any rain at the airfield

2.11.3 Flight Data Recorder

A BUR-1-2G Flight Data Recorder (FDR) was installed on the aircraft. The equipment records 25 analogue parameters and 48 discrete commands. The FDR is contained in a shock-resistant and fire proof container. Data is recorded on magnetic tape using a group of twelve recording heads arranged in twelve tracks. Another group of twelve heads is installed for readout. The analogue input signals of the individual transducers are converted to a binary code which is recorded. A tape drive provides tape movement in either direction. Having completed the

recording on the first track, the direction of tape movement is automatically changed and further recording is made on the next track. When all twelve tracks are used up, recording is re-started on the first track. The FDR can store data for 50 hours of flight. The FDR automatically switches on when the engines are started, and stops when the engines are cut off. A 27 Volts supply is required for tape movement.

FDR S1 No 10300 was installed on VT-ETC on 12 Jul 94 at component life of 00:00 hrs. The FDR originally had an overhaul life of 1500 hrs/10 years, whichever is earlier, and retirement life of 4000 hrs/18 years, whichever is earlier. However, the TBO was later changed to "On Condition" by the manufacturers. The FDR had not been removed from the aircraft due any defect.

Archana Airways has facilities for retrieval of FDR data at only 8/12 second intervals. This is not adequate for detailed investigation of an accident.

The FDR was retrieved from the wreckage at the accident site. Its mounting, power and data connectors were found bent and the back plate mounting was broken and separated. The drive pulley shaft was found broken.

An attempt made to retrieve data by repairing the drive pulley shaft was unsuccessful. The FDR was later taken to the manufacturers facilities in the Czech Republic, by the Inspector of Accidents, for repairs and retrieval of data.

The Inspector of Accidents reported that the manufacturers had not yet developed any software for computerized de-coding of FDR recording. The raw data had to be converted to usable information through laborious individual measurements and calculations.

The flight path of Flight ACY 103 from Shimla to Bhuntar on 11 Jul 96, was reconstructed on the basis of the FDR data, and plotted on a map of the Pando-Bhuntar area (Annexure "D").

An analysis of FDR recording of the VT-ETC flight on 11 Jul 96 brought out the following salient points:

- The aircraft climbed to altitude of about 9000' during the flight.
- The aircraft made a 360° turn over Sundarnagar.
- The aircraft was descending at the rate of about 500 ft/min when it crashed into the hill.
- All flight control and engine parameters were normal throughout the flight.
- The Radio Altimeter warning came "ON" approximately one second prior to impact.
- The aircraft had crashed into the hill, with wings level, at 7380'.

2.12 Accident Site and Wreckage

2.12.1 The accident site is at Lat 31° 43.643' N and Long 77° 07.996' E, at an altitude of 7380'. The accident site and the standard route from Shimla to Bhuntar is shown in Annexure "E".

The aircraft was found to have crashed into terraced fields, on the side of a steep hill, and the wreckage of the aircraft was scattered over an area of about 5,000 sq ft. The aircraft had impacted about 60' below the saddle of a hill which was at 7440'. The aircraft was totally

destroyed and all the occupants were killed instantaneously. No aircraft part was found on the flight path before the crash site.

2.12.2 Some photographs taken at the accident site are at Annexure "F", and the location of various parts of the wreckage is shown in Annexure "G".

The distribution of the wreckage indicates:

- The right wing of the aircraft had hit a thick tree trunk, at the edge of a terrace, before impacting the hill.
- The aircraft had broken up and overturned after impact.
- A portion of the right main plane was found in an inverted position, along with the engine, about 10' from the point of impact. The mainplane was badly damaged and skin was compressed and corrugated along the chord. Burning marks were observed on the deicing boots on the leading edge of wing.
- The cockpit and a portion of the fuselage was found about 12' to the left and about 18' ahead of the initial point of impact. The cockpit was found crushed.
- A portion of the left wing was found about 13' to the left and about 25' from the point of impact.
- The left engine was found about 15' to the left of the cockpit. The engine was in one piece but its casing was severely damaged.

- The empennage was found in an inverted position at a distance of about 15' to the left and about 62' from the point of impact. Burn marks were found on the deicing boots on the leading edges and skin of the control surfaces.
- The FDR and CVR were recovered from near the empennage.
- The bodies of the pilot, co-pilot, air hostess and passengers were found badly mutilated.

2.12.3 The following deductions were made from a detailed examination of the wreckage:

- The aircraft heading at the time of impact was 062°.
- There was no evidence of in-flight structural failure.
- The condition of the engines and propellers indicated that they were developing power.
- All landing gears were in up and locked position.
- The flaps were in the fully up position.
- The aircraft appeared to have crashed into the hill with wings level.

2.12.4 The cockpit was badly damaged due to the impact. The cockpit instruments and controls were smashed. Even though most of cockpit instruments were retrieved from the wreckage, and examined in detail, it was possible to ascertain only the following significant information:

- The "bug" of the Radio Altimeter was set at 400'.
- VHF 1 was selected to 122.7 MHz.
- The baggage compartment fire extinguisher pressure gauge indicated 11.5 kg/sq cm and did not appear to have been operated.
- The ELT was in "auto" position but burnt. It could not have transmitted any signals.
- The landing gear lever was in up and locked position, with the lever bent.
- The fuel shut off valve lever was in the open position.
- One ITT gauge was showed 400°C while the other indicated 500°C.

2.13 Medical and Pathological Information

The bodies of the pilots were disfigured and crushed. The skulls and a number of bones were broken. Most of the internal organs were crushed and ruptured. The bodies of the air hostess and passengers were dismembered. In the opinion of the doctor who conducted post mortem, death in all these cases was instantaneous and due to injuries sustained in the aircraft crash.

The injuries to the crew and passengers are indicative of high impact forces usually associated with this type of accident. Injuries sustained by the air hostess indicate that she may not have been seated at the time of accident and burns on her body appeared to be post mortem. The post-mortem report has not brought out any pre-crash medical problems which could have resulted in

incapacitation of the flight crew. It has also not brought out any unusual findings/ observations which could point to fire/smoke, explosion, etc during flight.

Histopathological and toxicological examination carried out at the Institute of Aviation Medicine, Bangalore, did not reveal any carbon mono-oxide toxicity or any ante-mortem burns. No pre-existing disease was detected.

2.14 Fire

The wreckage indicated signs of fire which appeared to have been only minor to moderate. The fire apparently started on impact of the wings when the fuel tanks burst open. Fire damage was found on the wing leading edges with deicing boots burnt/charred. Splashes of fuel caused fire at various other locations of the wreckage. Some huts in the vicinity, containing wooden logs and food grains, also caught fire. The fire extinguished itself when the fuel was burnt out. No fire fighting services could be provided at the site of accident.

Only the body of the air hostess had signs of burning, and these burns appeared to be post-mortem.

There was no evidence of any in-flight fire or explosion.

2.15 Survival Aspects

The accident resulted in very high impact forces causing disintegration of the aircraft. All the occupants were killed instantaneously.

The accident was not survivable.

METHOD OF INVESTIGATION

- 3.1 This Formal Investigation was ordered by the Government of India, Ministry of Civil Aviation, under Rule 75 of Aircraft Rules 1937, vide Notification No AV.15013/2/96-SSV dated 15 Jul 96, copy placed at Annexure "A".

The procedure adopted by the Court, for carrying out the investigation, is briefly stated below.

- 3.2 Immediately on being appointed to conduct this Formal Investigation, the Court had a meeting with Shri H S Khola, Director General Civil Aviation, (on 17 Jul 96) to ascertain background information on the accident and initial briefing. Capt A K Malhotra, one of the Assessors, and Shri S N Dwivedi, Secretary to the Court, were also present at this meeting. Shri S N Acharya, the other Assessor, was not able to attend the meeting as he had not yet arrived in New Delhi. He, however, joined the investigation a few days later.
- 3.3 The DGCA informed the Court that, on the very day of the accident, Shri A K Chopra, Director Air Safety, Delhi Region, DGCA, had been appointed as the Inspector of Accidents under Rule 71 of The Aircraft Rules, 1937. The DGCA also briefed the Court on the procedure for carrying out the formal investigation. The Court directed that, henceforth, the Inspector of Accidents should carry out all further investigations under the directions of the Court.
- 3.3 The next day (18 Jul 96), the Court held a meeting with the Assessors, Secretary to the Court and the Inspector of Accidents, to review the progress made on the investigation to date and to decide on the further course of action. The Inspector of Accidents stated that, immediately after the accident, he had impounded all the relevant operational,

maintenance and aircraft documents from Archana Airways. He also stated that his team of officers had visited the scene of the accident, taken charge of the Cockpit Voice Recorder (CVR) and Flight Data Recorder (FDR), taken photographs, drawn a sketch of the distribution of the wreckage, and taken statements from people present at the site at the time of the accident. He stated that, according to eye witnesses, the accident had occurred in very thick fog.

- 3.4 The Court, along with the Assessors and the Secretary to the Court, personally heard the CVR recording and gave instructions to the Inspector of Accidents to prepare a faithful transcript of the recording. The Court and the Assessors, thereafter, repeatedly listened to the CVR recordings, with reference to the transcript, and made minor refinements of the transcript on the basis of these repeated hearings and intonation of the recorded voices.
- 3.5 The Inspector of Accidents informed the Court that the facilities for decoding the FDR recordings, in India, were inadequate. Readings could only be obtained at 8/12 second intervals. This was confirmed, to the Court, by the Czech engineers working with Archana Airways. The Court also ascertained that no other facilities existed in India for detailed decoding of the recording on this particular type of FDR. The Court therefore requested the DGCA to make arrangements for the FDR to be escorted to the Czech Republic for decoding by the manufacturers of the aircraft. Accordingly, Shri A K Chopra, Inspector of Accidents, went to the Czech Republic and got the recording decoded at one second intervals. He later plotted the readings on a map, to show the flight path of the aircraft. This plot was included in the Report of the Inspector of Accidents, submitted to the Court. The flight path of the aircraft, during the last six minutes prior to the crash, is at Annexure "D".

- 3.6 The Court and the Assessors examined and deliberated on the report of the Inspector of Accidents, at great length and in great detail, with specific reference to the flight path of the aircraft, as plotted from the FDR recording, and its correlation with the CVR recording. It must be mentioned here, that the personal views/comments of the Inspector of Accidents, as reflected in his Report, were ignored by the Court and the Assessors. The Court and the Assessors took cognisance only of factual information and measurements recorded by the Inspector of Accidents and his officers. The Court and the Assessors carried out their own independent deliberations. However, the Court later examined the Inspector of Accidents as a witness, in the same manner as other witnesses, during the open hearings of the Court.
- 3.7 The Court directed the Secretary to issue a public notification, inviting persons having direct or relevant knowledge of the causes or circumstances of the accident to make such knowledge available to the Court. This public notification (copy attached at Annexure "H") was published in leading English and Hindi newspapers, in the Delhi, Punjab, Haryana and Himachal Pradesh regions, on 25 Jul 96. A similar notification was also individually addressed to all interested parties such as Archana Airways, Director General Civil Aviation, Airports Authority of India, Air Traffic Controllers' Guild, Meteorological Department, Government of Himachal Pradesh, Japanese Embassy, Aircraft and Engine manufacturers, and also the next of kin of the crew of the aircraft.
- 3.8 The Court and one of the Assessors then went to Chandigarh, on 22 Jul 96, from where an Indian Air Force helicopter had been arranged to convey them to the scene of the accident and Bhuntar airport. The helicopter flight had to be aborted half-way to Bhuntar, due to bad weather and low clouds in the Bilaspur/Sundernagar area and beyond. The

weather forecast was that this bad weather would prevail for at least the next week. The Court took this opportunity to interview the Senior Air Traffic Control Officer (SATCO), Senior Met Officer (S Met O) of Air Force Station Chandigarh, as well as Air Force pilots who had flown in the Sundernagar/Pando/Largi/Kullu area on the day of the accident, and at about the same time. The Court was able to get a very good idea of the weather prevailing over that area at the time of the accident.

