ENCLOSURE A

VI

REPORT
ON

ACCIDENT TO SAHARA INDIA AIRLINES B-737 AIRCRAFT VT-SIA DURING TRAINING FLIGHT AT IGI AIRPORT, DELHI ON 8th MARCH 1994

BY

V.K. CHANDNA

INSPECTOR OF ACCIDENT

INDEX

ANNEXURES

REPORT ON ACCIDENT TO SAHARA INDIA AIRLINES B-737-200 AIRCRAFT DURING THE TRAINING FLIGHT ON 8.3.94 AT IGI AIRPORT, DELHI

A.	Aircraft and Registration	B-737-200, VT-SIA
B.	Owner & Lessee	(a) Owner Mr. Stephan Grzimek GAC USA II INC. 36, West 44th Street Messinger, New York. (b) Lessee Sahara India Airlines, 7th Floor, Ambadeep, 14 Kasturba Gandhi Marg, Connaught Place, N. Delhi.
C.	Operator	Sahara India Airlines
D.	Date & Time of Accident	8.3.94 1454 hrs. IST
E.	Type of Operation	Training Flight (Circuits and landings)
F.	Phase of Flight	During the initial Climb
G.	Place of Accident	Apron II (International Terminal) Palam Airport near Bay No.46
H.	Crew on Board	1. Capt. P. Khurana, Instructor 2. Pilot Trainee P. Singh 3. Pilot Trainee V.Mahajan 4. Pilot Trainee Anshu Khurana
I.	No. of persons killed	9 which include 4 crew members of Sahara India Airlines, 4 personnel of Aeroflot and 1 Bharat Petroleum Contractor.

1. FACTUAL INFORMATION

1.1 HISTORY OF FLIGHT

On 8.3.94, Sahara India Airlines operated the flight No. S2-003/004 (Delhi-Bangalore-Delhi) on B-737-200 VT-SIA Aircraft. The aircraft had departed Delhi at 0655 hrs (IST) and returned back at 1320 hrs (IST). After this flight the aircraft was to carry out training flight. Three pilot trainees (Mr. Pramod Singh, Mr. Vidul Mahajan and Miss Anshu Khurana, all Commercial Pilot Licence Holders) who had undergone Boeing 737 simulator training at British Caledonia were to undergo training on aircraft, which broadly consisted of circuits and landing involving 3 take offs and 3 landings for each trainee. This training was being conducted so that pilot trainees could be prepared for the skill test (CA 40(A) Check) for the endorsement of rating in their licences as co-pilot of Boeing 737 aircraft. Capt. P. Khurana a DGCA approved Instructor was to impart the training. This was the first assignment of Capt. P. Khurana as an Instructor. The flight plan was filed for carrying out local training flight which included circuits and landings for a period of two hours. Prior to training flight, the crew had undergone pre-flight medical check. The aircraft took-off at 14:12 hrs. IST and carried out 5 left hand circuits uneventfully from runway 28 which included touch and go. After the 5th circuit, the aircraft carried out touch and go and after it was airborne for carrying out 6th circuit, aircraft was seen turning to left after reaching a height of about 400 feet. It continued turning left and crashed near bay 46 of Terminal II (International Terminal). The aircraft disintegrated and caught fire. The moving portions of the aircraft wreckage hit the Aeroflot IL-86 aircraft parked at bay 45. The number of disintegrated pieces of aircraft moved in two trails - one on the road adjoining the terminal building and another in the direction towards the Aeroflot aircraft upto bay 41. There was extensive fire and most of the disintegrated portions of the Sahara aircraft were subjected to fire. The Aeroflot aircraft also suffered impact damage and was engulfed in a big fire. The fire fighting facilities reached the site of the crash and later extinguished the fire. The Aeroflot aircraft fuselage was extensively burnt, however, the wings which contained more than 50 tonnes of fuel remained more or less intact. All the four crew members of Sahara India Airlines were killed. The 4 personnel of Aeroflot, who were working on the aircraft were exposed to severe fire and succumbed to injuries. One Bharat Petroleum contractor who was working

nearby Aeroflot aircraft also succumbed to fire injuries. Three Oberoi Flight Services personnel, who were in their vehicle near the Aeroflot aircraft suffered fire injuries. Also one IAAI contractor, who was working in the area, suffered fire injuries. The injured were taken to hospital and duly attended to. The accident occurred at 14:54 hrs. IST in the day-light conditions.

1.2 INJURIES TO PERSONS

a. Fatal

1.	Capt. P. Khurana	Sahara India Airlines	Indian	
2.	Sh. Vidul Mahajan	Sahara India Airlines	Indian	
3.	Sh. P. Singh	Sahara India Airlines	Indian	
4.	Ms. A. Khurana	Sahara India Airlines	Indian	
5.	Sh. B.P. Mashi	Bharat Petroleum	Indian	Died in Safdarjang hospital.
6.	Sh. Ivonov	Aeroflot	Russian	
7.	Sh. Gorbachov	Aeroflot	Russian	
8.	Sh. Analdi Nikolai	Aeroflot	Russian	Died in Safdarjung hospital.
9.	Sh. Damodran	Aeroflot	Indian	Died in Safdarjung hospital.

b. Injured

1.	Sh. Gautam Chatterjee	Oberoi Flight Kitchen	Indian	
2.	Sh. Ravinder	Oberoi Flight Kitchen	Indian	
3.	Sh Ikrar	Oberoi Flight Kitchen	Indian	

4. Sh. Chagan Lal C/o IAAI Indian

1.3 DAMAGE TO AIRCRAFT

Sahara India Airlines aircraft was disintegrated into a number of pieces and subjected to extensive fire and was completely destroyed.

1.4 OTHER DAMAGE

Aeroflot aircraft was destroyed due to impact damage and fire. As the aircraft crashed in the Apron area, the ground equipments and number of aero-bridges were damaged. The details are as follows:

a. Aeroflot IL-86 Aircraft

Aeroflot IL-86 aircraft, registration no. RA 86119, was operating the flight under call sign AFL-558 on route Singapore-Delhi-Moscow. This aircraft had reached Delhi on 7.3.94 at 2310 hrs. IST. All the passengers (273) were off-loaded and were in the Terminal Building while the aircraft was prepared for the further flight. Later on when the flight was further delayed due to oil leakage in third engine, the passengers were accommodated in a hotel. The necessary repairs were carried out and the aircraft was refuelled (around 55 tonnes in the wings) at 1330 hrs. IST and was parked in bay no. 45. The aircraft was to depart at 1830 hrs. IST. The engineers inside the aircraft were preparing the report when the accident took place. The baggage and hand baggage of transit passengers and the cargo were totally destroyed during the accident.

b. Aerobridges and Apron Area of IAAI

Two Aerobridges 44 and 45 were damaged. Aerobridge no. 45 was extensively damaged as a result of fire and debris strike. Approx. 25,000 sq. mtr. of apron area opposite to bay no. 41-46 was affected and approx. 5,000 sq. mtr. of the surface was badly damaged.

c. Ground Equipment

Number of ground equipment of Air India and Indian Airlines and Oberoi

Flight Services which were parked on the apron area suffered fire damages. Following are the details of damaged ground equipment:

Oberoi Flight Services

One Tempo traveller No. DDL 7031 - catering van.

Air India

i. Aircraft Tow Tractor
ii. Ground Power Unit
iii. Toilet Cart
iv. Water Cart

Indian Airlines

i. Ground Power Unit
ii. Bulk Freight Loader (BFL)
iii. Ambassador Car
iv. One Coach and GPU partly damaged.

1.5 PERSONNEL INFORMATION

1.5.1 Instructor

Name : Capt. P. Khurana
Date of Birth/Age : [redacted]/43 years
Licences Held :

S. No.	Licence	No.	Date of Initial Issue	Currently Valid upto
1.	SPL	4098	15.7.69	-
2.	PPL	1658	23.6.70	-
3.	CPL	1041	11.3.74	-
4.	SCPL	558	23.11.82	-
5.	ALTP	1226	16.4.85	18.5.94
6.	COP/RTR	2744	18.1.72	17.1.95
7.	FRTO	1902	31.1.73	18.5.94

Ratings	:	Instrument Rating No. 630 Issued on 6.11.79 on HS-748 aircraft & 26.3.83 on B-737.
		Date of last IRC/LR/RC carried out : IRC (Instrument Rating Check) 5.6.93 LR (Licence Renewal Check) 31.12.93
		RC (Route Check) 8.10.93
Type of Aircraft Flown	:	DHC-1, Pushpak, HS-748 and B-737.

Date of Endorsement as Pilot-in-Command(PIC)/ Co-Pilot :

Aircraft	PIC	Co-pilot
DHC-1	11.3.74	
Pushpak	15.3.75	
HS-748	3.7.84	6.11.79
B-737	29.6.88	21.4.83

Flying Experience

Total Flying Experience	:	7263.20 Hrs.
Total Experience as PIC	:	4540.20 Hrs.
Total Experience as PIC on Type	:	2821.20 Hrs.
In last 30 Days	:	108.10 Hrs.
In last 7 Days	:	26.20 Hrs.

Date	Total Hours
1.3.94	04.10 Hrs.
2.3.94	03.50 Hrs.
3.3.94	05.20 Hrs.
4.3.94	03.50 Hrs.
5.3.94	05.20 Hrs.
7.3.94	03.50 Hrs.

In last 24 Hrs. : 03.50 Hrs.

Check Pilot/Instructor Approvals

a) Approved as Check Pilot on B-737 aircraft for Indian Airlines in 1992, vide DGCA letter No. 8.1.92.L(1) dated 7.4.92. However, Capt. Khurana did not undergo Check Pilot's Assessment/Training and as such was never utilised as a Check Pilot on B-737 aircraft while in service with Indian Airlines.

b) Details of Capt. Khurana experience in M/s East West Airlines was as follows:

Date of Joining	:	July 1992
Date of Leaving	:	May 1993
Total Flying Experience in East West	:	556:55 Hrs. (Approx.)

M/s East West vide their letter dated 9.11.92 had requested DGCA for appointing Capt. P. Khurana as Check Pilot along with their other pilots. However, DGCA had not approved Capt. Khurana as Check Pilot probably keeping in view the number of Check Pilots to be approved in the organisation.

c) Details of Capt. Khurana's experience in M/s Modiluft was as follows:

Date of Joining	:	May 1993
Date of Leaving	:	2.11.1993
Total Flying Experience in Modiluft	:	166 Hrs. (Approx.)

Modiluft had requested to DGCA vide their letter dated 19.8.1993 for approval of Capt. P. Khurana as Instructor and it was certified that he is meeting various clauses/ requirements of AIC 7 of 1990. DGCA, however,

approved Capt. P. Khurana as Check Pilot on B-737 for Modiluft vide DGCA letter No. 8-47-93-L(II) dated 9.9.93.

Capt. P. Kling, Director Flight Crew Training, Lufthansa German Airlines in his Pilot's Proficiency Report (Transition Training) in respect of Capt. P. Khurana made the following observations :

Capt. Khurana's knowledge and understanding of technical systems and procedures is excellent.

Phase 1 (acting as Pilot Flying)

His aircraft handling in all given situations (normal and abnormal) is good. Crew coordination and crew resource management is timely and adequate.

Phase 2 (acting as Pilot-not-Flying/Instructor)

Capt. Khurana's corrective action, just verbally or to the extent that he takes over control, is based on the principles of flight crew training. the safety of the training flight is at no times in jeopardy.

Due to his performance, I recommend that Capt. Khurana is trained as Instructor pilot.

According to Modiluft regulations, this training is as follows :

a) Simulator student training under supervision,
b) Route check on right hand seat, and
c) Line student training under supervision.

Modiluft vide their letter dated 29.10.1993 had requested DGCA for approval of Capt. Khurana as Instructor on B-737 aircraft on the basis of following training which he underwent in India and at Lufthansa Flight crew training centre :

In India :

i) Flying training with Lufthansa Examiner at Nagpur on 23.9.1993 which included 7 touch and go with three overshoots covering abnormal simulated faults and circuits/landings.

ii) Route check during day from right hand side with Lufthansa Examiner on 8.10.1993.

iii) Route check by night from right hand side with Lufthansa Examiner on 25.9.1993.

In Frankfurt, Germany (at Lufthansa Flight Crew Training Centre) :
Capt. Khurana underwent the following training for Instructorship at Lufthansa from 18.10.1993 to 21.10.1993 :

i) A total of three hours training of normal and abnormal procedures in right hand seat of their B-737-200 simulator (six axis).

ii) A subsequent cross-check in the simulator while occupying the right hand seat.

iii) A total of eight hours of instruction under supervision in the simulator.