- 3.9 The Court made another attempt to fly to the scene of the accident and to Bhuntar, by an Indian Air Force helicopter, eight days later (30 Jul 96). The helicopter had to again turn back due to bad weather and low clouds. Once again, the forecast was for persistent bad weather for the next week.
- 3.10 The Court, Assessors and Inspector of Accidents then flew to Bhuntar airport, by Jagson Airlines, on 09 Aug 96. The Indian Air Force had been requested to position a helicopter there to convey the Court to the scene of the accident. However, the helicopter could not be positioned there, in spite of repeated attempts, due to continued bad weather in the area. Finally, on 10 Aug 96, the Court and one of the Assessors (Capt A K Malhotra) trekked up to the accident site.
- 3.11 The Court was able to make a first hand examination of the scene of the accident, the wreckage of the aircraft, and also take relevant measurements with a hand-held Global Positioning System (GPS), Altimeter and Compass, taken on loan. The Court was also able to speak personally with persons who were at the site at the time of the accident. During the couple of hours that the Court was at the scene of the accident, the entire area was shrouded in fog. After visiting the scene of the accident, the Court gave clearance for the wreckage to be cleared from the site.

- 3.12 While at Bhuntar, the Court examined all the airport facilities available, and met with the airport authorities. The Court also met with the civil authorities of the area.
- 3.13 The Court also visited Shimla airport and met with the airport authorities.
- 3.14 The Court visited the operational offices and maintenance facilities of Archana Airways, personally examined various documents and maintenance facilities, and also interviewed a number of employees.
- 3.15 On response to the public and individual notifications, the Court invited the interested parties, and their legal representatives, for an initial meeting on 13 Aug 96. The Court briefed them on the following:
- (a) The authority under which the Court had been constituted.
 - (b) The contents of Rule 75 of The Aircraft Rules 1937, with specific reference to the fact that the Court could conduct the investigation "in such manner and under such conditions as the Court may think fit for ascertaining the causes and circumstances of the accident and for it enabling it to make the report", and that the Court was not fettered or hindered by the rigidity of the procedures which govern proceedings in other courts of law. 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 investigation of earlier accidents.
 - (c) The procedure which would be followed during formal proceedings of the Court.
 - (d) That all affected parties would be given a fair opportunity to explain/defend their conduct, if any information or evidence before the Court would be used against them.

- (e) That all interested parties could submit affidavits to indicate their basic position, or any aspect concerning the accident, and that these affidavits would be made available to all other participants.
- (f) That all participants would be given the opportunity to call any witnesses they desired and also cross-examine any of the witnesses before the Court.
- (g) That copies of the Report of the Inspector of Accidents would be made available to all participants by the time the Court hearings commenced. Further, that copies of all other relevant reports would also be made available to the participants, as and when they became available.
- (h) That, after the Court hearings, the participants would be given the opportunity to make final written submissions, as well as present oral arguments to refute the written submissions of other parties.
- (i) The time schedule of the Court hearings, with specific reference to the fact that the final report of the Court was required to be submitted by 31 Oct 96.
- (j) The first hearing of the Court was scheduled for Tuesday, 03 Sep 96.
- (k) The Court, on their request, granted participant status to the following parties:
 - (i) Archana Airways
 - (ii) Directorate General of Civil Aviation
 - (iii) Airports Authority of India
 - (iv) Air Traffic Controllers' Guild
- (l) The Court urged the Archana Airways representatives to expeditiously finalise and pay out any compensation which may be due to the next-of-kin of the crew and passengers of the aircraft, as well as to the owners of property which may have been damaged in the accident.

3.16 The open sittings of the Court commenced on 03 Sep 96 and concluded with the oral arguments of all interested parties on 25 Oct 96.

- 3.17 A list of all witnesses examined during the open hearings of the Court is placed at Annexure "J".
- 3.18 A list of all witnesses interviewed by the Court at Chandigarh, Shimla, Bhuntar and the crash site is at Annexure "K".
- 3.19 The proceedings of all the Court hearings were tape recorded and copies of cassettes of the day's recordings were given to all participants the very next day.
- 3.20 Throughout the investigation, the Court and the Assessors were guided by the objective of aircraft accident investigation as given in ICAO Annexure 13, ie "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 the Court would ignore shortfalls in the systems, or mistakes/violations committed by any people, which may have caused the accident or contributed towards its occurrence. To do so would have negated the very purpose of the investigation and would not have enabled the Court to suggest any preventive or remedial measures for the future. Thus the general and guiding principle of the Court was to find out everything relevant to the accident, with specific emphasis on "why it happened", rather than "who did it". The Court's comments, in this report, on the errors of individuals and deficiencies in the organisations are not intended to suggest any punitive action, but to focus attention on areas which need urgent remedial or preventive measures in the interest of Flight Safety.
- 3.21 Throughout the hearings, the Court had continuously reminded all participants that immediate remedial action must be initiated on any deficiencies or shortcomings highlighted during examination of the witnesses, and that

such action must not await specific instructions from the Court or submission of the Court's final report. Accordingly, the DGCA has issued a number of directives and clarifications on various matters. .

ANALYSIS OF THE ACCIDENT

4.1 This analysis is based on the factual information detailed earlier, along with relevant documentary and oral evidence, and other material presented to or collected by the Court.

Aircraft

4.2 The Court scrutinised the maintenance records of L-410 aircraft VT-ETC and found that it was fully serviceable to undertake the flight on 11 Jul 96. All relevant inspections/checks had been carried out as required. There is no evidence of any unserviceability or malfunction/defect which could have affected the safety of the aircraft during this flight.

Flying Crew

4.3 Capt V M Malik, the Pilot-in-Command (PIC), and Capt S Gupta, the Co-pilot (P2), held valid licences and were fully qualified to undertake the flight.

4.4 Smt Sunita Mishra, the air hostess, was trained on L-410 aircraft and was fully qualified to undertake the flight.

4.5 According to the records, all the above flying crew had been medically examined prior to the flight and had been found fit to undertake the flight.

Weather

4.6 The Meteorological Department, based on their forecast and satellite cloud imagery, have stated that the weather, in the Shimla-Bhuntar-Mandi triangular area, at the time of the accident, as having convective cloud clusters which were growing towards East/South-East direction.

- 4.7 The satellite imagery (visual and infra-red), as at 0830 hrs, clearly indicates heavy total clouding in the Shimla-Mandi-Bhuntar area. Copies of the imagery are placed at Annexures "L-1" and "L-2".
- 4.8 The evidence of Air Force, Army and civil pilots, flying in the area at about the time of the accident, indicates heavy clouding, with cloud base at 6000/8000', extending up to 15000'.
- 4.9 Eye-witnesses at the site of the accident have stated that there was very heavy fog, since morning, and the visibility was so poor that they could not see their own feet.

Diversion of Other Aircraft due to Bad Weather

- 4.10 Jagson Airlines Flight JA 221 (VT-ESS) scheduled to fly Delhi-Shimla-Bhuntar, which had taken off from Delhi at 0805 hrs, decided not to land at Shimla, due to bad weather there, and opted to proceed directly to Bhuntar. However, having encountered heavy clouding and bad weather near Bilaspur, the aircraft diverted at 0922 hrs, and landed at Chandigarh at 0940 hrs.
- 4.11 UP Air aircraft VT-UPD, scheduled to fly Delhi-Chandigarh-Bhuntar, which had taken off from Delhi at 0830 hrs, decided not to land at Chandigarh, due to a thunderstorm there, and opted to proceed directly to Bhuntar. The aircraft was flying at Flight Level 140, above cloud. Around Bilaspur, at about 0930 hrs, the pilot observed that the clouding extended up to 13500' and there was no visual contact with the ground. The pilot therefore decided to divert to Chandigarh and landed there at 1030 hrs, having had to climb to Flight Level 150 to remain above clouds.

4.12 It is quite evident, from the above, that the entire Shimla-Mandi-Bhuntar area was covered by heavy clouding, from about 6000/8000', extending up to about 15000'.

Archana Airways Flight ACY 131/103 on 11 Jul 96

4.13 Archana Airways Flight ACY 131, VT-ETC, operating from Delhi to Shimla, took off from Delhi at 0702 hrs and landed safely at Shimla at 0810 hrs. The flight was uneventful.

4.14 Thereafter, the aircraft continued from Shimla to Bhuntar as Flight ACY 103, taking off from Shimla at 0832 hrs. After take off, the P2 reported climbing to Flight Level 090 with ETA Bhuntar at 0854 hrs. However, at 08:37:41 hrs, the P2 reported to Bhuntar (on HF R/T) that he was climbing to Flight Level 110. According to the FDR readout, the aircraft reached 9450' (on a datum of 1013.2 Hp) at 08:38:15 hrs. This altitude recorded on the FDR, when converted to the Chandigarh QNH of 996 Hp (on which setting the aircraft was flying), works out to 8934'.

4.15 The transcript of the CVR recording, from 0842 hrs onwards, with the Height, Speed and Heading of the aircraft, as retrieved from the FDR, is placed at Annexure "M". The CVR has recorded a cockpit conversation between PIC and P2 (at 08:42:26 hrs), P2 reporting to Alpha Control (at 08:43:54 hrs), and P2 reporting to Chandigarh (at 08:44:05 hrs) that the aircraft was at an altitude of only 8500'. The FDR readout, at 08:44:05 hrs indicates that the aircraft was at an altitude of 9100'. This altitude recorded on the FDR, when converted to a QNH of 996 Hp (as set by the aircraft), works out to 8584'. This clearly shows that the aircraft, having climbed to about 8950', did not climb any further as intimated to Alpha Control and Bhuntar respectively. On the other hand the aircraft descended to 8500'.

- 4.16 It is evident that, in view of the weather conditions prevalent at that time, the PIC decided not to maintain his designated altitude but descend to 8500' to avoid entering heavy clouding above that altitude.
- 4.17 At 08:43:08 hrs, the PIC had asked the P2 to check the coordinates of Sundernagar and Pando. This indicates that the PIC was using the GPS for navigation.
- 4.18 At 08:45:28 hrs, the P2 reported position over Sundernagar lake. At this point, the PIC decided to make one orbit over Sundernagar to see if they could proceed further. Soon after, at 08:45:41 hrs, the conversation between PIC and P2 indicates that, while at the same altitude (8500'), they were not clearing the clouds.
- 4.19 At 08:46:43 hrs, while on a heading of 339°, the PIC initiated a turn to the left, and rolled out on a heading of 051° at 08:48:48 hrs. During this turn, the aircraft has lost about 380'. During this turn, at 08:48:12 hrs, the P2 informed the PIC that they had cleared clouds at 8000'. This is corroborated by the FDR readout which shows an altitude of 8612' which, when converted to the Chandigarh QNH of 996 Hp, works out to 8100'.
- 4.20 This clearly indicates that the PIC had decided to descend to 8000' to avoid entering clouds.
- 4.21 At 08:50:18 hrs, the PIC made a comment "*chalo, ab beech mein aa gaya*". The Court has interpreted this comment to mean that the PIC had observed his GPS display indicating that the aircraft had now come on track to Pando.
- 4.22 After completing an orbit over Sundernagar, the aircraft had flown on a steady course of 046° till 08:50:48 hrs.
- 4.23 At 08:51:32 hrs, the PIC called for descent checks.

4.24 At about the same time, the PIC carried out a gentle descending turn to the left, through about 25°, losing about 300' in about 70 secs. Thereafter, he maintained an altitude of about 7850'. At 08:52:45 hrs, the P2 informed Bhuntar ATC that the aircraft was approaching Pando. It is evident that he had made this call on the basis of the GPS display, and not on visual identification of Pando. If Pando had been visually identified, there was no reason for the aircraft to have been turned to the left, away from the Pando-Largi valley track. Thereafter, at 08:53:10 hrs, the PIC initiated a turn to the right and rolled out on a heading of 062° at 08:53:40 hrs. From this point onwards, the FDR plot shows that the aircraft was on a steady course of 062°, with a flight path almost parallel to the Pando-Largi track, but displaced left by about 1.5 to 2 nm. At 08:54:30 hrs the aircraft started a descent, losing about 250' in 35 seconds, before it crashed at 08:55:05 hrs.

4.25 At this stage, it is necessary to analyse why the PIC had chosen to deviate from the standard Sundernagar-Pando-Largi track which he was required to fly.

4.26 An answer to this question may lie in analysing the flight from Shimla to Bhuntar flown by the same PIC (Capt V M Malik) on the previous day (10 Jul 96). The co-pilot for that flight was Capt A K Tyagi. The FDR readout for the flight was plotted (Annexure "N"), and showed that the aircraft had not followed the standard Sundernagar-Pando-Largi-Bhuntar route. This standard route is required to be flown under VFR, coming overhead Pando at 8500', descending along the Pando-Largi valley, reaching Largi at 6500' and then turning left towards Bhuntar while continuing descent. The aircraft had, however, been flown about 3.5 nm left of the Pando-Largi track at an altitude of 11000', coming directly over the Largi-Bhuntar valley, carrying out non-standard descending turns (with upto 40° bank) in the valley before making the approach to Bhuntar airfield.

- 4.27 The co-pilot, (Capt Tyagi) was examined by the Court and asked to describe the flight path of the aircraft and explain why the standard route had not been followed. He stated that the standard route had not been followed because the Pando-Largi valley was covered by clouds. He admitted that the flight pattern, of that flight, as plotted in Annexure "N" was basically correct but that actual flight path was about 1.5 nm to the right. He also stated that the aircraft had been flown at about 11000', in clear weather above cloud. He was then asked to plot his own recollection of the flight path on the same chart.
- 4.28 When further questioned as to why the aircraft was flown directly to the Largi-Bhuntar valley, and not along the standard Pando-Largi-Bhuntar route, Capt Tyagi stated that this was a regular practice whenever the Pando-Largi valley was found to be covered by clouds. This practice was also confirmed by all other Archana Airways pilots examined by the Court. It was also confirmed, during examination, that Jagson Airlines (operating Dornier 228 aircraft) were also following this practice.
- 4.29 In the light of this background, it can be reasonably presumed that Capt V M Malik, while operating Flight ACY 103 the next day (11 Jul 96), observed cloud cover in the Pando-Largi valley and decided to deviate to the left and fly directly towards the Largi-Bhuntar valley. The only difference was that, on 10 Jul 96, he had flown this track at about 11000', whereas on this particular day (11 Jul 96) he was descending from 8000'. Here again, the Court has deliberated as to why he was flying this track at 8000', knowing fully well that there were high hills all round. The only plausible reason appears to be that, since he was flying just below cloud, he did not want to climb and risk entering the heavy clouding he could see above him. However, he probably encountered clouding even at this height but, possibly thinking that he could descend clear

of clouds, commenced a descent at 08:54:30 hrs. There is also a doubt as to whether Capt Malik was in visual contact with the ground during this time. He eventually crashed into a hill, which was obscured by clouds, at 08:55:05 hrs. He appears to have been in cloud for at least one minute prior to the crash.

- 4.30 The Radio Altimeter audio warning, which was set for 400', came on just one second prior to the impact with the hill. This would not have given sufficient time for the PIC to take evasive action. Given the steepness of the hillside into which the aircraft crashed, any higher setting of the audio warning would also have been of no use.
- 4.31 It is evident that, though the flight from Shimla to Bhuntar was to be flown under Visual Flight Rules (VFR), Capt V M Malik was under Instrument Meteorological Conditions (IMC) for at least one minute prior to the crash.
- 4.32 An overview of the sequence of events leading to the accident appears to indicate that Capt Malik had been overly dependent on the GPS.
- 4.33 From the CVR recording, it appears that there had been some ambiguity regarding the correct QNH at Bhuntar. The P2 seems to have heard that it was 1010 Hp, even though Bhuntar ATC had transmitted it as 1004 Hp. However, the P2 later confirmed (at 08:53:20 hrs) that the QNH was in fact 1004 Hp. There is no reason to disbelieve that the pilots did not set this QNH on their altimeters. It can therefore be reasonably presumed that the correct QNH setting of 1004 Hp had been set by both pilots during at least the last 105 seconds of flight.
- 4.34 The CVR recording indicates that neither the PIC nor the P2 had expressed any concern regarding the serviceability of

the aircraft or displayed any anxiety or apprehension about the weather, or their ability to fly into Bhuntar.

- 4.35 However, it is the opinion of the Court that the P2 should have cautioned the PIC in regard to deviation from the standard route and the fact that he was entering Instrument Meteorological Conditions (IMC) instead of maintaining flight in Visual Meteorological Conditions (VMC). This shows a complete lack of awareness of Cockpit Resource Management.
- 4.36 Another matter which needs to be analysed is why Capt Malik did not divert in spite of the bad weather prevailing in the area. The Court feels that he may have been influenced by his understanding of the weather in the Largi-Bhuntar valley and his recent experience (the previous day) of being able to land at Bhuntar when that valley was clear.
- 4.37 A mention needs to be made of the Garmin 100 Global Positioning System (GPS) fitted on L-410 aircraft of Archana Airways, and the way it is being used.
- 4.38 The GPS contains certain in-built data, based on Jeppesen charts. This data base contains information only on major airfields, nav aids, ATS routes, etc, but does not contain details of waypoints on non-ATS routes, eg Shimla-Bhuntar. Data on these waypoints is being entered by pilots, on the basis of lat/long taken from maps or by flying over them. The Garmin 100 GPS can accept a maximum of ten reversible routes with a maximum of nine waypoints per route. It has therefore been a practice to enter non-ATS routes on an as-required basis. There seems to be no standard procedure for entering such routes or for checking their accuracy before each flight.
- 4.39 Though the GPS has been placarded for VFR use only, it appears that pilots of Archana Airways have been relying on and using the system in all weather conditions.

4.40 The investigation and analysis carried out by the Court points to a chain of circumstances and events which have led to the accident. The basic organisational structure and operational control of Archana Airways has not been conducive to safe operations. These flight safety aspects have been covered in the next chapter.

FLIGHT SAFETY ASPECTS

5.1 During the investigation carried out by the Court, certain serious Flight Safety aspects came to light. The majority of these concerned Archana Airways, but there were also some concerning other agencies.

Archana Airways

Organisation and Duties

5.2 Archana Airways does not have a properly organised system with clearly defined responsibilities for supervisory personnel. Though some duties and responsibilities have been specified in their Operations Manual, the designation stated therein do not correspond with the designations presently held by various personnel. There is also considerable ambiguity regarding responsibilities for various important and vital functions required to be carried out by any aircraft operator. Some examples are given below:

5.3 Capt V Mehta has been designated as the Chief Pilot in Archana Airways. However, by his own admission:

- (a) He has not been involved in framing or reviewing any flying procedures.
- (b) He is not responsible for disseminating information to pilots.
- (c) He had never carried out any class-room training of any pilots.
- (d) Pilots are not reportable to him.
- (e) His only duties, as an Examiner, is to carry out checks and associated pre-flight briefing and post-flight debriefing.

5.4 Wg Cdr A S Anand (Retd) has been designated as the Manager Operations and Manager Flight Safety. He is an ex-IAF transport pilot. By his own admission:

- (a) He reports only to the Senior GM (Airport), Wg Cdr M S Sandhu (Retd), who is basically in charge of Commercial and Security, but also oversees Rostering of Staff and Airport Operations. Wg Cdr Sandhu does not look after any professional aspects of flying or maintenance.
- (b) He has never checked or reviewed any of the operational manuals or procedures, and stated that this is not included in his duties.
- (c) He was not aware of the periodicity of CVR and FDR checks.
- (d) He was not aware of whether FDR readout facilities existed in the company.
- (e) He has never carried out co-relation of CVR and FDR readouts.
- (f) Though having attended a DGCA workshop on FDR readout and analysis, he stated that this activity was not applicable to the FDR fitted on Archana Airways aircraft.
- (g) He has never carried out any checks on preparation of Trim Sheets.
- (h) Though he has forwarded an internal flight safety audit report to the DGCA, he admitted that this audit was actually carried out only by the people directly responsible for the day-to-day functioning of each department, and that he had only collated these individual reports without having personally checked their veracity.

5.5 There is a distinct lack of operational control and flight safety awareness, in Archana Airways, due to this ambiguity of responsibilities.

Orders and Instructions

- 5.6 The system of disseminating orders and instructions leaves much to be desired. The Court found that many vital and important orders/instructions were being passed down by only word of mouth. When questioned on this aspect, the Managing Director stated that, being a small airline, there was nothing wrong in passing orders verbally and it was not necessary to reduce everything to writing. The Court does not accept this argument.
- 5.7 The Court found that, due to the above attitude, and inadequate monitoring of performance, many non-standard practices were being followed in the company. These non-standard practices also varied from person to person.