However, Modiluft vide their letter dated 10.5.1994 had intimated that Capt. Khurana left their organisation without completing the training for acting as Check Pilot/Instructor. He was not cleared as route Check Pilot or instructor on Modiluft fleet since he did not complete line student training under supervision.

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d) Details of Capt. Khurana experience in M/s Sahara India Airlines is as follows:

Date of Joining : 3.11.1993

He was approved as Check Pilot on B-737 for Sahara India Airlines vide DGCA letter No. 8-66/93-L(II) pt. dated 24.12.93. After his approval as Check Pilot and till the date of accident, he had done four route checks.

M/s Sahara India Airlines had requested DGCA vide their letter dated 28.2.1994 for approval of Capt. Khurana as Instructor. Capt. V.N. Arora, Chief Operations Manager, Sahara India Airlines certified that Capt Khurana is meeting the requirements laid down in AIC 13 of 1993 and also certified that he had done 40 hours of LOFT training and six route checks at the time of submission of papers. Later he intimated that Capt. Khurana had carried out only four route checks as a Check Pilot. He also indicated the completion of following training of Capt. P. Khurana :

i) A total of three hours training of normal and abnormal procedures in right hand seat of their B-737-200 simulator (six axis).

ii) A subsequent cross-check in the simulator while occupying the right hand seat.

iii) A total of eight hours of instruction under supervision in the simulator.

iv) Flying training with DGCA Examiner at Nagpur-7 touch and go with three overshoots covering abnormal simulated faults and circuits/landings.

v) Route check (day) by right hand side with DGCA Examiner.

vi) Route check (night) by right hand side with DGCA Examiner.

Capt. Khurana was approved as Instructor on B-737-200 for Sahara India Airlines vide DGCA letter No. 1.569/69-L(1) dated 8th March 1994.

Last Medical	:	Undergone last medical at Air Force CME, New Delhi on 8th Nov., 1993. He was declared medically fit for renewal of his Airlines Transport Pilot's Licence. Capt. Khurana was declared temporarily medically unfit for all flying licences for a period of 3 months w.e.f. 16.3.72 due to deflected Nasal septum (Left) inadequate airways. He was advised to consult ENT specialist for treatment of his nasal condition. He was subsequently declared fit on 14.4.72.
Incident/Accident	:	Capt. Khurana was earlier involved in an incident on 16.2.1989 wherein while operating Indian Airlines flight IC-490 (Imphal-Guwahati), he made an approach for landing at Barapani and subsequently overshot after reaching about 200 feet above the runway at Barapani. He was severely warned to be more careful in future and adhere to laid down procedures vide DGCA letter No. 1-569/69/L(1) dated 5th April, 1989. He had undergone refresher course and subjected to two route checks. His performance was also monitored for a period of one year.

1.5.2 Pilot Trainees

A. P/T Pramod Singh

Date of Birth	:	[redacted]1969
Licence Details	:	He was issued Commercial Pilot Licence

vide Certificate No. [redacted] by Federal Aviation Administration -Department of Transportation - USA on 25.7.89.

Commercial Pilot Licence ([redacted] was initially issued by DGCA in 7.11.89. The Licence was valid upto 1.11.95.

Flight Radio Telephone Operator's Licence No. 4025 valid upto 1.11.95.

Instrument Rating No. 1424 valid upto 10.9.1994 (on Cessna 152A).

Types of Aircraft Flown	:	Aircraft flown during training : PA 38 (Piper Tomahawk), PA 28 (Piper Cherokee), PA 28 R (Piper Arrow), BE 76 (Beechcraft Duchess) and Cessna 152 A.
Total Flying Experience	:	330 Hrs.
Pilot-in-command	:	229 Hrs.
Dual Hours	:	86 Hrs.
Total Multi-engine Time	:	16 Hrs.
Total Instrument Time	:	65 Hrs.

In addition, he had supernumerary experience of 140 hours on B-737 aircraft including 90 hours with East West Airlines and 50 hours with Sahara India Airlines.

Gliding Experience	:	137 winch tow launches
Technical Qualification	:	Attended DGCA Approved Course from Delhi Flying Club and passed DGCA B-

737-200 Technical & Performance Examination in Aug./Sept., 1993. He underwent Simulator Training at British Caledonia from 14.12.93 to 1.1.94 and completed 54 hours.(Pilot Flying + Pilot Not Flying). He had completed 3 circuits and landing practice on the aircraft during the training sortie on which crash took place.

Last Medical : Undergone last medical at Air Force CME on 10.1.94. He was found fit medically.

B. P/T Anshu Khurana

Date of Birth & Age : [redacted]/23 years

Licence Details : She was issued Commercial Pilot Licence vide Certificate No. [redacted] by Federal Aviation Administration - Department of Transportation -USA on 15.3.92.

Commercial Pilot Licence [redacted] was initially issued in 26.5.1992 by DGCA. The Licence was valid upto 15.4.1995.

Flight Radio Telephone Operator's Licence No. 4551 valid upto 15.4.1995.

Instrument Rating No. 1828 valid upto 10.9.1994 (on Cessna 152A).

Types of Aircraft Flown : Aircraft flown during training:
Cessna 152, Cessna 152 A, Cessna 150, Cessna 172, Cessna 310 A, Cessna 310 I,

Pushpak, Grumman AA5.

Total Flying Experience	:	280 Hrs.
Pilot-in-Command	:	172 Hrs.

In addition, she had supernumerary experience of 50 hours on B-737 aircraft with Sahara India Airlines.

Technical Qualification	:	Attended DGCA Approved Course from Delhi Flying Club and passed DGCA B-737-200 Technical & Performance Examination in Jan. 1994. She underwent Simulator Training at British Caledonia in Feb, 1994 (5.2.1994 to 22.2.1994) and completed 52 hours (Pilot Flying + Pilot Not Flying). She was authorised by DGCA to undergo training with Capt. P. Khurana vide DGCA letter No. 1-476/92-L(1) on 8.3.1994. She was on the aircraft for carrying out circuits and landings when the crash took place.
Last Medical	:	Undergone last medical at Air Force CME on 22.12.93. She was found fit medically.

C. P/T Vidul Mahajan

Date of Birth & Age	:	[redacted]/27 Years
Licence Details	:	He was issued Commercial Pilot Licence vide Certificate No. [redacted] by Federal Aviation Administration -Department of

Transportation - USA on 13.11.1991. Commercial Pilot Licence [redacted] was initially issued in 12.5.1992 by DGCA. The Licence was valid upto 15.4.1995.

Flight Radio Telephone Operator's Licence No. 4535 valid upto 15.4.1995.

Instrument Rating No. 1823 valid upto 10.9.1994 (on Cessna 152A).

Types of Aircraft Flown : Aircraft flown during training: Cessna 150, Cessna 152, Cessna 152 A, Cessna 172, Cessna 310, Grumman AA5, Beechcraft A-23, Citabria 7ECA.

Total Flying Experience : 330 Hrs.

Pilot-in-Command : 244 Hrs.

In addition, he had supernumerary experience of 150 hours on B-737 aircraft with Sahara India Airlines.

Technical Qualification : Attended DGCA Approved Course from Delhi Flying Club and passed DGCA B-737-200 Technical & Performance Examination in Dec. 1993. He underwent Simulator Training at British Caledonia in Feb, 1994 (5.2.1994 to 22.2.1994) and completed 52 hours (Pilot Flying + Pilot Not Flying).

He was authorised by DGCA to undergo training with Capt. P. Khurana vide DGCA

letter No. 1-476/92-L(1) on 8.3.1994.

He was on the aircraft for carrying out circuits and landings when the crash took place.

Last Medical : Undergone last medical at Air Force CME on 10.12.93. He was found fit medically. He was advised to wear corrective bi-focal/look over glasses.

Delhi Flying Club has given the following phases of training which the Pilots undergo for type endorsement:

Phase-I : This phase of endorsement training involves ground training covering systems and aircraft performance. Faculty of Flight Safety Services Delhi Flying Club is approved by the DGCA to conduct this training as per a prescribed syllabus. After successful completion of the course, trainees are put up for the exam. conducted by the CEO, DGCA.

Phase-II : On attaining 'PASS' STATUS IN THE CEO, DGCA exam. the trainee pilot is eligible to go through phase 2 of the endorsement process. During this phase he has to carry out simulator training as approved by the DGCA. The Faculty of Flight Safety Services had approached the DGCA and got the following approved for the benefit of trainee pilots who successfully complete their ground training at this faculty:

1. The B 737-200 simulator of British caledonian Flight training

2. Capt. R.N. Rao as Simulator Instructor (B737-200)

3. Capt. V.K. Sharma as Examiner (B737-200)

On successful completion of simulator training and there after passing a simulator check by the DGCA approved examiner, the students pass on to phase 3. Simulator training/checks are recorded in triplicate in a bound booklet 'Simulator training Report' for each trainee pilot. At the end of a simulator training this booklet is handed over to the trainee for presenting it to the agency conducting his flying training and checks.

Phase-III : Trainee Pilots who successfully complete phase I & II as stated above, join an Airlines, who then conducts their flying training. On completion of flying training and checks, one copy of the 'Simulator training report' and the flying training report are submitted to the DGCA for obtaining type endorsement.

As reported by Sahara India Airlines, the records of the trainees were with them on board the aircraft and have been destroyed during the crash.

General Comments by Capt. R.N Rao about Performance of Trainees as per his Personal Dairy During Simulator Training:

Trainee Pilot P. Singh

14.12.93 - 0200 Hours

Performance standard as per his existing experience.

15.12.93 - 0200 Hours

Carried out briefing and simulated C.P.T. in the room for four hours.

Needs practice to handle and scanning.

16.12.93 - Off - Gave them lots of home works for three days.

17.12.93 - Off

18.12.93 - Off

19.12.93 - Off

20.12.93 - 0200 Hours

Showed slight improvement in the performance. Still needs lots of hard work.

21.12.93 - 0200 Hours

Briefing and simulated CPT done for approx. four hours.

Improved both on handling and scanning. However, must work hard for anticipation while on let down.

22.12.93 -

Briefing in the room on single engine. Simulated CPT for approx. four hours.

Needs more practice for Rudder and Stab Trim.

After this Trainee Pilot P. Singh was flying with Pilot Trainee Tripathi as PNF (Pilot not flying).

On 27.12.93 cleared for CA40(A) check on simulator.

28.12.93 - Off

Lots of briefing on all types of circuits and landings and simulated CPT carried out at Guest House.

29.12.93 -

Both the pilots successfully completed CA40(A) checks with Capt. V.K. Sharma.

30.12.93 - 0200 Hours

Circuits and landings two engine normal and bad weather circuits and over shoot. Standard.

31.12.93 - 0200 Hours

Two engine, single engine normal/bad weather circuits over shoot and engine fail on over shoot. Standard.

1.1.94 - 0200 Hours

Circuits and landings

All types of circuits and landings, over shoot, let down carried out satisfactory.

Trainee Pilot V. Mahajan & Miss A. Khurana

4.2.94 -

Miss A. Khurana requested on phone to postpone the training for next day as they were feeling very tired.

Accepted their request and accordingly informed Mr. Martin at British Caledonia.

5.2.94 -

T/P V. Mahajan 0400 Hours

T/P Miss A. Khurana 0400 Hours

Performance standard as per their existing experience. General Flying, Air works and stall series carried on.

6.2.94 - 0400 Hours

Briefing and simulated CPT carried out at the Guest House for approx. 4 hours. Both require lots of hard works to do the training. Handling, scanning is quite poor. General Flying, Air works, stall series and constant rate of descent. Must work hard and concentrate on scanning all the instruments.

7.2.94 - 0400 Hours

Must concentrate on handling, scanning, Power relations with IVSI.

Briefed let down at Guest House and carried on simulated CPT for 4 hours.

Miss Khurana must work hard to remember the procedure.

8.2.94 - Off

Lots of briefing and simulated CPT at Guest House. Seems to have picked up the procedure nicely. On CPT actual simulator Mahajan performance was reasonably OK. However, Miss Khurana requires prompting while doing the let downs though she understood the procedures.

9.2.94 - 0400 Hours

Improved on handling. Needs to improve scanning still. Heading, Height and speed within limits. Procedure on let down requires prompting though they have

understood.

10.2.94 - 0400 Hours

Lots of home works, briefing particularly on single engine and simulated CPT carried on at Guest House.

Introduced and demonstrated single engine. Needs practice to keep a/c straight and altitude. Must improve Rudder trimming accurately. Needs more practice for trimming.

11.2.94 - 0400 Hours

Performance on both engines flying is standard. Scanning and handling improved. Heading, Heights and speeds within limits, (Miss Khurana must work hard to improve still) On single engine hesitates Rudder Trimming. Forgets stab Trim on single engine, gets panicky on single engine, as such scanning goes out. Needs more practice.

12.2.94 - Off

Kept them busy whole day by giving them home work. In the evening briefing, simulated CPT carried on. Single engine VOR/ILS let down carried on simulated CPT at Guest House. Seems to have picked up the procedure.

13.2.94 - 0400 Hours

Improved on scanning on single engine. Rudder and Stabilizer trimming improved, showed hands of flying (Miss Khurana at times forgets to trim whenever change of power is there, on prompting remembers) Single engines VOR/ILS let down within limits.

14.2.94 - Off

Kept busy with briefing and simulated CPT practically whole day.

15.2.94 - 0325 Hours

Performance standard. Simulator motion u/s, could not complete the training as per schedule (Miss. Khurana)

16.2.94 - V. Mahajan - 0200 Hours
Standard. Miss Khurana could not do as the motion was u/s.

17.2.94 - Off

18.2.94 - 0235 Hours
Training completed. performance attain standard. Cleared for CA40(A) Checks on Simulator.

19.2.94 -
Both completed CA40(A) checks successfully with Capt. V.K. Sharma.
Briefing done on all types of circuits and landings, different power settings. Procedures for circuits and landings explained. Simulated CPT carried on at Guest House.

20.2.94 - 0400 Hours
Both engines normal/bad weather circuits and landings and over shoots carried on. At times forgets the appropriate check list otherwise performance OK.
Briefing and CPT at Guest House carried on.

21.2.94 - 0400 Hours
Single engine normal/bad weather circuits and landings carried out. Performance standard.

22.2.94 - 0400 Hours
All types of circuits and landings carried out satisfactorily. Finish the training Standard.

Certificate issued in respect of trainees by Capt. V.K. Sharma, DGCA approved Boeing 737-200 Examiner to Flight Safety Services of Delhi Flying Club on 19.2.1994

This is for your information and record that after completion of the required simulator exercises successfully under Capt. R.N. Rao (DGCA approved B 737-

200 Simulator Instructor), the following Trainee Pilots who had undergone ground training at the Faculty of Flight Safety Services, have been given a Simulator Check ride by me today. Their proficiency has been assessed as 'Standard' and they are found fit to undergo CA 40 A on B 737-200 aircraft.

1. Trainee Pilot VIDUL MAHAJAN

2. Trainee Pilot ANSHU KHURANA

A similar certificate was issued by Capt. V.K. Sharma in respect of trainee pilot Pramod Singh on 29.12.1993.

1.6 AIRCRAFT INFORMATION

Boeing 737-200 model 2R4C (Combi) bearing aircraft sl. no. 21763 was manufactured by Boeing Company in Dec.,'79. This aircraft was purchased by M/s. Air Executive Norway Busy Bee A/S and was operating under the Registration No. LN-NPB. The aircraft was maintained by M/s. Braathens SAFE, Norway upto May,'91. After that it was purchased by Leasing Company of United states M/s. GAC, USA II (Inc.) New York. It was given the American Registration No. N401MG on 8.6.92. In USA the aircraft was maintained by M/s. PEMCO Aeroplex, Dothan ALABAMA.

Before delivery to Sahara India Airlines, the aircraft had undergone major checks 7c, Corrosion Prevention & Control Programme (CPCP) and structural inspection. The aircraft was taken by Sahara India Airlines under lease agreement in Nov.,'93 between GAC USA II as Lessor and Sahara India Airlines Ltd. as Lessee. The Export Certificate of Airworthiness (NO. E 286227) was issued by FAA of USA for this aircraft on 18.11.93. The aircraft was deregistered from American Register on 3.12.93 and it was registered in India on 6.12.93. The Certificate of Registration No. 2450 with registration marking of VT-SIA was issued to M/s Sahara India Airlines. When the aircraft landed in India, it had logged total time/total cycles as 25352 hrs./21555 cycles. The aircraft was equipped with two Pratt and Whitney JT8D-17 engines bearing Sl. No. 702652 and 688188. When the aircraft landed in

India, Engine Sl. No. 702652 had done 23127 hrs./19731 cycles since new and 12587 hrs./10974 cycles since overhaul and the engine Sl. No. 688188 had done 23983 hrs./10395 cycles since new and 2570 hrs./1239 cycle sine overhaul.

The aircraft was issued with Indian Certificate of Airworthiness on 9.12.93 initially for a period of three months. Subsequently, it was revalidated for a period of three months upto 7.6.94 on 7.3.94. The Flight release Certificate which was issued on 6.3.94 was valid upto 5.5.94/26283 aircraft flying hrs. The aircraft category is normal with passenger/mail/ goods aircraft. The minimum crew necessary is two and maximum weight authorised at Brake release is 53750 kgs. This aircraft is 123 passenger configuration. Flight Release Inspection Schedule (350 flying hrs/60 days) was carried out on this aircraft on 6.3.94 for the purpose of Certificate of Airworthiness revalidation. As on date of accident, following was the aircraft status:

Aircraft hrs. since new	25947
Cycles since new	21861

After arrival of the aircraft in India, the aircraft had undergone 1st check 'C' (350 hrs./60 days/flight release inspection) on 30.1.94. After renewal of C of A on 7.03.94, the aircraft had flown 5-05 hrs./2 cycles Delhi-Bangalore-Delhi flight on 8.3.94 and was released for training flight when it met with the accident.

Check 'B' and pre-flight inspection on the aircraft was carried out by Sh. A.K. Chonna, AME, on 8.3.94.

With the previous operators before arrival in India, the aircraft was involved in three incidents, the details of which are as follows:

1. Aircraft was hit by lightening strike at Basel, Switzerland. The graphite rudders trailing edge was splitted over a length of 0.5 mtr. Necessary permanent repairs were carried out.

2. Skin scratches/dents aft of external power door. On skin between frames

235.8/251.6 and Stringers 2IR/23R external repairs was carried out.

3. Aircraft hit runway with tail on take off at Bardu Pardufoss. Fuselage skin between BS 967 and 1040, frame and bulk head BS1016 damaged.

During the operation with Sahara India Airlines, on 17.02.94 the aircraft was involved in taxing incident at Bangalore when the aircraft port wing hit a coach while going to the parking bay. The aircraft slat no. 2 was damaged.

No mandatory Modifications/Inspection were outstanding at the time of accident.

Life limited components of the aircraft and engines were within the prescribed/approved limit.

Summary of Aircraft Details

Aircraft Type/Model	B-737-200
Aircraft Registration No.	VT-SIA
Aircraft Sl. No.	21763
Manufacturing Date	12.12.1979
Time Since New	25947 hrs.
Cycles	2861
Time Since Ist C of A as on 7.03.94	591 hrs.
Time Since Last C of A as on 8.03.94	5 hrs.

Summary of Engine Details

i. Port Engine

Sl. No.	688188
Date of Manufacture	Jan.,'80
Time/cycles since new	24578 hrs./10701 cycles.
Hrs./cycles since last Overhaul	3165 hrs./1545 cycles

ii. Starboard Engine

Sl No.	702652

Date of Manufacture	Dec.,'79
Hrs./cycles since new	23722 hrs./20037 cycles
Hrs./cycles since last Overhaul	13182 hrs./11280 cycles

Detail of Reported Defects

There were no repetitive defects from the date of issuing of 1st C of A till the date of accident except that of defect on right airconditioning pack which occurred on 5.01.94 and repeated on 7.01.94.

Further, during the scrutiny of records, following defect of engines and aircraft occurring during the preceding seven days were observed

	Date/Sector		Reported Snag
1.	From 1.3.94 to 3.4.94		Nil.
2.	4.3.94/Madras-Delhi	1.	PDCS is U/S.
		2.	P1 side overhead speaker gives lot of whistling noise when on No.1 ASP Toggle switch is selected to "INT" position.
		3.	During climb throttle stagger is observed No. 2 thrust lever is ahead of No.1 by 1/2". Parameter observed as :

ENG.	EPR	N1	EGT	N2	Fuel Flow
No.1	2.01	82%	515 o C	83%	2700
No.2	2.01	82%	530 o C	83%	2600

		4.	Taxi light U/S.
3.	5.3.94/BLR-DLH		Capt. side frequency selector (VHF) U/S.
4.	6.3.94		Check 'C' (FRC Check carried out by the operator)

5. 7.3.94 To 8.3.94 Nil.

During the training flight, pilot did not make any report of emergency on board.

Aircraft Weight Schedule

Empty weight	29535 kgs. (Index 17.92 and MAC % 30.6%)
Variable load	118.8 kgs. portable water and 20 kgs. ship library
Weight of fuel (full tanks)	16596 kgs.
Operating empty weight	30184 Kgs (Index 16.36)
Maximum Zero fuel weight	43091 kgs.
Maximum permissible landing weight	46720 kgs.
Maximum authorised weight at Brake release	53750 kgs
Maximum sitting capacity	131 which includes two pilots, two observers and four cabin crew.

Load and trim sheet details during the training flight

For the training flight aircraft was loaded 15 tonnes of fuel and there were four crew members which included one instructor and three pilot trainees. At take off aircraft weight was 46720 kgs. Ballast weight of 1959 kgs. was placed in the cargo holds with 1359 kgs. in the forward cargo hold and 600 kgs. in the aft hold. At the take off centre of gravity was at 17.02% MAC which indicated trim setting of 5 3/4, 6 1/4.

Taking an average fuel consumption of 3 tonnes per hour, it is estimated that for the flight time of 45 minutes prior to crash, the fuel consumed would be around 2300 kgs. and the remaining fuel would be around (14800 - 2300) 12500 kgs. The estimated CG position comes to around 18.4% MAC which will give trim setting as 5 1/2, 6. The CG position and the aircraft weight are within the envelope. The fuel used on the aircraft is Aviation Turbine Fuel.

1.7 METEOROLOGICAL INFORMATION

The Met Reports issued by the Met Office at Delhi (Palam) indicate there was no significant weather at Palam around the time of accident. The aircraft was on visual circuit and landing.

The following weather existed at Palam around the time of accident :

	1400 hrs IST	1430 hrs IST	1500 hrs IST
Surface wind	310/12	300/12	290/18
Visibility	6 Km	8 Km	8 Km
Cloud	Scattered	Scattered	Scattered
	20,000 ft.	20,000 ft.	20,000 ft.
Weather	No Sig.	No sig.	No sig.
Temperature/	27/07	28/06	27/06
Dew Point (deg C)			
QNH	1014	1013	1013

1.8 AIDS TO NAVIGATION

The aircraft was flying local VFR circuits. The runway in use was 28. The aircraft had carried out five ' touch and go' before the accident. Nothing was reported against the functioning of the Nav Aids at Delhi airport.

1.9 COMMUNICATIONS

The aircraft was fitted with Very High Frequency (VHF) and High Frequency (HF) communication equipments. The aircraft was in two way communication with Tower. It is evident from the Air Traffic Control (ATC) tape transcript that the aircraft had no problem on communication during all the circuits. Prior to sixth circuit the aircraft was advised that the runway in use would be 27 so climb on runway heading to 3500 ft. and further climb with Delhi Radar. The aircraft acknowledged the last transmission by Tower. The initial take-off was executed at 0842 UTC (1412 IST) and the last 'touch and go' was carried out on 0923 UTC (1453 IST).

Following channels of communications are available at Palam Airport :

Service	Call Sign	Frequency
Surface Movement Control	Delhi Ground	121.9 MHZ
Aerodrome Tower Control	Delhi Tower	118.1 MHz
Approach Control	Delhi Approach	127.9 MHz
Area Control Centre (East)	Delhi Control	120.9 MHz
Area Control Centre (West)	Delhi Control	124.55 MHz
Area Control Centre (Standby)	Delhi Control	124.2 MHz
Aerodrome Surveillance Radar	Delhi Radar	119.3 MHz
Air Route Surveillance Radar	Delhi Radar	120.9 MHz

No unserviceability on these channels were reported. ATC tape transcript of the Surface Movement Control (121.9 MHz) and Tower Control (118.1 Mhz) and ATC unit telephones are enclosed at Annexures 'B', 'C' & 'D'.

1.10 AERODROME INFORMATION

IGI Airport is about 15 Kms away from Delhi. The administrative authority of the airport is vested with International Airports Authority of India, New Delhi and Air Navigation Services is provided by National Airports Authority. The aerodrome is operational for full 24 hours.

The elevation of IGI Airport is 227 metres AMSL.

The geographical coordinates of the airport reference point are : 283407 N ; 770648 E.