Standard Operating Procedures/Route Guides

- 5.8 The Standard Operating Procedures (SOPs)/Route Guides were submitted to the Court, by Archana Airways, as part of their affidavit. However, it was found that these documents had been amended after the accident on 11 Jul 96, and were at variance with the documents taken into custody by the Inspector of Accidents immediately after the accident. Wg Cdr T Keelor (Retd), the Chief Executive (Operations), has admitted to the Court that some of the documents submitted along with the affidavit had been amended and did not reflect the orders/instructions applicable at the time of the accident. The Court therefore took into cognisance only the original documents taken into custody by the Inspector of Accidents.
- 5.9 The Archana Airways Route Guides for the Delhi-Bhuntar and Shimla-Bhuntar sectors are identical from Sundernagar onwards. Aircraft are required to fly only under VFR, via Sundernagar, Pando and Largi, maintaining minimum altitudes as follows:

Sundernagar	9000'
Pando	8000'
Largi	6500'

5.10 Route Checks to Bhuntar had been carried out only on the above route. There are also the following specific references to safety precautions in the Route Guide:

- Fly with visual reference to ground
- Identify Pando positively
- In case Pando is not identified, do not proceed further
- Do not enter clouds
- Do not proceed whenever in doubt

5.11 The Route Guide mentioned above indicates a "Minimum Sector Altitude" of 12600'. Archana Airways presently operate L-410 aircraft which are unpressurised. Para 1.5 of their Operations Manual clearly states that the aircraft is not to be operated above 10000' ASML on commercial flights. This only indicates that the Route Guide has been made without proper application of mind and without safety considerations.

5.12 The "Minimum Sector Altitude" mentioned above, may have been taken from the MOCA (Minimum Obstruction Clearance Altitude) shown on the Jeppesen chart. A better safe altitude for this route, where there is inadequate navaid coverage, would have been the MORA (Minimum Off-Route Altitude) of 13200' which ensures safe terrain and obstruction clearance within 10 nm of the route centreline. However, this would be of only academic interest for unpressurised aircraft.

5.13 There is no mention of any other route to be followed into Bhuntar.

5.14 However, The Court found that, as a matter of practice, Archaná Airways pilots have been following an entirely different route whenever the Pando-Largi valley is covered in cloud and Pando is not visually identified. Basically this has involved flying directly over the hills into the Largi-Bhuntar valley, without entering through the Pando-Largi valley. No Route Guide has ever been formulated, nor have any Route Checks been carried out for this direct route. Each pilot seems to follow his own practice as regards the route and height flown, and the descent pattern.

5.15 It is amazing and shocking that, in bad weather, aircraft are being flown on a route for which no Route Guide exists and on which no Route Checks have been carried out, whereas very strict instructions exist, and safety precautions emphasised, for the standard route to be followed in fair weather.

5.16 The Court also found that this non-standard practice was also being followed, at times, by Jagson Airlines operating Dornier-228 aircraft.

5.17 This clearly indicates a glaring lack of flight safety culture and inadequate operational control/supervision.

Cockpit Checks

5.18 The Court found that cockpit checks were not being carried out by the standard **"Challenge and Response"** method, but were being only read out by the co-pilot. This seems to be an accepted practice in the company. Further, there was no check-list for serviceability and setting of the GPS.

Global Positioning System (GPS)

5.19 There is no technical expertise, available in the company, on the Garmin 100 GPS. Hence there are no maintenance checks being carried out on the serviceability and performance of this system.

- 5.20 The GPS contains certain in-built data, based on Jeppesen charts. This data base contains information only on major airfields, nav aids, ATS routes, etc, but does not contain details of waypoints on non-ATS routes, eg Shimla-Bhuntar. Data on these waypoints is being entered by pilots, on the basis of lat/long taken from maps or by flying over them. The Garmin 100 GPS can accept a maximum of ten reversible routes with a maximum of nine waypoints per route. It has therefore been a practice to enter non-ATS routes on an as-required basis. There seems to be no standard procedure for entering such routes or for checking their accuracy before each flight.
- 5.21 Though the GPS has been placarded for VFR use only, it appears that pilots of Archana Airways have been relying on and using the system in all weather conditions.

Trim Sheets

- 5.22 The Court found that the Trim Sheets were being prepared in a very casual manner. A perusal of the Trim Sheet for the last flight of VT-ETC showed many over-writings, corrections and mistakes. The Court also asked two of the staff responsible for preparing Trim Sheets to explain how they had worked out certain Trim Sheets and to prepare sample Trim Sheets for a given load and fuel configuration. The Court found that they were not aware of the consequences of misrepresentation of certain vital data.
- 5.23 The Court also found that the company was following a system of "free seating", in spite of the fact that this had been objected to in a previous DGCA Flight Safety Audit Report. The Court demonstrated to the staff that if there were only six passengers in the aircraft, and they were all seated in the last two rows of seats, the CG went outside safe limits.

5.24 The Court also found that there was no standard system of distribution of baggage between the forward and aft baggage compartments. Further, the weight of the catering load was being understated. The weight of de-mineralised water, for engine injection, and the weight of the step ladder were not being reflected in the Trim Sheet.

Medical Examinations of Aircrew

5.25 The Court found that the procedure for recording pre-flight medical examination leaves much to be desired. For Flight ACY 131/103 (VT-ETC) on 11 Jul 96, the time entered in the medical examination records was shown as 0515 hrs whereas, according to the affidavit filed by Archana Airways, the time at which the co-pilot and air hostess reported for duty was 0530 hrs and Capt Malik reported at 0540 hrs. The explanations given by the Archana Airways staff, for this discrepancy, were not convincing.

5.26 This raises a doubt as to whether medical examinations are at all being carried out prior to flight.

TBO of FDR and CVR

5.27 The Court found that the TBO of the CVR and FDR are "On Condition". Both these very vital components have magnetic tapes and a number of moving parts, which require periodic maintenance to ensure their serviceability. The TBO of these items requires review.

FDR Readouts

5.28 The Court found that Archana Airways do not have adequate facilities for readout of FDR recordings. The existing capability is for readout at only 8/12 second intervals, through manual measurement, whereas any accident investigation would require readouts at one second intervals.

5.29 The only maintenance checks carried out on the FDR unit are "integrity checks", which only show that all parameters are being recorded.

5.30 Archana Airways has no system for co-relation of the CVR and FDR recordings or verification of whether the FDR recordings accurately reflect the flight path of the aircraft for any particular flight.

Routes and Schedules

5.32 During the Formal Investigation, Archana Airways complained that Met reports from Shimla and Bhuntar are not available before the scheduled time of departure of their flights, and that the ATC watch hours do not meet their requirements. Archana Airways implied that the duty/watch hours of the Met offices and ATCs should be amended to meet their requirements.

5.33 The Court feels that Met/ATC watch hours could be adjusted to meet the requirements of operators wherever possible. Thereafter, the operators should adjust their own schedules according to the available Met/ATC watch hours, instead of operating their flight when adequate Met/ATC facilities are not available.

Follow-Up on DGCA Safety Audit Report

5.34 The DGCA had carried out a very comprehensive Safety Audit of Archana Airways in 1994. The report highlighted numerous deficiencies in the system and violation of safety norms.

5.35 A sample check carried out by the Court revealed that these deficiencies and violations still existed.

Flight Safety Ethos and Culture

5.36 There seems to be a glaring lack of Flight Safety awareness and culture in Archana Airways. There appears to be no formal and effective procedure for reviewing and updating safety norms, or for carrying out detailed safety audits.

- 5.37 It is left to individual department heads to carry out their own safety reviews which are only collated by the nominal Manager Flight Safety. No independent internal safety audits are ever carried out as required by the DGCA.
- 5.38 The reporting pattern of the Manager Flight Safety and his manner of functioning has already been stated in an earlier paragraph, and is most unsatisfactory.
- 5.39 One of the arguments made by the Archana Airways representatives was that they meticulously follow all instructions issued by the DGCA, but that they cannot be faulted for not doing what they were not required to do. The Court is of the opinion that this argument cannot be accepted. DGCA cannot possibly issue detailed and comprehensive instructions on every single subject. Aircraft operators must use all available instructions as guidelines, develop their own flight safety culture, carry out their own internal audits, issue necessary orders and ensure compliance. Operators cannot take the attitude that they can do whatever they like when no specific instructions exist on a subject or if DGCA has not specifically pointed out any violations.
- 5.40 The present accident has occurred entirely due to an inadequate safety culture, inadequately prepared SOPs, undocumented instructions/procedures, habitual deviations from standard procedures, a casual attitude, lack of adequate supervision and inadequate cockpit resource management in the operations of Archana Airways.

Directorate General of Civil Aviation

Definition of VFR

- 5.41 During the hearings of the Court, there appeared to be considerable ambiguity as to the precise parameters governing Visual Flight Rules (VFR) and where it is defined

authoritatively. Witnesses and their legal representatives variously quoted ICAO Annexures 2 and 11, Aircraft Manual (India) and NOTAM 36/1991.

Airports Authority of India

Ground-to-Air Communication

5.42 The range of HF as well as VHF R/T of Bhuntar is unsatisfactory. There is a virtual no-communication zone between Sundernagar and Pando when an aircraft is often not in contact with either Chandigarh, Alpha Control or Bhuntar.

5.43 Further, due to this inadequate communication facility, an aircraft taking off from Bhuntar would remain on Bhuntar QNH till R/T contact is established with Chandigarh, whereas an aircraft on a reciprocal track, into Bhuntar, would remain on Chandigarh QNH till R/T contact is established with Bhuntar. Thus adequate vertical separation cannot be ensured. This is a flight safety hazard.

Ground-to-Ground Communication

5.44 There is no direct land-line communication between Bhuntar ATC and Delhi FIC, Chandigarh ATC and Alpha Control, as a result of which Bhuntar ATC has to rely on the normal P&T circuits.

ATC Watch Hours

5.45 The ATC and Met watch hours, at both Shimla and Bhuntar, are such that destination weather information is not available, prior to departure, for flights originating from Delhi during the early morning hours.

Bhuntar Airfield

5.46 There is an electrical cable across the approach path to Runway 34, rendering the first 180' of the runway unusable. This is an unnecessary restriction on an already short runway.

Meteorological Department

Met Facilities

5.47 The METARs at Bhuntar are presently being issued at hourly intervals. As weather in this area is fast changing, the weather information to operators is not adequately updated.

5.48 The met facilities at Bhuntar are also quite inadequate. As an example, there is no reliable anemometer to indicate accurate wind velocity.

Met Watch Hours

5.49 The ATC and Met watch hours, at both Shimla and Bhuntar, are such that destination weather information is not available, prior to departure, for flights originating from Delhi during the early morning hours.

FINDINGS

- 6.1 Archana Airways L-410 aircraft VT-ETC was fully serviceable for undertaking Flight ACY 131 from Delhi to Shimla, and Flight ACY 103 from Shimla to Bhuntar, on 11 Jul 96.
(Para 4.2 refers)
- 6.2 Capt V M Malik was the Pilot-in-Command (PIC) and Capt S Gupta was the co-pilot (P2).
(Para 2.1.4 refers)
- 6.3 There is no evidence of any in-flight unserviceability or malfunction which could have affected the safety of the aircraft.
(Para 2.11.1, 4.2 and 4.34 refer)
- 6.4 There is no evidence of any sabotage or unlawful intervention.
(Para 2.12.1, 2.12.3 and 2.14 refers)
- 6.5 The Flight Crew held valid licences and were fully qualified to undertake the flight. The Flight Crew had been certified as having undergone the requisite pre-flight medical examinations at Delhi, and declared fit to operate these flights.
(Paras 2.5.1, 2.5.2, 2.5.4, 4.3 and 4.5 refer)
- 6.6 The weather in the entire Shimla-Mandi-Bhuntar area was bad. There was heavy clouding from about 6000/8000', extending up to about 15000'.
(Paras 2.7 and 4.6 to 4.12 refer)
- 6.7 Two other aircraft flying in the area (Jagson Airlines VT-ESS and UP Air aircraft VT-UPD), en route to Bhuntar at about the same time as Archana Airways VT-ETC, diverted to Chandigarh due to bad weather.
(Paras 4.10 and 4.11 refer)

6.8 Flight ACY 131 from Delhi to Shimla was uneventful.
(Paras 2.1.5 and 4.13 refer)

6.9 Flight ACY 103, from Shimla to Bhuntar, was to be flown under Visual Flight Rules (VFR), routing via Sundernagar, Pando, and Largi. After take off from Shimla, the pilot decided to descend from his designated altitude to about 8500' to avoid entering heavy clouding above that altitude.
(Para 4.16 refers)

6.10 The aircraft having arrived over Sundernagar, Capt V M Malik carried out one left hand orbit, before proceeding to Pando. During this turn, he descended to about 8000', probably to avoid entering clouds.
(Para 4.20 refers)

6.11 Capt V M Malik was overly dependent on his GPS.
(Para 4.32 refers)

6.12 Capt V M Malik did not visually identify Pando and did not follow the standard Pando-Largi-Bhuntar route. Instead, while approaching Pando, Capt Malik deviated slightly to the left and flew a track parallel to the standard Pando-Largi track, but displaced about 1.5 to 2 nm to the left, maintaining an altitude of about 8000' altitude.
(Para 4.24 refers)

6.13 Capt V M Malik did not maintain VFR flight, as required on this route, but went into IMC without ensuring a safe altitude, as required under IFR.
(Para 4.31 refers)

6.14 Capt V M Malik inexplicably started descending, while still in cloud, without being aware of his precise position.
(Paras 4.24 and 4.29 refer)

- 6.15 Archana Airways L-410 aircraft VT-ETC crashed into a steep hill while in cloud.
(Paras 4.24 and 4.29 refer)
- 6.16 The site of the accident was at Lat 31° 43.643'N and Long 77° 07.999'E at an altitude of 7380'. The aircraft impacted about 60' below the saddle of a hill which was at 7440'.
(Para 2.12.1 refers).
- 6.17 The aircraft was totally destroyed and all occupants were killed instantaneously.
(Para 2.12.1 refers)
- 6.18 There was no fire, explosion or structural failure prior to the impact.
(Paras 2.12.1 and 2.14 refer)
- 6.19 The accident to Archana Airways L-410 aircraft VT-ETC, operating the Shimla-Bhuntar Flight ACY 103 on 11 Jul 96, was totally avoidable and was due to a complete lack of safety awareness, proper supervision and operational control in the organisation.

RECOMMENDATIONS

- 7.1 All operators with flights into hilly areas, such as Shimla and Bhuntar, should evolve and standardise SOPs/Route Guides for each of the airfields and for each of their types of aircraft, covering routes, climb and descent procedures as well as procedures for overshoot and engine failure after take off. These SOPs/Route Guides should be evolved in consultation with the respective aircraft manufacturers to ensure that they are within the performance capability of the aircraft.
(Para 4.28 and 5.7 to 5.17 refer)
- 7.2 All operators should also ensure that only these standard procedures are strictly followed and that no non-standard practices are allowed to creep in.
(Paras 5.14 to 5.16 refer)
- 7.3 With specific reference to Bhuntar, flights with unpressurised aircraft should be carried out only along the Pando-Largi-Bhuntar valley, strictly under VFR, and after establishing positive visual identification of Pando
(Paras 5.11 and 5.12 refer)
- 7.4 All cockpit checks should be carried out strictly by the "Challenge and Response" method.
(Para 5.18 refers)
- 7.5 All pilots should be cautioned not to use the GPS as a primary navigational aid.
(Paras 5.19 to 5.21 refer)
- 7.6 All operators having GPS installed on their aircraft should have adequate facilities for its maintenance and also evolve a standard procedure for updating, entering and checking data.
(Para 5.19 and 5.20 refer)

- 7.7 Archana Airways should re-structure their organisation and clearly define duties and responsibilities for operational control and flight safety supervision.
(Paras 5.2 to 5.4 and 5.36 to 5.40 refer)
- 7.8 Archana Airways should ensure that all important orders and instructions are properly documented and that undue reliance is not placed on word-of-mouth instructions.
(Paras 5.6 and 5.7 refer)
- 7.9 Archana Airways should ensure that adequate monitoring and control is exercised to ensure that all orders and instructions are strictly observed.
(Para 5.7 refers)
- 7.10 All operators should ensure regular monitoring of flight procedures by the use of FDR readouts and co-related CVR recordings.
(Para 5.30 refers)
- 7.11 Archana Airways should evolve a proper system of carrying out internal safety audits and taking suitable remedial measures.
(Paras 5.4, 5.5 and 5.36 to 5.40 refer)
- 7.12 DGCA should carry out a special safety audit on Archana Airways which should include verification of remedial action taken on the deficiencies pointed out in the audit report of 1994 and other issues pointed out in this report.
(Para 5.34 and 5.35 refer)
- 7.13 DGCA should take exemplary and deterrent action against any operator repeatedly violating safety norms.
(Paras 5.35 and 5.39 refer)
- 7.14 DGCA should clearly define the precise parameters governing Visual Flight Rules (VFR), to remove all ambiguity and

ensure that this information is disseminated to all concerned.

(Para 5.41 refers)

7.15 DGCA should have a standard and comprehensive accident investigation kit, in every Region, which should include, among other things, a hand-held GPS, Altimeter, Compass and Camera.

(Para 3.11 refers)

7.16 DGCA should review the TBO of the CVR and FDR fitted on L-410 aircraft.

(Para 5.27 refers)

7.16 AAI should review and ensure improvement of Nav aids, HF, VHF and ground-to-ground communications, and other ATC facilities at Shimla and Bhuntar.

(Para 5.42 to 5.44 refer)

7.17 AAI should arrange to reposition the electrical cable across the approach to Runway 34 at Bhuntar so that the full length of the runway is usable.

(Para 5.46 refers)

7.18 AAI should improve the over-run areas at both ends of the Bhuntar Runway.

(Para 2.10)

7.19 The Meteorological Department should review the met facilities at Shimla and Bhuntar to ensure that accurate weather information is made available and that METARs are issued more frequently, specially when the weather is fast changing.

(Para 5.47 and 5.48 refer)

7.20 AAI and the Met Department should consider change of watch hours at Shimla and Bhuntar to cater to the requirements of operators to these airfields.

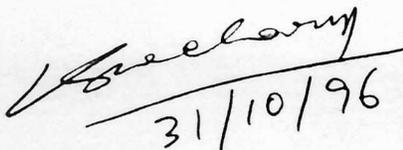
(Paras 5.33 and 5.49 refer)

7.21 Operators should ensure that their flights are scheduled on the basis of the availability of weather information and ATC facilities at the destinations.

(Para 5.32 and 5.33 refer)



Air Marshal S S Ramdas (Retd)
PVSM AVSM VM VSM
The Court



31/10/96

Shri S N Acharya
Director Projects (Retd)
Indian Airlines Ltd
Assessor



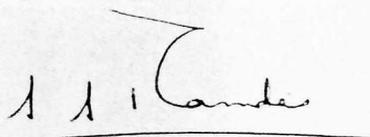
Captain A K Malhotra
General Manager (SHOD)
Indian Airlines Ltd
Assessor

New Delhi
31 Oct 96

ACKNOWLEDGEMENTS

The Court wishes to acknowledge and express its appreciation to the following people for their co-operation, assistance and support during the course of this inquiry:

- 8.1 Capt A K Malhotra and Shri S N Acharya, the Assessors, for their most valuable contribution in collecting and analysing evidence to reconstruct the circumstances and sequence of events leading to the accident and suggesting remedial measures.
- 8.2 Shri Yogesh Chandra, Secretary to the Government of India, Ministry of Civil Aviation, for his help and support.
- 8.3 Shri H S Khola, Director General of Civil Aviation, for providing all facilities for technical analysis of evidence, particularly in regard to CVR and FDR readouts.
- 8.4 Shri A K Chopra, Director Air Safety, Delhi Region, DGCA, for his technical assistance in collecting and analysing evidence, particularly in relation to interpretation of FDR recordings.
- 8.5 Air Vice Marshal H M Shahul (Retd) AVSM VSM, Chairman Airports Authority of India, for the providing accommodation and administrative arrangements for the functioning of the Court.
- 8.6 Shri S N Dwivedi, Secretary to the Court, for his untiring efforts and efficient management to ensure smooth functioning of the Court of Inquiry and completion of the task on schedule.



Air Marshal S S Ramdas (Retd)
PVSM AVSM VM VSM

New Delhi
31 Oct 96

ANNEXURE "A"
(Para 1.1 refers)

(To be published in Part II, Section 3, Sub-Section(ii) of the Extraordinary Gazette of India.)

GOVERNMENT OF INDIA
MINISTRY OF CIVIL AVIATION

New Delhi, the 15th July, 1996

N O T I F I C A T I O N

S.O.... Whereas an Archana Airways L-410 aircraft VT-ETC while operating a flight on Delhi-Shimla- Kulu sector was involved in an accident on 11th July, 1996 near Village Kanda, District Mandi in Himachal Pradesh about 30 Kms south of Bhuntar airport;

And whereas it appears to Central Government that it is expedient to hold a formal investigation into the circumstances of the said accident;

Now, in exercise of the powers conferred by Rule 75 of the Aircraft Rules, 1937, the Central Government hereby directs that a formal investigation of the said accident be held.

The Central Government is pleased to appoint Air Marshal (Retd.) S.S. Ramdas, former Chairman and Managing Director, Indian Airlines, to function as the Court to hold the said investigation.

The Central Government is also pleased to appoint:-

(i) Capt. A.K.Malhotra, Operations Manager, Short Haul Division, Indian Airlines, and

(ii) Shri S.N.Acharya, Director of Engineering (Retd), Indian Airlines, New Delhi

to act as assessors for the said investigation.

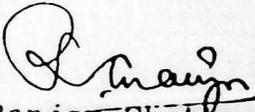
Shri S.N.Dwivedi, Senior Airworthiness Officer, Directorate General of Civil Aviation will function as Secretary to the Court.

The Court is requested to complete its investigation by 31st October, 1996. The Court is also requested to give interim recommendations for any additional safety measures, if required, for ensuring safety of operations to/from Kulu particularly during monsoon and bad weather conditions.

The Headquarters of the Court will be at New Delhi.

Secretarial assistance to the Court will be provided by the office of the Director General of Civil Aviation.