There are two take-off and landing runways : runway 28/10 and 27/09. Runway 28 (true bearing 284 degrees) is the main Instrument Runway. The elevation of threshold runway 28 is 776 ft. (239 metres) AMSL. The declared distances of runway 28 are as follows :

Landing Distance Available (LDA) : 3810 metres

Take-off Distance Available (TODA)	:	3810 metres
Width of Runway	:	46 metres
Length of Clearway	:	274 metres
Type of Surface	:	Asphalt
PCN	:	55

There are two aprons - domestic and international.

International Apron (Apron-II) :

International Apron is accessible by taxiways L,M,N,P,Q.R. The international aircraft after landing on runway 28 clear the runway on any one of the high speed taxiways i.e. L,M, or at the end of runway on taxi track N to proceed to the international parking area normally known as Apron II, which is on the southern side of runway 28/10.

There is the provision of parking a maximum of 18 aircraft on Apron II. These parking stands are numbered serially. The parking stand No. 41 to 49 have the provision of Aerobridge. These stands are also provided with the Visual Docking System. In addition there is a remote apron having Bay Nos. 81 to 85. Aerobridge facility is not available in remote apron.

Cargo aircraft are parked in Cargo Apron which is accessible by taxiway 'Q'. There are four parking stands in this apron. They are numbered from 99 to 102.

Domestic Apron (Apron-I) :

The domestic terminal of IGI Airport is on the northern side. The taxiways leading to this terminal are A,B,,C,D,E. The domestic and Indian Air Force aircraft, after landing on runway 28 normally clear the runway on taxiway D and Taxi on runway 27 for coming to domestic parking bays or proceed to Air Force Technical area on the northern side of runway 27.

Control Tower :

The ATC Control Tower building which is at a height of 39.34 metres above ground

level, contains other offices of Air Traffic Control and Aeronautical Communication Stations like Area Control Centre, Air Route Surveillance Radar, Approach Control Office, Terminal Area Radar, Equipment Room, H.F. R/T etc. A clear and unobstructed view of the whole airport including the Approach Area of runway 28/10 and 09/27, can be had from the ATC Control Tower in clear visibility.

Fire Stations :

Delhi Airport is equipped with Cat IX fire fighting services. There is one Main Fire Station and two Sub Fire Stations.

Main Fire Station :

Fire Tenders	:	Two
Ambulance	:	Two

Sub Fire Station I :

Sub Fire Station I is located at the domestic apron.

Crash Fire Tenders	:	Two

Sub Fire Station II : Two Crash Fire Tenders

Sub Fire Station II is located very close to Apron II. The Apron Control Tower II is located just above the Sub Fire Station II wherefrom an unobstructed view of Apron II and adjoining taxi tracks can be obtained.

Fire Tenders	:	Two
Ambulance	:	One

Meteorological Information :

An Automatic Terminal Information System (ATIS) broadcast is recorded by the Tower Controller after the receipt of each METAR or SPECI and it is broadcasted continuously on 126.4 MHz.

1.11 FLIGHT RECORDERS

Aircraft was fitted with Cockpit Voice Recorder and Universal Flight Data Recorder.

1.11.1 Cockpit Voice Recorder (CVR)

Fairchild Cockpit Voice Recorder (CVR), Model No. A-100 bearing Serial No. 3298 was fitted on aircraft. This recorder has magnetic tape recording on four channels. The channel recording is done for pilot, co-pilot, observer and area mike. Channel 1 is for Observer, Channel 2 is for First Officer, Channel 3 for Captain and Channel 4 is for Area Mike. The recording information for last 30 minutes is retained.

The CVR unit had suffered impact and fire damage. The unit was opened at CVR Laboratory of DGCA. CVR outer cover was damaged and was cut to open the CVR. Inner metallic casing and tape assembly were found intact. The tape remained protected in the armoured unit. Condition of the tape was also found to be satisfactory.

The tape was taken out and the it was replayed at DGCA laboratory. The recordings were found to be proper. Initially reference time was given during the preparation of tape transcript and then with the help of ATC transcript, reference timing was converted into Universal Coordinated Time (UTC). Relevant CVR tape transcript is enclosed at Annexure 'E'.

1.11.2 Universal Flight Data Recorder (UFDR)

The aircraft VT-SIA was fitted with Sundstrand UFDR, Model No. 980-4100-GX-US, Serial No. 6543. The data is stored for last 25 hours of flight. The UFDR records 11 parameters. The parameters recorded in the UFDR are as follows :

1. Altitude
2. Airspeed
3. Magnetic Heading
4. Roll Attitude
5. Pitch Attitude
6. Control Column Position
7. Vertical Acceleration
8. Longitudinal Acceleration
9. Engine Pressure Ratio (1 & 2 engine)

10. Elapsed Time
11. VHF Keying

The unit was externally damaged. The front panel along with the ULB and front socket had ripped opened. The unit was exposed to fire and smoke could be seen on the side walls and also inside. The steel body containing the tape transport mechanism appeared to be intact.

The unit was taken to Air India facilities at Bombay for opening and copying the data from the tape. Following observations were made :

The frame structure for mounting the electronic boards and the transport/environmental enclosure was bent on front side due to impact. The transport/environmental enclosure had detached from the mountings but appeared to be intact except for smoke deposit on casing. The top frame cover was removed by opening out the attachment phillips screws to take out the enclosure. There was no apparent damage to stepper motor, connector and the wiring appeared to be intact. The motor cover had detached during the impact and there was some stiction in the motor rotation, although the belt appeared to be intact. The condition inside the enclosure was good and tape appeared to be intact.

The enclosure of UFDR of the crashed aircraft was then installed in a serviceable UFDR of M/s Sahara India Airlines. As the stepper motor of the crashed aircraft UFDR was jammed, the stepper motor of the serviceable unit was installed on the transport/environmental enclosure.

The data was then extracted at M/s VSM Aerospace facilities of Bangalore, who are an approved organisation for working on this model of UFDR. The data however did not come out completely.

Retrieval of Data at National Aerospace Laboratory

The unit was taken to the NAL facilities at Bangalore for recovery of data as at M/s VSM facilities full data could not be recovered. At NAL, data of one more

second just prior to crash was recovered. It was observed that most of data recovered needed refining. Engine's power parameter recordings (EPR values) were found normal.

After the necessary CVR tape speed corrections, co-relation of CVR and UFDR data (Engine Power Parameter for the last about 4 minutes before the crash was prepared and is given below :

CORRELATION OF COCKPIT VOICE RECORDER TRANSCRIPT AND UNIVERSAL FLIGHT DATA RECORDER DATA(EPR VALUES ONLY)

TIME	EPR1	EPR2	TEXT
09:19:29	1.08	1.02	Maintain 2500.
09:19:37	1.08	1.02	Speed 172 knots.
09:19:39	1.14	1.04	Yah. Turn on heading 320 radar vector for you.
09:19:44	1.15	1.06	Turning Sir.
09:19:45	1.15	1.06	OK now localiser alive. Continue.
09:19:47	1.15	1.06	Ha ha.
09:19:48	1.15	1.05	Late ho gaya.
09:19:52	1.15	1.06	Continue.
09:19:54			(ATC transmission with VRF).
09:20:04	1.22	1.10	Come on a heading of 260.
09:20:09	1.22	1.16	(Altitude alert horn).
09:20:11	1.30	1.27	Vidhul why are you descending.
09:20:15	1.38	1.33	OK heading is coming up.
09:20:19	1.38	1.33	260 is good.
09:20:24	1.39	1.34	You want to establish on 2000, it is OK.
09:20:27	1.41	1.35	It is OK chalo. You are back on the localiser now.
09:20:30	1.41	1.36	Back to the localiser.
09:20:39	1.41	1.36	Glideslope alive.
09:20:42	1.41	1.36	Landing gear down.
09:20:43	1.41	1.36	Gear down.

TIME	EPR1	EPR2	TEXT
09:20:44	1.41	1.36	Flap.
09:20:44			Fifteen.
09:20:45	1.41	1.36	Check list.
09:20:46	1.41	1.36	(Outer marker crossing sound starts).
09:20:49	1.41	1.36	Localiser pakar lein pehle.
09:20:52	1.37	1.31	Pick up your localiser.
09:20:54	1.37	1.31	OK start switches.
09:20:56	1.37	1.31	Recall.
09:20:58	1.37	1.32	Altimeter.
09:21:00	1.38	1.31	1014.
09:21:01	1.38	1.31	Speed brakes.
09:21:02	1.38	1.31	Victor India Alpha Delhi Tower.
09:21:05	1.37	1.31	Go ahead.
09:21:06	1.37	1.31	Roger after this touch and go runway in use will be 27. After touch and go on runway heading, climb 3500 feet further climb with Delhi radar.
09:21:15	1.37	1.31	Copied Sir. After take-off 2500, runway heading and will call you down wind for 27 Victor India Alpha.
09:21:20	1.37	1.31	Runway heading 3500.
09:21:22	1.37	1.31	Copied 3500 and we call you down wind for 270.
09:21:26	1.37	1.31	Han ji.
09:21:28	1.37	1.31	Flap 25.
09:21:34	1.14	1.13	____ Flap two five Sir. Altitude ____.
			(ATC transmission with other aircraft).

TIME	EPR1	EPR2	TEXT
09:21:35	1.14	1.12	Getting too high isn't it.
09:21:37	1.09	1.05	So you do something.
09:21:40	1.08	1.02	What do we do.
09:21:41	1.08	1.01	Undercarriage down.
09:21:42	1.07	1.01	You have to take flap otherwise.
09:21:43	1.05	1.01	Sir flap 25.
09:21:44	1.04	1.02	OK.
09:21:47	1.03	1.02	Still we are very high.
			Flaps 30-40 Sir.
09:21:58	1.04	1.02	Thirty forty aaye ga he nahi mere pas 170 knots pe.
09:22:00	1.03	1.02	But any way get the speed first.
09:22:07	1.01	1.02	OK glideslope. Picking up the glideslope. It is going up.
09:22:11			(ATC transmission with VRF).
09:22:16	1.01	1.01	Add power now onwards otherwise you will be low.
09:22:22	1.27	1.23	Speed it up.
09:22:23	1.27	1.25	Trim trim trim trim nose down.
09:22:26	1.27	1.25	Nose down?
09:22:27	1.28	1.25	Ya because the pressure is coming in no.
09:22:28	1.28	1.25	____.
09:22:29	1.28	1.25	Speed speed. Look at your speed.
09:22:36	1.37	1.32	We are on visual now.
09:22:37	1.36	1.32	Visual to hai speed bhi to laao.
09:22:42	1.41	1.37	Going below bug na.

TIME	EPR1	EPR2	TEXT
09:22:44	1.42	1.37	Ya ya I am going down down down nothing happens.
09:22:48			____.
09:22:49	1.30	1.28	Han just stuck to it.
09:22:50	1.30	1.28	Nothing happens to Boeings.
09:22:51	1.29	1.28	Just stuck to it yaar.
09:22:53	1.10	1.08	Ya.
09:22:54	1.06	1.03	Nothing happens.
09:22:55	1.04	1.01	(Touchdown sound).
09:22:58	1.03	1.02	Ke gal hai yaar.
			Chal straight. Runway seeda lagana.
09:23:07	1.99	1.88	____ rotate.
09:23:09	2.06	2.04	Rotate.
09:23:10	2.06	2.04	
09:23:11	2.07	2.06	
09:23:12	2.02	2.07	Nothing is happening.
09:23:14	1.86	2.08	Let's see what to do now.
09:23:16	1.69	2.09	Positive climb.
09:23:18	1.55	2.10	Gear up.
09:23:25	1.15	2.11	
09:23:26	1.10	2.11	(Horn sound).
09:23:27	1.08	2.11	
09:23:28	1.05	2.11	Rudder rudder rudder.
09:23:29	1.04	2.11	
			Na na leave leave.

TIME	EPR1	EPR2	TEXT
09:23:30	1.04	2.11	Leave leave.
			Leave leave leave leave.
09:23:31	1.03	2.11	Yaa aa...
09:23:32	1.03	2.12	
09:23:33	1.03	2.11	Stick shaker sound (continues till crash)
09:23:34	1.03	2.10	
09:23:35	1.05	2.08	
09:23:36	1.14	2.08	
09:23:37	1.13		Aah. (Crash Sound).

1.12 WRECKAGE AND IMPACT INFORMATION

The aircraft first impacted the ground at International terminal apron near Bay No. 46 at a distance of approx 1700 feet from the runway centre line on its left side. The crash location is at a distance of about 10,800 feet from the beginning of runway 28. The aircraft disintegrated at the impact point and caught fire. The ground marks indicate that the aircraft path was at a heading of about 160 degrees from North. Photographs showing the wreckage at the crash site are at Annexure 'A'. Wreckage diagram and flight path diagram is enclosed at Annexure 'F' and 'G'. Wreckage examination of the aircraft revealed the following:

1.12.1 Ground Marks

At the initial impact point, aluminium metal rub marks could be observed at a heading of about 160 degrees from north. Fuel spillage and fire marks on the apron could be seen immediately after the impact point. After initial rub of about 70 feet, the ground marks could be seen branching of in two directions with one towards the Aeroflot aircraft and other towards the road adjoining the terminal building serving the various bays. The wreckage pieces moved on these two trails. Ground marks on the road could be seen upto the Bay No. 41 where right engine was found. The Aeroflot aircraft parked at Bay No. 45 was a distance of about 450 feet from the initial impact point. The wreckage impact marks could also be seen on the Aerobridge 45 arm under which road for serving the bays passes. At number of places deep digging marks could be observed.

1.12.2 Break-up Pattern

From the scatter of the wreckage, it could be seen that the port wing, cockpit and the fuselage, leaving the tail portion, and the portion of starboard wing got fragmented heavily indicating a very severe impact of the aircraft with the ground in left bank condition. The fire had started immediately at the impact. The aircraft wreckage moved in two trails one towards Aeroflot aircraft parked on Bay No. 45 and other towards road adjoining the terminal building serving various bays. The wreckage of left wing, cockpit and the front fuselage along with left engine moved towards the Aeroflot aircraft and impacted it. As a result of which, the Aeroflot aircraft suffered damage and caught fire. The wreckage was scattered over the apron area in front of Bay No. 46 to 41. Most of the wreckage pieces suffered fire damage. Port engine which had passed across the Aeroflot aircraft suffered severe impact forces and was lying near the Aeroflot aircraft close to Aerobridge 45 pillar

and was exposed to extensive fire. Cockpit portions in small pieces were found close to Aeroflot aircraft. Some of the wreckage got mixed up with the Aeroflot wreckage. The tail portion and the right engine were found on the road adjoining the terminal building serving the various bays. However the starboard wing portion was found thrown away near Bay 41 on the apron and had suffered extensive fire damage.

1.12.3 Observations From the Wreckage

a) Fire had erupted immediately at the impact point and fire marks could be seen on most of the wreckage pieces. Examination of the wreckage has revealed that the extent of fire damage is more prominent on the starboard side compared to port side. Further the fire damage is extensive in the front portion of the aircraft.

b) The Aeroflot was hit by the wreckage as a result of which it was damaged and caught fire.

c) The cockpit of the aircraft was completely shattered and broken into small pieces. No observation of any use could be made.

d) Number of buckles on the fuselage portion identified to the portion on left side near cargo door indicated an impact angle of the fuselage with the ground of approx. 34 degrees pitch down.

e) Fuselage portion up to Station No. 867 was found ripped open. Forward portion had severe fire damage, whereas the rear portion had soot deposit. Interior of the cabin was completely destroyed due to fire and impact. Only fuselage skin covering along with deformed structural members with grazing marks at few places could be recovered.

f) Fuselage rear portion from 867 to 1217, with aft service door, was found in shape though damaged along with empennage. Port stabilizer along with corresponding elevator was destroyed and broke away from the main fuselage structure. Tip portion of starboard stabilizer broke away. Vertical fin was damaged at leading edge on tip due to crushing. Rudder portion from approximately its centre to bottom end ripped open and damaged due fire. The aft air stair assembly was found largely intact. Main deck and cargo

doors were located in this portion.

g) A large piece of the right wing, from about the normal location of No. 2 (right) engine to the aileron and outboard slat, was in shape but severely burnt. Leading edge slats and a portion of the training edge flaps were present, but severely damaged by fire. The left wing was found in many pieces with the largest portion found being a piece of upper wing skin about 2/3 the length of the left wing. This piece showed no evidence of fire. The wing centre section was also completely destroyed. However, a large number of centre wing pieces were identified, some with and without fire damage. A number of other pieces of wing and leading edge structure were found but their exact location on the wing could not be easily determined. Other components such as spoilers, portions of ailerons and wing tank components, such as fuel boost pump, hydraulic system heat exchanger and tubing, were also found heavily damaged by impact and usually also by fire.

h) Port engine was lying near Bay No. 45 and found damaged due to severe impact and fire. Most of the blades were found broken from the root end. Rotor discs were also found shattered. Starboard engine was lying near Bay No. 41 and also sustained damage due impact. It did not show signs of fire damage. In this case too, number of blades were found broken from near blade root. Engine accessories of both the engines were found detached. Both the engine rear portions along with thrust reversers were found damaged. Condition of thrust reversers indicated stowed position.

i) Nose landing gear attachment was found detached from main structure. Upper and lower drag brace links were found damaged and came out from the main structural fitting. Both the nose steering actuators were found in damaged condition. Nose landing gear locking mechanism was found in broken condition. In the port main gear assembly, one of the tyres had detached and the corresponding brake assembly found stripped open. while other was found damaged due to fire. Walking beam was found attached with the landing gear, however, it came out from the main structure. Oleo strut and locking mechanism were damaged. Side strut found collapsed. Starboard landing gear system disintegrated. Oleo piston broke into two parts. One of the tyre was found burst. Side strut was partially collapsed and the drag brace

was intact. Walking beam was found separated both from main structure and landing gear. Both the main and nose landing gears had extensive fire damage. Both the main and nose landing gear actuators were found in fully extended position indicating that all the three gears were in fully retracted condition at the time of accident.

j) The cargo door which is located on the left side of the fuselage just aft of the forward entry door, was severely buckled and exhibited extensive scraping in the aft direction.

k) Flight Controls

As the aircraft structure had dis-integrated into pieces upto the rear portion, on the flight control linkage pieces, no useful observation could be made. However, in the tail portion, the cables actuating the rudder PCU were found connected and functioning.

Trailing Edge Flaps

Out of eight flap screw jacks, seven were located (No. 1, 3, 4, 5, 6, 7 and 8). No. 2 flap screw jack could not be located as it probably mixed with the Aeroflot wreckage.

Leading Edge Flaps

All the four L.E. flap actuators have been identified.

Leading Edge Slats

Out of six actuators, only five could be retrieved. Actuator No. 4 & 5 are intact while another three are in broken condition and could not be identified as for their position due to peeling off of its name plates during the crash. The untraced actuator is probably mixed up with the Aeroflot wreckage.

Spoilers

Spoilers No.(s) 6,7 & 8 were attached to starboard wing and found flush with the surface. Leaving one inboard ground spoiler actuator, all other spoiler actuators were recovered. Piston extension measurements indicated that spoilers were in fully retracted conditon.

Ailerons

Both the aileron PCU's were recovered and were found to be detached and in damaged condition due to impact and fire.

Horizontal Stabilizer

The screw jack was found intact and its ball nut was found jammed in position.

Elevator

Both of the elevator PCU's were found in damaged condition in fully retracted position. The feel and centring springs and feel actuators moved smoothly and normally.

Rudder

Rudder was found intact and attached to the vertical fin. The cables were found connected to the quadrant and further linkage was intact in the tail portion. Both, main and standby rudder PCU's were found intact. No abnormality was observed. By cable movement, linkage could be operated upto power control units.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

Post mortem of the dead bodies was carried out at Safdarjung Hospital. Bodies of all the four crew members were found in disfigured, mutilated and in the burnt condition. The major portion of the body of the captain was found the next day with the Aeroflot wreckage in extensively burnt condition. Two Aeroflot personnel had suffered fatal burn injuries. While other two personnel of Aeroflot who had also suffered burn injuries, died later at Safdarjung Hospital, New Delhi. The Bharat Petroleum contractor, who suffered burn injuries also died at Safdarjung Hospital. In addition, four persons received the burn injuries for which they were attended to.

1.14 FIRE

IGI Airport is managed by International Airports Authority of India. This airport is equipped with category IX fire fighting services, which cover heavier aircraft like Boeing-747 category. There are three fire stations i.e. Main Fire Station located near 'D' Taxi Track, Sub Fire Station-I close to domestic apron and Sub Fire Station-II

close to the International Apron. There are 6 Crash Fire Tenders, two water tenders, one highlight platform and 3 Ambulances. There are 15 static tanks of different capacities at different locations at the airport. Static Tank No.9 and Static Tank No.11 are located near the accident site.

A Group was Constituted by DGCA to examine the fire fighting aspects and a detailed report in this regard was prepared. Following are the salient observations from the report :

1. Aircraft accident took place at 1454 hrs IST at the International Terminal Apron (Apron-II) of Delhi Airport.

2. The aircraft disintegrated during the crash and wreckage hit the Aeroflot aircraft parked on Bay No.45. The wreckage of aircraft was spread over the apron area. There was fire all over the apron on the scattered pieces of wreckage and intense fire on the Aeroflot aircraft.

3. The Control Tower had sounded the siren immediately.

4. IAAI Apron T-II Assistant Airport Manager had transmitted on R/T that Sahara India Airlines aircraft has crashed at Terminal II Apron.

5. Some Main Fire Station personnel had seen the aircraft coming down and they immediately swung into action.

6. Initially, the Crash Fire Tenders from Sub Fire Station-II which is located near Apron T-II reached the crash site followed by Main Fire Station and Sub Fire Station-I. The fire fighting vehicles from the IAAI Fire Fighting Training School located adjacent to Airport also reached the site of crash. Fire fighting action began in about three minutes after the crash time.

7. Air Force Station Palam Domestic Fire Tenders and a water tender also reached the site of crash at 1510 hrs and assisted IAAI fire fighting services. Water was also supplied to Airport Crash Fire Tenders.

8. The Delhi Fire Services received the information at 1505 hrs IST and the fire fighting vehicles reached around 1520 hrs IST. Nineteen water tenders and 2 ambulances along with other equipments participated in the fire fighting. About 125 Officers and men of Delhi Fire Services with 37 units participated in this operation.

9. The IAAI Airport fire fighting vehicles were supported by Delhi Fire Services, Air Force Station Palam for water supply from their water tenders. The continuity of water supply was maintained through the static water tanks at the airport.

10. The total time taken to control the fire was about 43 minutes (1457 hrs IST to 1540 hrs IST) as per IAAI log books. However, as per Delhi Fire Services, the fire was under control at 1615 hrs

11. Though fuselage of the Aeroflot was completely charred, the spread of fire on to the wings was checked which contained about 50 tonnes of fuel.

12. Number of vehicles and ground equipment were destroyed in this fire. Also, apron area and three aerobridges suffered damage. There were nine casualties and 4 persons suffered injuries.

13. On the date of accident, the Airport Authority Fire Services had 35,000 ltrs of water, 400 Kgs of DCP and 500 Kgs of BCF. Total of 42 Fire Fighting Personnel were on duty.

14. There was no mobile water replenishment arrangement for the CFTs positioned for the fire fighting resulting in dislocation of CFTs from ideal position to collect water from Static Tank No.9 & 11. Thus the fire fighting operation was carried out in stages.

15. The quality of the produced foam through the CFTs of IAAI was not standard and the fire extinguishing media was not creating required actions at the fire to combat, as stated by their fire officer.

16. On two Crash Fire Tenders of IAAI, the monitor controls was unserviceable and on other two Crash Fire Tenders, these monitors became unserviceable during fire fighting operation. Side channels for fire fighting were used on these crash fire tenders. The jet throw through the monitor did not cover the specified distance and CFTs were repositioned to the close vicinity of fire in the danger zone.

1.15 SURVIVAL ASPECT

The log book of Sub Fire Station II and that of the Fire Officer indicates that six dead bodies were recovered from the wreckage. The bodies of Sahara India Airlines crew had disintegrated and exposed to fire and were lying scattered near Bay 45.

Around 1515 hrs. two injured persons Shri Ravinder and Shri Ikrar Ali of Oberoi Flight Kitchen were rescued from the site and were sent to casualty centre at Terminal-I. From there they were sent to Ram Manohar Lohia Hospital.

Five more injured persons by name S/Shri B.P. Mashi of Bharat Petroleum Corporation, Damodaran of Aeroflot, A. Nikolai of Aeroflot with severe burns, Chagan Lal of IAAI and Gautam Chatterjee of Oberoi Flight Kitchen with multiple injuries were sent to Safdarjung Hospital. Out of these persons Shri D.P. Mashi, Shri Damodaran and Shri Nikolai succumbed to their injuries in the hospital. Following are the extracts from Log Book of MI Room, Terminal II, as recorded by Dr. Mahajan :

Mr. B.P. Mashi, Bharat Petroleum - almost 80% burns all over the body.