No.AV.15013/2/96-SSV


(Ranjan Chatterjee)

Joint Secretary to the Govt. of India

To,

The Manager,
Govt. of India Press,
Mayapuri, New Delhi.

ANNEXURE "B"
(Para 2.11.1 refers)

TRANSCRIPT OF CVR RECORDING
VT-ETC FLIGHT ACY 103
ON 11 JUL 96

TIME (IST) (H:M:S)	TIME BEFORE IMPACT (SEC)	FROM	TEXT
08:31:12	1433	P2	Shimla Archana 132 correction 103. Ready for take off.
	1429	SHIMLA	Archana 103 Shimla clear for take-off. Wind calm.
	1425	P2	Clear for take-off, wind calm, Archana 103.
	1421	P2	All checks complete.
	1419	P1	_____.
	1417	P2	Clear for take-off.
	1402	P2	_____.
	1401	P2	_____ Armed.
	1397	P2	_____ Armed.
	1396	P2	Increasing power.
	1389	P2	Full power is _____.
08:31:56	1384	P2	50.
	1383	P2	Out of 60 now.
	1381	P2	No warning light.
	1379	P2	70.
	1376	P2	Over 79.
	1374	P2	Rotate.
	1372	P1	_____.

	1370	P2	Yes it is going up.
	1362	P2	Starboard clear.
	1359	P1	Flaps Up. Max. Continuous.
08:32:28	1357	P2	400 feet, flaps going Up. Setting max. continuous.
	1335	P2	Max. continuous set, 1000 feet, Spoilers _____ . Autofeather off, _____ off.
08:33:02	1323	SHIMLA	Archana 103 Shimla airborne 02, report contact established with Chandi and estimate Bhuntar.
	1316	P2	Roger, Roger Shimla.
	1295	P1	QNH _____ 9 (pause) 9.
	1292	P2	995.
08:33:41	1284	P2	Chandi Archana 103.
	1280	CHANDI	Archana 103 Chandi, go ahead.
08:33:48	1277	P2	Sir, we are airborne Shimla 0302 for Bhuntar, level climbing to niner zero, arrival Bhuntar 0324.
	1265	CHANDI	Roger Copied, your estimate Chandigarh QNH is niner niner six, report in contact with Bhuntar.
08:34:07	1258	P2	Roger sir, call you in contact with Alpha control, Archana 103.
08:34:11	1254	CHANDI	For your information Chandigarh is at present experiencing rain, thundershower with heavy shower over the airfield. Visibility down to 800 meters.

	1246	P2	Roger Sir, copied.
08:34:26	1239	P2	Alpha Control, Archana 103.
	1236	ALPHA	Sir.
	1233	P2	Sir we are from Shimla to Bhuntar, airborne Shimla 0302, level climbing to 90, arrival Bhuntar 0324.
08:34:43	1222	ALPHA	Roger call abeam Bilas.
	1218	P2	Call you abeam Bilas, Archana 103.
08:34:54	1211	P2	Shimla, Archana 103.
	1208	SHIMLA	Go ahead.
08:35:00	1205	P2	Sir we are in contact with Alpha and Chandi, arrival Bhuntar 0324.
08:35:06	1199	SHIMLA	03 Shimla, Roger estimate Bhuntar 0324. Change over approved.
	1193	P2	Archana 103.
	1190	P1	Delhi Kulu lagadho.
	1188	P2	Roger.
	1187	P1	---- Route.
	1130	P@	No. 1 ADF to Chandi.
	1125	P1	Roger.
08:36:30	1115	P2	Bhuntar Bhuntar Archana 103.
	1108	P2	_____.
	1104	P1	We will continue to _____.
	1102	P2	Roger Sir.
08:36:45	1100	P2	Bhuntar Bhuntar Archana 103.
	1092	P2	Bhuntar Bhuntar Archana 103.

	928	BHUNTAR	_____.
	926	P2	Radio strength 3. Radio strength 3. Go ahead with your weather.
	922	BHUNTAR (HF)	_____ surface wind _____ visibility 5000 metres _____.
08:40:01	904		(Bhuntar Bhuntar Bhuntar this is Victor Papa Delta calling Bhuntar 89 _____ TXR of other aircraft).
		BHUNTAR (HF)	_____.
	888	P2	Confirm rain, confirm rain and QNH 1010.
	880	BHUNTAR	_____.
	852		(Bhuntar Bhuntar Bhuntar Victor Papa Delta. How do you read? Txr of other aircraft).
		BHUNTAR	_____.
	844		(Airborne Delhi for Chandigarh. Estimate Chandi 0345. Copied your weather, 5 km, scattered 200, broken 5000 and overcast 9000, 23 degrees, 1004. Confirm. Txr of other aircraft).
	827	BHUNTAR	_____.
	820		(Copied your weather OK. We call you getting airborne from Bhuntar Ah.. from chandi. Over. Txr of VPD other aircraft).
	814	BHUNTAR	_____.
08:41:37	808	P2	Bhuntar Archana 103. Confirm 5000 metres visibility and overcast 8000, temperature 21, 1010.

	796		(Delhi Victor Papa Delta. Departed Delhi 0304. Ascending to one.. Txr of VPD other aircraft).
08:42:07	778	P2	Sir Bhuntar ka toh yeh mila hai. 5.. 5 knots ki wind hai Sir. 5000 metres, scattered 200, broken 5000, overcast at 8000, temperature 21, 1010.
	761	P2	Kuch clear nahi Sir abhi itna.
	759	P1	Visibility 5 OK. Maintaining 8500.
	753	P2	OK Sir.
	751	P1	Then we go over to Sundar Nagar.
08:42:37	748	P1	We are abeam Bilas now.
	745	P2	Roger.
08:43:08	717	P1	Ek minute iska coordinates check kar lo.
	711	P1	Sundar Nagar aur Pandoh ka.
	688	P2	Thik hai Sir.
	686	P1	OK. Alpha ko bolo. Change over kar lo. Chandigarh se change over kar lo aur VHF pe isko try karo.
08:43:47	678	P2	Alpha Control Archana 103.
	673	ALPHA	103 Alpha go.
08:43:54	671	P2	Sir we are abeam Bilas 8500 in contact with Bhuntar.
08:44:00	665	ALPHA	Roger change over.
	663	P2	Roger change over.

08:47:48	437	AH	Capt . Gupta.
	435	P2	Go ahead.
	433	AH	Temperature please.
	430	P2	Ha.. temperature 20.
	427	AH	Thankyou.
08:48:12	413	P2	Sir eight zero to clear ho gaya clouds.
	409	P1	Han _____ we will go in this side na.
	354	P1	Try and get Bhuntar please.
	347	P2	Bhuntar Bhuntar Archana 103.
	333	P2	Bhuntar Bhuntar Archana 103.
	318	P2	Bhuntar Bhuntar Archana 103.
	309	P2	Bhuntar Bhuntar Archana 103.
	304	P1	He might call back.
08:50:14	291	P2	Sir usse HF pe to contact ho gaya hai.
	287	P1	Chalo ab beech main aa gaya. It is quite clear now.
	278	P1	_____.
08:51:32	213	P2	Descent checks. Seat belt signs ON, fuel quantity checked, 900.
	210	P2	Brake and hydraulic pressure checked, normal.
	208	P2	Altimeter setting 1010.
	193	P2	Authofeather ON.
08:51:56	189	P2	Missed approach. We are descending visually. MDH selected 200. Missed approach procedure _____. QNH 1010.

08:52:05	180	P1	1010?
	173	P2	Sir I think yahi diya tha.
	163	P2	Bhuntar Bhuntar Archana 103.
	156	P2	Bhuntar Bhuntar Archana 103.
	146	P2	Bhuntar Archana 103.
08:52:42	143	BHUNTAR	Archana 103, Bhuntar. How do you read?
	140	P2	Aa.. radio strength now 3. We are approaching Pandoh 8000. Arrival Bhuntar 0324.
08:52:55	130	BHUNTAR	5000 metres, clouds scattered 200 feet, broken 3000 feet, overcast 8000 feet, temperature 23, dew point 21, QNH 1004 hecta pascals.
08:53:07	118	P2	Say again QNH 1004.
08:53:12	113	BHUNTAR	Archana 103, you are cutting out. I say again QNH 1004 hecta pascals. Report entering valley.
	105	P2	Roger Sir Archana 103 Thankyou.
	95	AH	Yes.
08:53:32	93	P2	24 temperature.
	92	AH	How much?
	91	P2	24.
	90	AH	Thankyou.
08:53:46	79	P1	What is the visibility he says?
08:53:49	76	P2	Visibility 5000.
	70	P2	Clouds at 200 feet.
	67	P1	Clouds at?

	65	P2
	64	P1
08:54:02	63	P2
08:54:12	53	P2
	49	BHUNTAR
08:54:18	47	P2
08:54:19	46	BHUNTAR
08:54:22	43	P2
08:54:24	41	BHUNTAR
08:54:28	37	P2
08:54:30	35	BHUNTAR
08:54:34	31	P2
08:55:01	4	P1
08:55:04	1	
08:55:05	0	

Yes Sir.

What is the clouds?

200 feet, then at 3500 feet and overcast at 8000.

Bhuntar Archana 103.

Go ahead.

Confirm any rain over airfield.

Negative.

And valley is visible.

Valley is partially visible. Aa.. low clouds are there.

Confirm visibility is 5000.

Visibility is 5000 metres, QNH is 1004.

OK Sir. Thankyou very much.

Ask him if the sky is visible.

(Radio altimeter warning)

(Impact).