Mr. Damodran, Aeroflot - almost 80% burns all over the body.

Mr. Analdi Nikolai, Aeroflot - almost 80% burns all over the body.

All the above three patients were given a wet saline cleaning, then wrapped in blankets and given injections, stabilised and sent for Safdarjung Hospital at 1515 hours.

The other two causalities brought to Terminal II MI Room were Shri Chagan Lal of IAAI who had received a clean laceration wound on forehead and Shri Gautam

Chatterjee of Oberoi flight service were also sent to Safdarjung Hospital.

1.16 TEST & RESEARCH

1.16.1 Flight Controls

a) General

The Boeing 737 aircraft features a powered flight control system which has aileron and flight spoilers for lateral control (roll), elevators and movable horizontal stabiliser for longitudinal control (pitch), rudder and yaw damper for directional control (yaw), speed brakes for flight and ground aerodynamic braking and high lift devices to provide lift at the lower speeds for take-off and landing.

Primary flight controls (ailerons, elevators, rudder) are powered by hydraulic systems 'A' and 'B'. Either of hydraulic system, alone, can power any primary control surface. In the event that both hydraulic systems 'A' and 'B' become unavailable, the aileron and elevator controls revert to a mechanical manual reversion backup system and the rudder is powered by the standby hydraulic system.

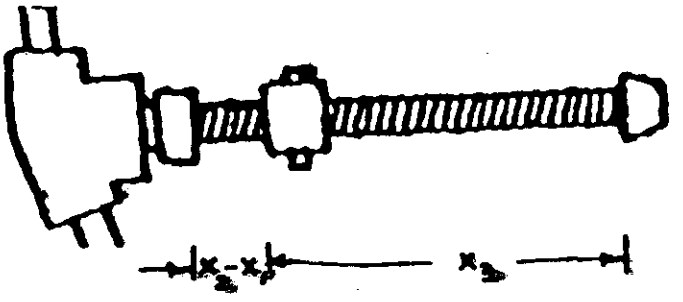
b) Examination

A Group was constituted by DGCA to examine into the flight controls. Following are the salient observations from the report :

i. Trailing Edge Flaps

The system consists of four flaps, two on each wing which are operated hydraulically through mechanical transmission. Each flap has two flap screw jacks. Thus there are a total of eight flap screw jacks.

Three flap screw jacks (No. 6, 7 and 8) on the starboard wing were found intact. No. 5 flap screw jack, which was not intact, was identified from the part number. Three screw jacks (No. 1, 3 and 4) were identified from their orientation and attachment. No. 2 flap screw jack could not be located. The measurement of various recovered screw jacks of accident aircraft, as recorded, are given below:



Screw Jack Dimension -	No.	1	2	3	4	5	6	7	8
	X2-X1 (inch)				25.25		25.258		
	X3 (inch)	5			6	7	6.25	4.6	

The flap screw jack measurements on the accident aircraft are quite close to the Flap 15 configuration when compared with the dimensions provided in Boeing 737 Control Position Data Document No. D6-19512-1 Rev. 'D'.

ii. **Leading Edge Flaps**

There are four L.E. flaps, two each on starboard and port wings. All the four L.E. flap actuators have been identified. Actuator No. 1 & 3 are intact while No. 2 & 4 are in broken condition. During leading edge flap extension, the actuator extension is about 7.95 inches. In the accident aircraft case, the extension of No. 1 & 3 actuators was also found to be about 7.9 inches. Thus the leading edge flaps were fully extended at the time of accident.

iii. **Leading Edge Slats**

There are six leading edge slats three on each side which are actuated hydraulically by six actuators. Out of six actuators, only five could be retrieved. Actuator No. 4 & 5 are intact while another three are in broken condition and could not be identified as for their position due to breaking away of the name plates. From the physical observations of the retrieved actuators, it may be concluded that the same were fully extended.

iv. **Spoilers**

There are eight spoilers, four on each wing. No.1, 4, 5 & 8 are ground

spoilers while No. 2, 3, 6 & 7 are flight spoilers. Ground spoilers No.4 & 5 have two actuators each while other spoilers has only one actuator.

Spoilers No.(s) 6,7 & 8 are attached to starboard wing and found flush with the surface. They are badly burnt. Piston extension measurements of the rest of the spoiler actuators also indicated that the spoilers were retracted at the time of crash.

v. Ailerons

There is one aileron on each wing operated by two power control units (System 'A' and System 'B'). Both the aileron PCU's were recovered and were found to be detached and in damaged condition due to impact and fire. The aileron trim gearbox was found in jammed condition in near neutral position. One of the aileron PCU's (lower) actuator extension is 1.125 inch corresponding to port aileron deflection of about 9 degrees down. Another PCU (upper) actuator extension is 0.25 inch corresponding to starboard aileron deflection of about 16 degrees up. Both the left and right aileron drive quadrants were found badly damaged. Drive cables were found separated and curled up. The left aileron quadrant was found jammed in counter clockwise direction with the push rod to aileron broken. No positive conclusion could be drawn from the above observations.

vi. Horizontal Stabilizer

The horizontal stabilizer can be moved by motor operated screw jack. The screw jack was found intact and its ball-nut was found jammed in position. The measured position of the ball nut corresponds to about 7 units up (within green band of take-off configuration) as confirmed on the serviceable aircraft.

vii. Elevator

Both of the elevator PCU's were found intact and in fully retracted position. The feel and centring springs and feel actuators moved smoothly and normally. The fully retracted position of both the PCU's indicate elevator 'up' position. However, in view of impact forces, it cannot be said that this was the elevator position prior to impact.

viii. Rudder

Rudder was found intact and attached to the vertical fin. Both, main and standby rudder PCU's were found intact. When the main PCU is in operation the standby idles. The actuator extension of main PCU is 2.25 inches while that of standby actuator was 2.8 inches. As checked from the Document No.D6-19512-1 Rev 'D' of Boeing Co. regarding '737 aircraft control position data', the above measured actuator lengths indicate that the rudder was deflected towards right about three and a quarter degrees. However, in view of impact damage to the aircraft and its controls, the exact position of the rudder prior to crash could not be positively concluded.

Functional check of main rudder PCU and auxiliary PCU were carried out. All the tests on main rudder PCU were carried out satisfactorily except the transducer null voltage test wherein the null voltage was observed to be 185 mV as against a maximum limit of 150 mV. Tests on auxiliary rudder PCU were also satisfactory except servo valve neutral position test which was found to be marginally out of limits. With this variation the units will still remain functional.

Examination of Undercarriage

Nose landing gear attachment was found detached from main structure. Upper and lower drag brace links were found damaged and came out from the main structural fitting. Both the nose steering actuators were found in damaged condition. Nose landing gear locking mechanism was found in broken condition. In the port main gear assembly, one of the tyres was found missing and the corresponding brake assembly found stripped open. while other was found damaged due to fire. Walking beam was found attached with the landing gear, however, it came out from the main structure. Oleo strut and locking mechanism were damaged. Side strut found collapsed. Starboard landing gear system disintegrated. Oleo piston broke into two parts. One of the tyre was found burst. Side strut was partially collapsed and the drag brace was intact. Walking beam was found separated both from main structure and landing gear. Both the main and nose landing gears had extensive fire damage. Both the main and nose landing gear actuators were found in fully extended position indicating that all the three gears were in fully retracted condition at the time of accident.

Summary :

i. Trailing edge flaps were selected to 15 degrees position.

ii. Leading edge flaps were fully extended.

iii. Leading edge slats were in extended position.

iv. Horizontal stabiliser was at about 7 units of trim.

v. Ground spoilers and flight spoilers were fully retracted.

vi. Rudder main and standby PCUs were found functionally satisfactory during the bench check.

vii. Due to the extensive damage to the aileron and elevator PCUs, no conclusion could be drawn.

viii. Landing gears were fully retracted.

1.16.2 Engines

a) General

Engines fitted on this aircraft are Pratt & Whitney JT8D-17. JT8D engine is an axial flow front turbofan engine having 13 stage spilt compressor, a nine can-annular combustion chamber, and a split four stage reaction impulse turbine. The engine is equipped with a full length annular fan discharge duct. The low pressure system is made up of the front compressor rotor and the second and third and fourth stage turbine rotors and is mechanically independent of the high pressure system which consists of the rear compressor rotor and the first stage turbine rotor. The engine is mounted from two points. The front mount is located at the fan discharge intermediate case. The engine rear is located at the turbine exhaust section outer duct. JT8D engine has got number of models which are basically same except some physical differences depending upon incorporation of the change. The dry weight of the JT8D-17 engine is 3340 lbs. and has take-off thrust of 16,000 lbs below 28.9 degrees C.

b) Examination of the Engines

A Group was constituted by DGCA to examine the engines. Following are the observations from the report :

Port Engine

Type of Engine	P & W JT8D-17
Serial No.	688188
Constructor's Name and Address	PRATT & WHITNEY
Time Since New (Hours)	24578
Cycles Since New	10701
Time Since Overhaul (Hours)	3165
Cycles Since Overhaul	1545

The strip examination was carried out at M/s Indian Airlines Jet Shop.

Findings

1. Appreciable damage was observed at engine inlet area. No.1 bearing housing was found missing. The LPT shaft was bowed at about 6 O'clock position with front end up. In the low pressure compressor region most of the rotor blades were found sheared from the root. Those attached were broken at the root end and bent in a direction opposite to the direction of rotation. The 3rd, 8th and 9th stage rotor disks were found sheared circumferentially near the rim. LPC stator vanes were found in pieces. 8th and 9th stage stators and seal spacers were also found badly damaged. Condition of 13th stage disk were found satisfactory and most of the blades were damaged and bent opposite to direction of rotation. 3rd stage turbine blades were found bent opposite to the direction of rotation.

2. All the fuel nozzles were found in position. There was no sign of burning on the fuel manifold and no cocking was observed on any of fuel nozzle. Condition of all the combustion chambers from inside was found satisfactory. There was no sign of oil streaking or burning or metal spattering. First stage NGVs were found in satisfactory condition. No symptoms of fire were observed in the hot section area. No fused metal was observed in the turbine stages.

Conclusion

1. Condition of the fan rotors, low pressure compressor and bend in the low pressure turbine shaft indicates that a severe impact suffered by the engine.

2. There is no indication of any engine fire.

3. No evidence of foreign object which could affect the performance of the engine was observed in the gas path area.

4. The physical condition of the engine parts investigated confirmed that the engine rotors were rotating at a higher speed at the time of impact.

5. The three engine mount provisions appeared to be intact before the engine impacted at the crash site.

6. No hot section distress was observed.

7. Determination of Engine Pressure Ratio (EPR) is not possible from the physical examination of engine hardware.

Starboard Engine

Type	P & W JT8D-17
Serial No.	702652
Constructor's Name and Address	PRATT & WHITNEY
Time Since New (Hours)	23722
Cycles Since New	20037
Time Since Overhaul (Hours)	13182
Cycles Since Overhaul	11280

Findings

Appreciable damage was observed at engine inlet area. Bolt holes of visible compressor rotor disks were elongated. Most of the compressor rotor blades were

found sheared and those available were bent opposite to the direction of rotation. Compressor stator vanes were observed to be bent in the direction of rotation. In 3rd stage about 50% of rotor disk was found broken with circumferential crack of 60 degree. The 4th stage dove tail shroud was found damaged/pressed all round periphery. In the turbine 4th stage available blade portions were found bent in anti clockwise direction and had rub marks at their convex area. Also in the 3rd stage NGV's rub marks were observed at the trailing edge. However no symptom of fire or fused metal deposit was observed.

Conclusion

1. There is no indication of any fire on the engine.

2. The condition of the rotating parts indicated that the engine rotors were running at a higher speed at the time of impact.

3. All the damages/breakages on the engine external parts were purely due to external impact on the engine.

4. All the three engine mounts provisions appeared to be intact until the engine impacted at the crash site.

5. No hot section distress was observed as viewed with the help of boroscope to the extent possible.

6. Determination of Engine Pressure Ratio (EPR) is not possible from the engine hardware.

1.16.3 Spectrum Analysis of the Altitude Alert and Unsafe Landing Configuration Horn as recorded in CVR

During the replay of the CVR tape, it was observed that a horn of unsafe landing configuration had sounded at reference time 34:44 and altitude alert horn at reference time 17:42. To confirm that these horns were truly the unsafe landing configuration horn and altitude alert horn respectively, comparative spectrum analysis of the horn sounds, as recorded in the CVR and Laboratory recorded true horn sound, was carried out at DGCA laboratory and then at the facilities of National Aerospace Laboratory, Bangalore and Bhabha Atomic Research Centre, Bombay.

The details of the frequencies of altitude alert horn and unsafe landing configuration horn were obtained from Boeing Co. The details of the frequencies are as follows:

i) Altitude Alert Horn

The altitude alert warning sounds one to two seconds when the airplane approaches a selected altitude either in ascent or descent. The warning horn is a 'C' chord and has three frequencies of 512 Hz, 640 Hz and 768 Hz with a tolerance of $\pm$ 5%.

ii) Unsafe Landing Configuration Horn

The unsafe landing configuration warning horn sounds continuously until the condition is clear. It has a single frequency of 250 Hz with a tolerance of $\pm$ 15%.

The extract of the reports are as follows :

i. Bhabha Atomic Research Centre

Result

i) The horn sound at 17:42 and the Lab altitude alert horn sound are close to each other with a 8.5% decrease in the CVR signal frequency spectrum shift.

ii) The horn sound at 34:44 and the Lab unsafe landing configuration horn sound are close to each other with a 3% increase in the CVR signal frequency spectrum shift.

ii) National Aerospace Laboratory

Spectrum of Lab recorded altitude alert horn showed prominent peaks at 517 Hz, 647 Hz and 777 Hz and spectrum of horn recorded in CVR at reference time 17:42 showed prominent peaks at 478 Hz, 599 Hz and 720 Hz. A constant ratio of 1.08 between corresponding spectral peak locations was observed.

Spectrum of Lab recorded unsafe landing configuration horn showed prominent peaks at 292 Hz, 585 Hz and 877 Hz and spectrum of horn

recorded in CVR at reference time 34:44 showed prominent peaks at 305 Hz, 600 Hz and 915 Hz. A constant ratio of 1.04 between corresponding spectral peak locations was observed.

iii) DGCA Laboratory

The report confirmed that the altitude alert horn appeared at reference time 17:42 with a frequency variation of 9.2% and that of unsafe landing configuration at reference time 34:44 with frequency variation of 14%. The frequency variations are within limits.

In all the three reports, the horn at reference time 34:44 confirmed to be of unsafe landing configuration and that at reference time 17:42 as that of altitude alert.

Note : Reference time 34:44 is 09:23:26 UTC as seen in the CVR Tape Transcript.

1.16.4 Examination of Wreckage for the explosion/Sabotage

Major T.V. Narayanan, Dy. Commissioner Security, Bomb Detection & Disposal Squad was assigned to examine the wreckage from explosion/sabotage angle.

Shri T.V. Narayanan, Shri K.K. Nair, Team Leader, Shri Tomy Mathew and Shri Asoken S, Bomb Technicians visited the site of wreckage storage area and carried out detailed inspection/investigation of the wreckage/debris. The wreckage/debris kept near Cargo Complex was thoroughly examined to trace out the possibility of an explosion/sabotage. The disintegrated parts of the aircraft was examined with special attention whether the crash of aircraft is due to any explosive device or not.

Following are the salient observations from Major Narayanan's report :

a) The fragments/debris materials may have curling/ringlet effects and spike toothed fractures on metal surface. These characteristics have not been observed in any part of the wreckage.

b) The incident of an explosion, the fragment will strike the surface at a glancing angle and produce gouge marks in the surface. no such gouge marks have been noticed on the recovered main wreckage.

c) Due to the hot detonation gases, melting and erosion on the surface of the metal is possible, which is termed as 'gaswash'. The debris/wreckage found in heavily melted condition is not due to detonation gases, but may be due to the excessive heat generated during the fire.

d) Cupping and dishing in the near vicinity metal surface is very common phenomenon with high explosive detonation, which is not observed on examination of the wreckage.

e) There is a possibility of embedding the high velocity fragments in rubber foams/cushions during an explosion. The recovered cushion seats were examined to find out penetration holes of fragments/embedded fragments. No such sign of penetration have been noticed.

f) Also no part of bomb such as battery, wire, portion of detonators etc were recovered.

g) On detailed inspection and investigation of the wreckage and debris of the crashed aircraft, no characteristic evidence of an explosion such as fragmentation, curling/ringlet effects, spike toothed structure of metals, gas washing, pitting and rolled edges have been noticed. No sign of cupping/dishing of metal surface is seen. No positive characteristics of a mid-air explosion were observed from the wreckage/ debris examined.

From the available evidence, it is opined that the crash of Sahara aircraft VT-SIA may not have occurred by explosive device/bomb.

1.17 ADDITIONAL INFORMATION

1.17.1 Logics for Aural Indications in case of Unsafe Landing Configuration

Following is the extract from the Boeing 737 Aircraft Operations Manual regarding warning horn for unsafe landing configuration:

Aural Indications - Advanced Airplanes

The warning horn is provided to alert the pilots any time the airplane is in a landing configuration and the gear is not down. The warning horn is activated by flap and

thrust lever positions and low engine EPR.

With the landing gear not down and locked, the aural warning system provides a steady horn as follows:

- With the flaps 1 to 10, any time either or both thrust levers are retarded to IDLE. The horn can be silenced (reset) with the horn cut-out switch.

- With flaps 15 or 25 and either, but not both, thrust levers retarded to IDLE. The horn can be silenced (reset) with the horn cutout switch.

- With flaps 30 or 40 regardless of thrust lever position or engine EPR. The horn cannot be silenced.

1.17.2 Stall Warning System

Following is the extract from Boeing 737 Operations Manual regarding the Stall Warning System:

Stall Warning System

Warning of an impending stall is required to occur a minimum of seven percent above actual stall speed. Natural stall warning (buffet) usually occurs at a speed prior to stall. In some configurations the margin between stall and stall warning (buffet) is less than the required seven percent. Therefore, an artificial stall warning device, a stick shaker, is utilized to provide the required warning.

The stall warning system or "stick shaker" is designed to alert the pilots before a stall develops. The warning is given by vibrating both control columns. The system is energized in flight at all times. The system is deactivated on the ground by the air-ground safety sensor.

The stall warning system consists of a control column shaker (eccentric weighted motor), a heated angle of airflow sensor, a flap position sensor, a stall warning amplifier, the air-ground safety sensor and a stall warning panel on the aft overhead panel.

1.17.3 Handling the Airplane with an Engine Inoperative

Following is the extract from Boeing 737 Operations Manual under the topic "Engine Inoperative Familiarization" regarding handling the airplane:

1. Establish or maintain control of flight path and airspeed, in other words, "fly the airplane".

2. Rudder and Lateral Control

To counter the thrust asymmetry due to an engine failure, compensate for yaw with rudder. Rudder application should always be smooth and at the same rate as thrust changes.

Under instrument conditions the instrument scan is centered around the attitude indicator. Roll is usually the first indication of an asymmetric condition. Roll control (ailerons) should be used to hold the wings level or maintain the desired bank angle. The rudder should be applied to approximately center the wheel.

Make turns at a constant airspeed and hold the rudder displacement constant. Do not attempt to coordinate rudder and lateral control in turns. Rudder pedal inputs will excite roll due to yaw and induce the pilot to counter his own rudder oscillations with opposite control wheel.

1.17.4 Criteria for Approval of Examiners/Instructors/Check Pilots for Airline Operations on Fixed-wing Aircraft

Following are the extracts for the criteria used for approval of check pilots/instructors/examiners from AIC No.13 of 1993 issued by DGCA on 4th November, 1993:

1. General

1.1 The seniority, the position in the airline and the remuneration received by the pilots shall not be the consideration for approval as an Examiner/Instructor/Check Pilot.

1.2 The pilots recommended for approval as Examiners/Instructors/ Check Pilots shall be known for their impartiality, free from prejudices and strong likes and dislikes and capable of recording fair assessments.

1.3 The operators, before recommending the names of the pilots for such approvals, shall subject the pilots to a process of selection and suitability tests.

1.4 The pilots recommended for approval as Examiners/Instructors/ Check Pilots should have been regularly flying the aircraft on which the approval is sought. They should have consistently shown satisfactory proficiency; and

i) should have obtained the pilot-in-command rating on the type in the first attempt;

ii) should not have failed in any of the proficiency checks on simulator/aircraft during the preceding two years;

iii) should have record completely free of notifiable accident attributable to pilot's proficiency in handling the aircraft, on the type of aircraft on which approval is sought. Further, he should have accident free record during the preceding ten years on any type of aircraft, in airline operations, attributable to pilot's proficiency; and

iv) should have a record free of any incident attributable to pilot's proficiency in handling the aircraft during the preceding three years.

1.5 The pilots shall be capable of instilling high standard of discipline in the aircrew and have balanced attitude towards them.

1.6 The pilots approved as Examiners/Instructors/Check Pilots for the first time shall undergo necessary training and satisfactory tests on an approved simulator/aircraft before exercising the privileges of such approvals. The pilots who fail in the test shall not be considered for the respective approval for a period of two years.

1.7 Pilots who are appointed as Check-Pilots for the first time will be checked by DGCA Flight Inspector before they are released by the operator to act as Check-Pilots.

1.8 The pilots once approved as Examiners/Instructors/Check Pilots may be disqualified by the DGCA, if subsequently found lacking in any of the aforesaid qualities. Besides, a Board consisting of the Director of Operations and Director/Chief of Training from the respective airlines may also recommend to the DGCA, disqualification of Examiners/Instructors/Check Pilots, giving adequate justification.

1.9 The total number of pilots recommended for approval should be based on actual requirement. The number should not be unduly large and should be just sufficient to meet the instructional requirements and to carry out the prescribed checks.

2. Requirement of Flying Experience

2.1 Check Pilot

i)	Total Flying Experience	-	3000 hours
ii)	Total Command Experience	-	1000 hours
iii)	Total Command Experience on the type	-	500 hours

2.2 Instructor

i)	Total Flying Experience	-	3500 hours
ii)	Total Command Experience	-	1500 hours
iii)	Total Command Experience on the type	-	1000 hours
iv)	Experience as approved Check Pilot on the type	-	1 year
	OR		
	Experience as approved Instructor on another type of aircraft	-	50 hours

2.3 Examiner

i)	Total Flying Experience	-	4000 hours
ii)	Total Command Experience	-	1750 hours
iii)	Total Command Experience on the type	-	1250 Hours
iv)	Experience as approved Instructor on the type	-	50 hours

2.4.1 Instructional experience on the approved type simulator may be counted towards the instructional experience on the type.

2.4.2 The total command experience on the type for approval as an Instructor shall be relaxable to 500 hours in case a pilot has an instructional experience of not less than 200 hours or acted as Examiner for a period of not less than one year on another aircraft in the same airline.

2.4.3 The total command experience on the type for approval as an Examiner shall be relaxable to 750 or 500 hours in case a pilot has been an Examiner on another type of aircraft in the same airline for a period of not less than one or two years respectively.

2.4.4 An Examiner/Instructor/Check Pilot shall exercise his privileges only when he has a minimum of 10 hours flying experience as Pilot-in-Command on the type during the preceding 30 days and a certificate to this effect shall be recorded on the check-report.

3. Privileges

The privileges of the Examiners/Instructors/Check Pilots shall be to carry out the tests/checks mentioned below:-

3.1 Examiners

3.1.1 Skill test for Co-Pilot's rating;

3.1.2 Skill test for Pilot-in-command rating;

3.1.3 Skill test for issue of Instrument rating;

3.1.4 To exercise the privileges of an Instructor and a Check Pilot.

3.2 Instructors

3.2.1 Training of pilots for Co-pilot/Pilot-in-command rating

3.2.2 Renewal local checks;

3.2.3 Instrument Rating renewal checks;

3.2.4 To exercise the privileges of a Check Pilot

3.3 Check Pilots

Route checks.

4. In case adequate number of pilots meeting fully the aforesaid criteria are not available, the Director General may, at his discretion, relax the requirements taking into consideration the past performance, the flying record and the experience of the individual pilot.

5. This supersedes AIC No.7 of 1990

1.17.5 Requirements of Commercial Pilot Licence (CPL) Holders to act as Co-pilots on Transport Airplanes

Following is the extract from Schedule II of the Aircraft (Amendment) Rules 1993:

SECTION-I ; COMMERCIAL PILOT'S LICENCE (AEROPLANES)

5. Extension of Aircraft Rating - For extension of aircraft rating, to include an additional aeroplane, an applicant shall be required to produce evidence of having passed a written examination in Aircraft and Engines as mentioned in para 1 (d) and of having satisfactorily completed the general flying tests by day and night in accordance with para 1 (h) in respect of the type of aeroplane for which the extension of aircraft rating is desired. The flying tests shall have been completed within a period of six months immediately preceding the date of application for extension of the aircraft rating.