Note:

1. Time is co-related with 'Alpha Control' in IST.
2. Some R/T conversations are in UTC.

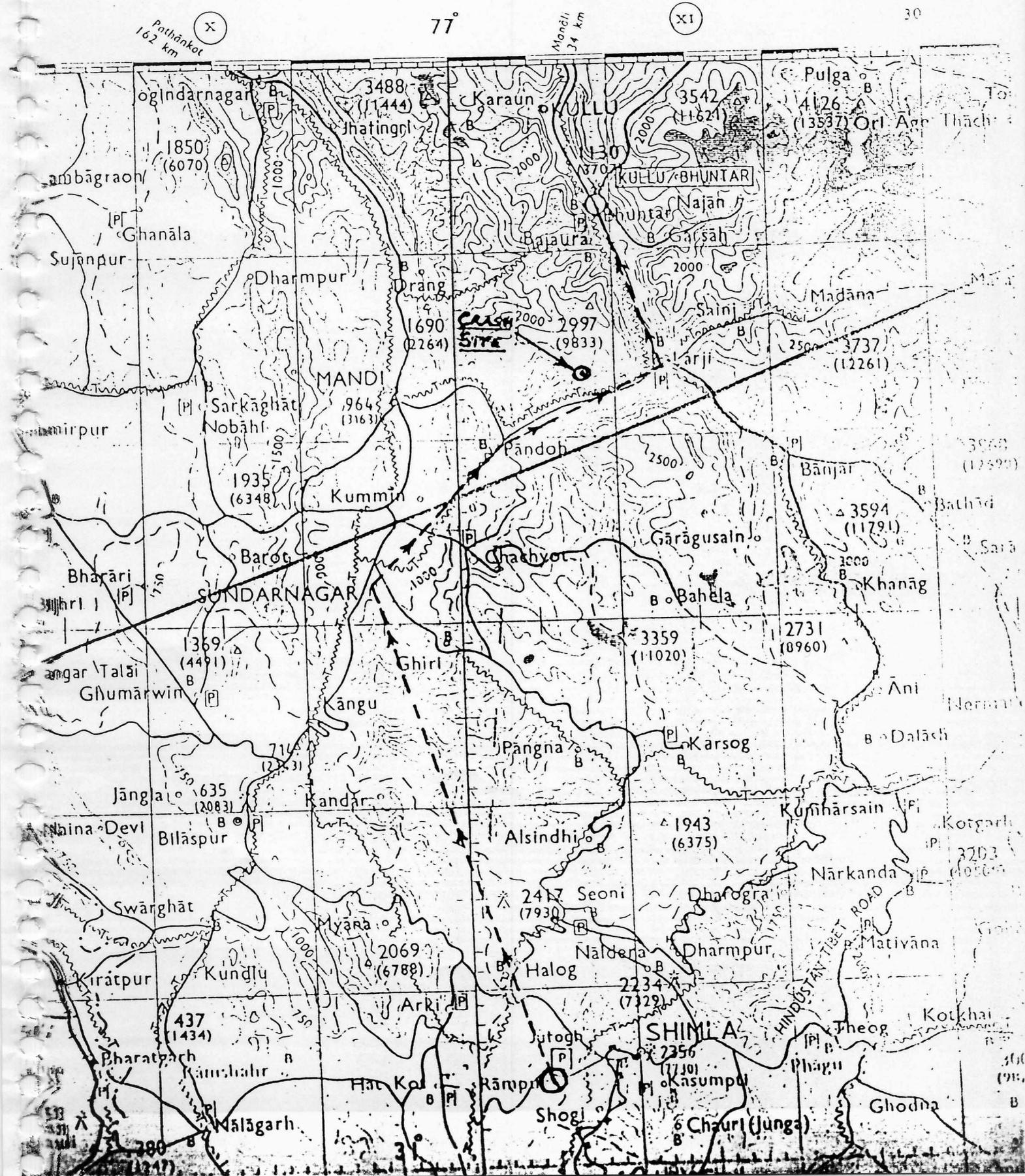
ANNEXURE "C"
(Para 2.11.2 refers)

TRANSCRIPT OF BHUNTAR ATC VHF R/T RECORDING

TIME IST	TIME	FROM	TEXT
08:52:44	0	BHUNTAR	Archana 103 Bhuntar, how do you read.
	07	BHUNTAR	Archana 103 Bhuntar if you read me copy Bhuntar weather 0300, wind calm, visibility 5000 meters, clouds scattered 200 feet, broken 3000 feet. Overcast 8000 feet, temperature 23, QNH 1004 HPa.
08:53:08	24	ARCHANA 103	Roger.
08:53:12	28	BHUNTAR	Archana 103 you are cutting out. I say again QNH 1004 HPa. Report entering valley.
08:53:19	35	ARCHANA 103	Roger Archana ____ Thankyou.
08:54:48	124	ARCHANA 103	Bhuntar Archana 103.
	128	BHUNTAR	Go ahead.
08:54:53	129	ARCHANA 103	Confirm any rain ____.
	131	BHUNTAR	Negative.
08:54:57	133	ARCHANA 103	_____.
08:55:06	142	BHUNTAR	Archana 103 _____.

ANNEXURE "E"
(Para 2.12.1 refers)

LOCATION OF ACCIDENT SITE



ANNEXURE "F"
(Para 2.12.2 refers)

PHOTOGRAPHS AT ACCIDENT SITE
(VT-ETC ON 11 JUL 96)



111



ANNEXURE "H"
(Para 3.7 refers)

PUBLIC NOTIFICATION
(Published in English and Hindi Newspapers)

COURT OF INQUIRY

ACCIDENT TO ARCHANA AIRWAYS' L-410 AIRCRAFT VT-ETC
NEAR KULU ON 11TH JULY, 1996

Whereas on 11th July, 1996 at about 0851 Hours, Archana Airways L-410 aircraft VT-ETC met with an accident near Village Kanda, District Mandi in Himachal Pradesh about 30 km. South of Bhuntar Airport while operating a Flight on Delhi - Shimla - Kulu Sector.

And whereas the Government of India, Ministry of Civil Aviation has by its Notification No.AV.15013/2/96-SSV dated 15th July, 1996 ordered a formal investigation into the circumstances of the said accident under Rule 75 of the Aircraft Rules 1937, and has appointed Air Marshal S.S. Ramdas (Retd.), PVSM AVSM VSM VM as the Court for conducting the said investigation.

And whereas the Court is of the opinion that it is necessary to collect all relevant information and facts about the said accident.

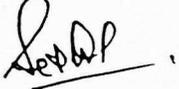
Now, therefore, it is hereby notified that any person having direct or relevant knowledge of or information about the said accident or the cause or circumstances leading to the said accident, or knowledge of or information which may lead to the determination of the cause of or circumstances leading to the said accident, or who may or is likely to be affected by the findings of the Court of Inquiry, may furnish, if he / she so desires, a statement in writing (in quadruplicate) to the Court of Inquiry.

Every statement so furnished shall be accompanied by an affidavit in support of the facts set out in the statements sworn to by the persons furnishing the statements.

Every person furnishing the statement shall also furnish to the Court of Inquiry along with the statement, the list of relevant documents, if any, and forward to the Court of Inquiry wherever practicable, originals or true copies of such of the documents as may be in his/her possession or power and shall state the names and addresses of the persons from whom the remaining documents may be obtained.

The statements together with the affidavit and the list of documents, if any, shall be delivered personally or through an authorised agent or by Registered Post at the Office of the Secretary, Court of Inquiry, Investigation of Causes of Accident to Archana Airways L-410 aircraft VT-ETC, Room No.354, III Floor, Rajiv Gandhi Bhawan, Safdarjung Airport, New Delhi-110 003 during office hours on or before 31st July, 1996.

NEW DELHI
19TH JULY, 1996


(S.N. DWIVEDI)
SECRETARY TO THE COURT OF INQUIRY

ANNEXURE "J"
(Para 3.17 refers)

WITNESSES EXAMINED DURING COURT HEARINGS

NO	NAME	DESIGNATION	ORGANISATION
1.	Dr Jagdish Singh	Director	Met. Deptt., Palam
2.	Shri P S Jaswal	Briefing Officer SAI, Palam (ATC)	AAI (NAD)
3.	Shri R S Kohli	Briefing Officer Com Officer Palam	AAI (NAD)
4.	Capt S R Singh	Pilot	Jagson Airlines
5.	Capt N K Sindhi	Pilot	UP Air
6.	Shri A K Soni	AAO, Simla Duty Officer	AAI (NAD)
7.	Shri Anil Goswami	AAO, Bhuntar Duty Officer	AAI (NAD)
8.	Wg Cdr T Keelor	Chief Executive (Operations)	Archana Airways
9.	Dr L M Narula	Medical Officer	Archana Airways
10.	Capt M K Pant	Pilot	Archana Airways
11.	Capt Vinod Mehta	Chief Pilot	Archana Airways
12.	Wg Cdr A S Anand	Operation Manager & Flight Safety Manager	Archana Airways
13.	Shri George Lahra	Duty Manager (Ops)	Archana Airways
14.	Capt S B Singh	Pilot	Archana Airways
15.	Capt V P Roy	Pilot	Archana Airways
16.	Capt S P Singh	Pilot	Archana Airways
17.	Capt P Bhalla	Pilot	Archana Airways
18.	Capt A K Tyagi	Pilot	Archana Airways
19.	Shri A K Chopra	Inspector of Accidents	O/O DGCA

20.	Gp Capt O K Chhabra	Vice President	Jagson Airlines
21.	Capt V R Devgan	Chief Pilot	Jagson Airlines
22.	Gp Capt H S Bedi	Operations Manager	UP Air
23.	Capt B S Bindra	Chief Pilot	UP Air
24.	Cdr J P Modi	QCM	Archana Airways
25.	Capt A K Chandra	-	Independent Witness (formerly pilot in Archana Airways)
26.	Shri N K Bhartiya	Managing Director	Archana Airways
27.	Wg Cdr M S Sidhu	Flight Safety manager	Archana Airways
28.	Air Mshl CKS Raje Raje	Executive Director (Operations)	Archana Airways

ANNEXURE "K"
(Para 3.18 refers)

WITNESSES INTERVIEWED BY THE COURT
AT CHANDIGARH, SHIMLA, BHUNTAR AND CRASH SITE

AT CHANDIGARH

	NAME	DESIGNATION & ORGANISATION
C-1 -	Flt Lt Tapesh	Pilot, IAF
C-2 -	Flt Lt P R Jayachandran	Co-pilot, IAF
C-3 -	Flg Off Awasthi	Pilot, IAF
C-4 -	Capt N Kaul	Co-pilot, IAF
C-5 -	Flg Off Alok	Navigator, IAF
C-6 -	Wg Cdr S S Savant	Senior Meteorological Officer, IAF
C-7 -	Wg Cdr S K Pathak	SATCO, IAF
C-8 -	Flg Off S S Chowdhry	ATCO on duty, IAF

AT SHIMLA

S-1 -	Shri G Srivastava	AO In-charge, AAI
S-2 -	Shri Hariom Sharma	AAO, AAI
S-3 -	Shri S K Sharma	Officer In-charge Communication, AAI
S-4 -	Shri Mani Bhushan	Station Manager, IOC

BHUNTAR AIRFIELD AND ACCIDENT SITE

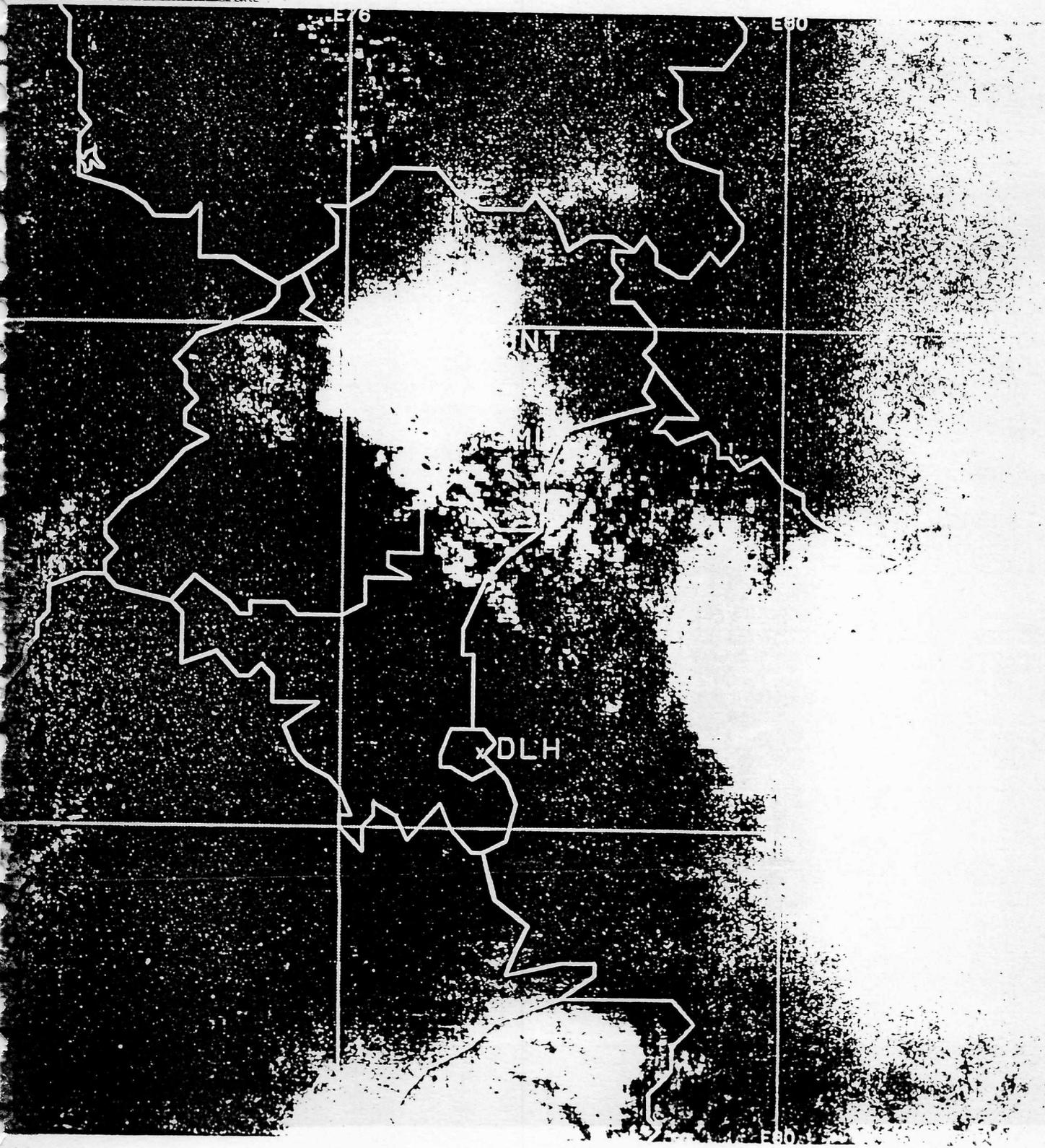
B-1 -	Shri Gopal Mehta	SAO, AAI
B-2 -	Shri Anil Goswami	ATCO on date, AAI
B-3 -	Shri S C Sharma	In-charge Meteorological Station, IMD
B-4 -	Shri Arun Kumar Jain	Officer In-charge Communication, AAI
B-5 -	Shri Bhola Ram	ASI, Aut Police Station

B-6	-	Shri Tej Ram	Eyewitness
B-7	-	Shri Gangu Ram	Eyewitness
B-8	-	Smt Kagdu Devi	Eyewitness
B-9	-	Smt Dompti Devi	Pradhan, Badhi Panchayat
B-10	-	Shri Jawahar Lal	Pradhan, Jwalapur

ANNEXURE "L-1"
(Para 4.7 refers)

WEATHER SATELLITE IMAGERY (VISUAL)

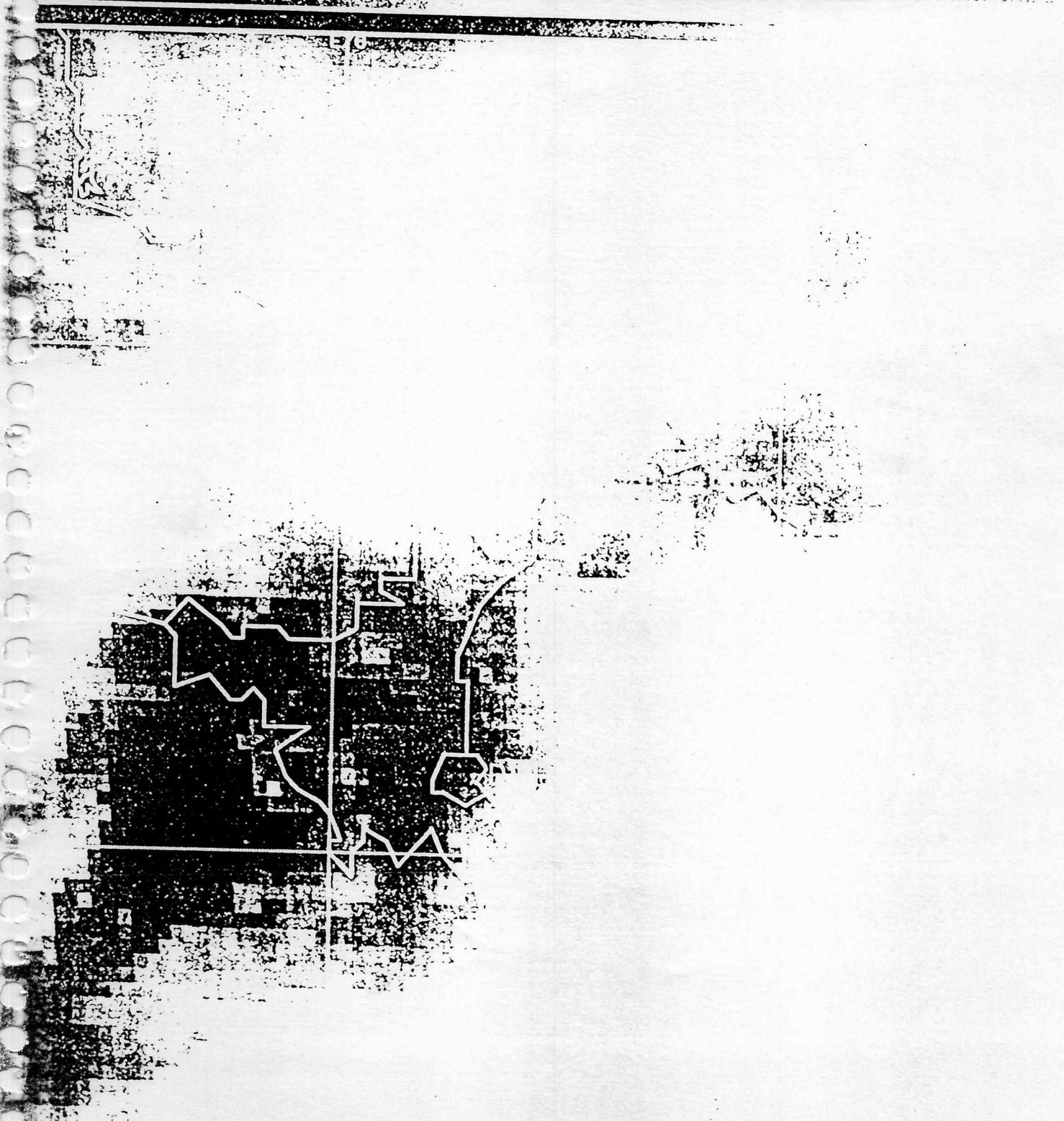
ARCHANA 11-JUL-96 03:00Z VISIBLE INSAT1D VIS STRETCH
MOPS IMD NEW DELHI



ANNEXURE "L-2"
(Para 4.7 refers)

WEATHER SATELLITE IMAGERY (INFRARED)

SHANA
PS IMD NEW DELHI 11-JUL-96 03:00Z IR BAND INSAT1D NORM-IR



CVR TRANSMIT WITH FDR DATA
FROM 0842 HRS ON 11 JUL 96

TIME IST (H:M:S)	TIME BEFORE IMPACT (SEC)	FROM	TEXT	FDR HEIGHT	SPEED	HEADING
08:42:07	778	P2	Sir Bhuntar ka toh yeh mila hai 5. 5 knots ki wind hai Sir. 5000 metres, scattered 200, broken 5000, overcast at 8000, temperature 21, 1010.	489	147	340
	761	P2	Kuch clear nahi Sir abhi itna.			
	759	P1	Visibility 5 OK. Maintaining 8500.			
	753	P2	OK Sir.			
	751	P1	Then we go over to Sundar Nagar.	486	147.4	338
08:42:37	748	P1	We are abeam Bilas now.			
	745	P2	Roger.			
08:43:08	717	P1	Ek minute iska coordinates check kar lo.	485	147.4	340
	711	P1	Sundar Nagar aur Pandoh ka.			
	688	P2	Thik hai Sir.			
	686	P1	OK. Alpha ko bolo. Change over kar lo. Chandigarh se change over kar lo aur VHF pe isko try karo.	9100	150	338
08:43:47	678	P2	Alpha Control Archana 103.			
	673	ALPHA	103 Alpha go.			
08:43:54	671	P2	Sir we are abeam Bilas 8500 in contact with Bhuntar.	9100	147.4	339
08:44:00	665	ALPHA	Roger change over.			
	663	P2	Roger change over.			
08:44:05	660	P2	Chandi Archana 103. Abeam Bilas 8500 and in contact with Bhuntar.	9100	145.6	339
08:44:12	653	CHANDI	Confirm your call sign is 132 or 103.			
	651	P2	103 Sir 103.			

58 130 8268

44 126.9 8200 I say again QNH 1004 hecta pascals.

21 132.3 8136 00 feet, broken 3000 feet, overcast point 21, QNH 1004 hecta pascals.

22 140 8120 re approaching Pandoh 8000. Arrival

22 140 8120 n read?

26 143.1 8136

MDH selected 200. visually. QNH 1010.

36 153.3 8120

ON, fuel quantity checked, 900. ked, normal.

	648	CHANDI	Roger Archana 103. C
	645	P2	Affirmative Sir.
08:44:21	644	CHANDI	Roger frequency chang
	641	P2	Roger.
	639		(Papa Victor say again
08:45:28	577	P2	Sir we are over Sunder
	574	P1	Yah.. but.
08:45:37	568	P1	We make one circle ove
08:45:41	564	P1	That's right. Not cle
	552	P2	Bhuntar Archana 103.
	542	P2	Bhuntar Archana 103.
	532	P2	Bhuntar Archana 103.
	520	P2	Bhuntar Bhuntar Archana
	513	P2	Bhuntar Bhuntar Archana
08:47:10	475	P1	Usne yeh to nahi batay
	471	P2	Nahi Sir.
08:47:19	466	P2	Sir koi bata to raha th
			tha.
08:47:48	437	AH	Capt. Gupta.
	435	P2	Go ahead.
	433	AH	Temperature please.
	430	P2	Ha.. temperature 20.
	427	AH	Thankyou.
08:48:12	413	P2	Sir eight zero to clea
	409	P1	Han _____ we will go i
	354	P1	Try and get Bhuntar pl
	347	P2	Bhuntar Bhuntar Archana
	333	P2	Bhuntar Bhuntar Archana

FLIGHT PATH OF FLIGHT ACY 103 ON 10 JUL 96