Para 1 (h)

1. Requirements for issue of Licence -- An applicant for Commercial Pilot's Licence shall satisfy the following requirements:-

(h) Skill -- He shall have demonstrated his competency to perform the procedures and manoeuvres prescribed in the syllabus to the satisfaction of an examiner on the type of aeroplane to which the application for licence relates within a period of six months immediately preceding the date of application. The competency shall be demonstrated in --

i) general flying test by day;
ii) general flying test by night;
iii) a cross-country flying test by day consisting of flight of not less than two hundred fifty nautical miles in the course of which at least one full stop landing at an aerodrome other than the aerodrome of departure shall be made; and
iv) a cross-country flying test by night consisting of a flight of not less than one hundred twenty nautical miles returning to the place of departure without landing elsewhere.

6. Privileges Subject to the validity of endorsements and ratings in the licence and compliance with the relevant provision of Rule 39 B, Rule 39 C and 42 of the Aircraft Rules, 1937, the privileges of the holder of a Commercial Pilot's Licence shall be :-

(c) to act as Co-pilot of any aeroplane where a Co-Pilot is required to be carried and which is entered in the aircraft rating of his licence;

Provided that -- for all flights under the Instrument Flight Rules, either as Pilot-in-Command or as Co-Pilot, he shall have a current Instrument Rating.

Provided further that -- for all flights as Co-Pilot of transport aeroplanes having an all-up weight exceeding five thousand seven hundred Kgs, he shall have carried out within the preceding six months of the intended flight appropriate proficiency checks in respect of that type of aircraft as required by the Director General.

PRELIMINARY FINDINGS

1. Boeing 737 aircraft VT-SIA was manufactured in December,1979 and was in operation with an Norway Airlines till 1991. It was then purchased by a leasing company of USA and was maintained by M/s. Pemco Aeroplex, Alabama, USA. The aircraft was leased to Sahara India Airlines in November, 1993.

2. The aircraft was issued Indian Certificate of Registration No.2450 and given initial Certificate of Airworthiness No. 2031 on 9.12.1993 which was revalidated on 7.3.1994 upto 7.6.1994. The aircraft all up weight and Centre of Gravity position were within limits.

3. On the date of accident prior to the training flight, Aircraft had operated the flight Delhi-Bangalore-Delhi and no defect was reported.

4. Weather was fine at Delhi with visibility around 8 Kms. during the period of training flight.

5. Nine circuits and landings were planned for the three trainees to give each trainee three circuits and landing practice.

6. Flight Instructor Capt. P. Khurana, along with the pilot trainees Mr. Pramod Singh, Mr. Vidul Mahajan and Miss Anshu Khurana took off from IGI Airport runway 28 at 1412 hours (IST).

7. Five circuits and landings (touch and go) were completed uneventfully. While the aircraft was going for sixth circuit after touch and go, it started turning to the left from an estimated height of about 400 ft and crashed at the apron II of International Terminal near Bay No.46.

8. The impact point was around 1700 feet left of the runway 28 and around 10,800 feet from the beginning of the Runway 28. The direction of the flight path at the point of impact is about 160 degree from North.

9. Aircraft disintegrated due impact and caught fire. The wreckage moved in two trails - one towards Aeroflot aircraft parked at Bay 45 and the other towards the road adjoining the terminal building.

10. The Aeroflot aircraft which was parked at Bay 45 and undergoing servicing by the Aeroflot personnel, was hit by the wreckage as a result of which it suffered damage and caught fire.

11. The Sahara aircraft wreckage including number of small pieces of the aircraft were scattered over the apron from Bay 46 to Bay 41. Most of the wreckage pieces caught fire.

12. A total of 9 persons were killed and four got injured. Persons killed included 4 crew members of the Sahara aircraft, 4 of Aeroflot and one contractor of Bharat Petroleum, who was working on the apron.

13. Fire fighting and rescue action were carried out by safety services of IAAI, Air Force Station, Palam and Delhi Fire Services. Fire was brought under control by about 1600 hours.

14. This was the first Instruction flight of Capt. P. Khurana who was issued the approval for instructorship by DGCA on 8th March, 1994.

15. The three pilot trainees had done their simulator training at British Caledonia, England and this was their first training on the aircraft.

16. Examination of aircraft flight control components revealed that prior to impact, the flaps were at 15 position, spoilers retracted, leading edge slats extended, horizontal stabiliser at position of 7 units of trim, under carriage retracted.

17. No abnormality was observed in the Rudder System Installation in the tail portion and the power control units were found in tact and functional during the Bench check.

18. Wreckage examination revealed that the aircraft impacted the ground in left bank attitude.

19. The strip examination of engines revealed that both the engines were running at a higher speed at the time of impact.

20. Examination of the wreckage did not reveal any signature of explosion.

21. It is observed from the CVR tape transcript that there is no mention/conversation by the crew regarding any malfunction of the aircraft and its systems till the crash.

22. The CVR replay reveals that trainee pilot Mr. P. Singh had done flying during the first three circuits and thereafter trainee pilot Mr. Vidul Mahajan was undergoing training for the third circuit when the crash took place.

23. Examination of CVR and UFDR read outs indicate that the left engine throttle was retarded back slowly and when it reached idle position the unsafe landing configuration warning horn sounded. This horn was a normal feature for the configuration of the aircraft at that time,i.e. under carriage up, flap 15 and one thrust lever retarded to idle.

24. In the simulated asymmetric power condition, after the horn sounded, the Instructor advised the trainee to apply rudder.

25. Around two seconds after the Instructor advised trainee to apply rudder, he shouted "leave leave leave". The observer pilot trainee (Mr. P. Singh) also shouted "leave leave leave leave".

26. Around four seconds after this "leave leave" shouting, the stall warning (stick shaker) came and continued for about four seconds till the crash point. This indicates a high angle of attack condition of the aircraft in the last phase.

27. The power on the left engine increased just about two seconds before the crash.

28. From the evidence available so far, it appears that this was a case of simulated one engine inoperative training exercise at a low height in which the aircraft turned to left, lost height and impacted the ground. Aircraft handling by the crew during this exercise needs further examination. Refinement of UFDR data may help in the investigation of this aspect.

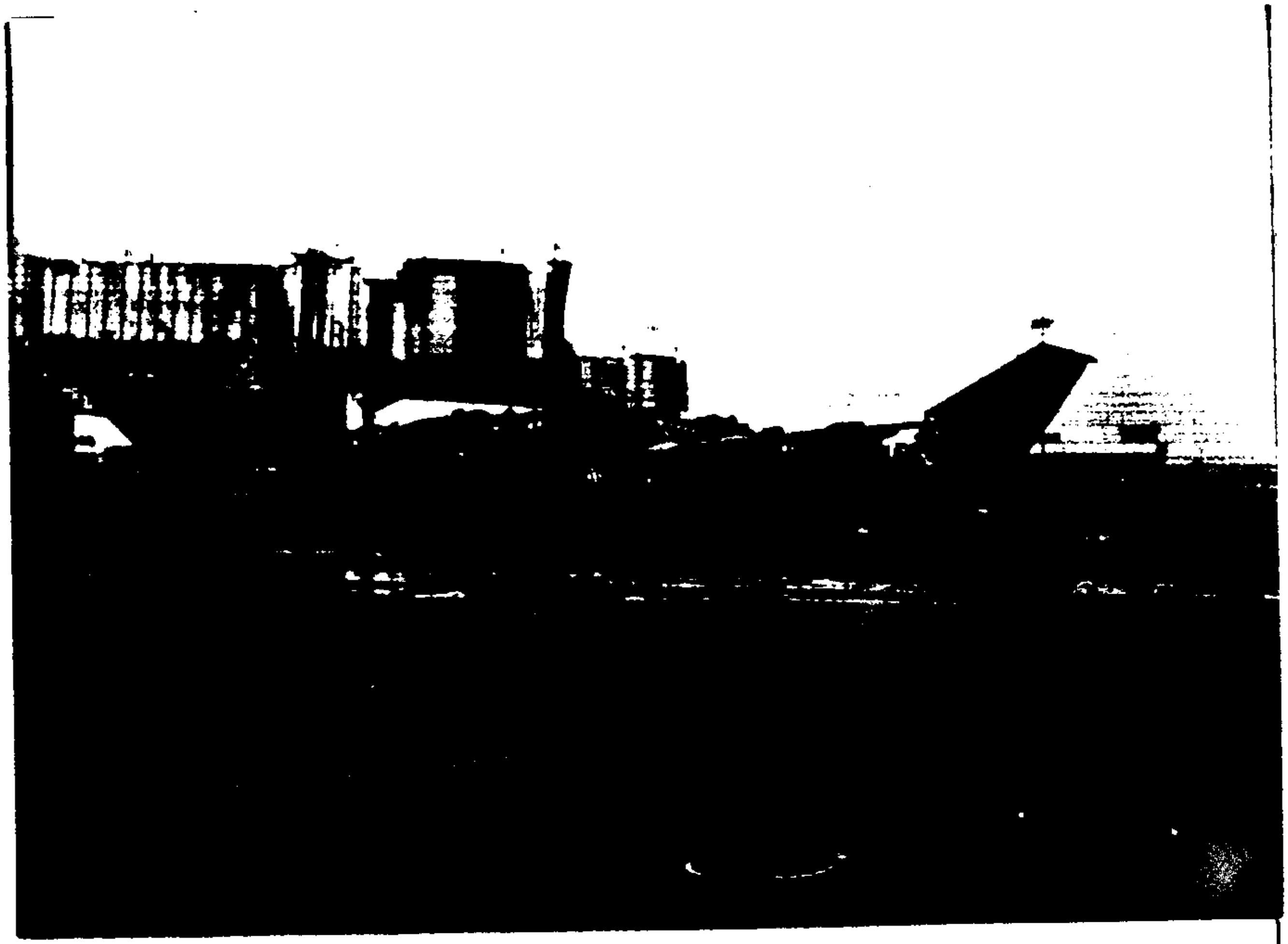
(V.K. Chandna)
Inspector of Accidents

Date : 5th August, 1994
Place : New Delhi

ANNEXURES

(INTERNATIONAL TERMINAL APRON [illegible]) ON 8.3.[illegible]

1. Burnt Aeroflot aircraft and wreckage scatter of Sahara aircraft near Bay 45.



2. Fuel spillage over apron and burnt Stbd. Wing Portion

3. Extensive fire and impact damage to Port Engine (near Bay 45 Aerobridge Pillar)

TAPE TRANSCRIPT OF 121.9 MHZ OF 8.3.94
SPOOL NO. 384, CHANNEL NO. 7, 0828 UTC

Time	To	From	Text
0831	GND	VIA	Delhi Ground - This is VIA.
	VIA	GND	VIA go ahead.
	GND	VIA	Good Afternoon Sir, starting for training flight, nine circuits and landings and we are parked on bay No. 4.
	VIA	GND	Stand by, only circuits and landing confirm.
	GND	VIA	Affirm only nine circuits and landings if you can permit us.
0831	VIA	GND	Stand by.
0832	VIA	GND	VIA start up approved and keep the numbers open.
	GND	VIA	Keep number open for us, sir.
	VIA	GND	I can't assure you in writing that I will be able to give you nine circuits and landings, it may be 8 or 7.
	GND	VIA	Roger. I think you will be able to accomodate us for maximum you can.
	VIA	GND	Sir, I will do.
0832	GND	VIA	Roger, thankyou Sir.
0835	GND	VIA	Request taxi Bay No. 4.
	VIA	GND	VIA taxi to holding point Rwy 28 via B, C2.
	GND	VIA	Taxi holding to Rwy 28 via B, C2.
	VIA	GND	Report number of persons on board.
0835	GND	VIA	Total 04 Sir.
0838	GND	VIA	Taxi holding Rwy 28.
	VIA	GND	Contact Tower 118.1.

	GND	VIA	Ground-VIA.
	VIA	GND	Contact Tower 118.1.
0838	GND	VIA	118.1 good day.

Prepared by

[redacted]

(A.K. Sharan)
Asstt. Director Air Safety

'C'

TAPE TRANSCRIPT OF 118.1 MHZ OF 8.3.94
SPOOL NO. 384, CHANNEL NO. 4 AND 5

Time	To	From	Text
0838	Tower	VIA	Tower Victor India Alfa.
	VIA	Tower	Victor India Alfa, hold short of Rwy 28 on C2 taxi track.
0838	Tower	VIA	C2 taxi track. VIA
0841	VIA	Tower	India Alfa line up Rwy 28 and wait.
0841	Tower	VIA	Line up and wait.
0842	VIA	Tower	VIA after departure turn left report left hand down wind Rwy 28 QNH 1014 HPA climb 2500 ft. and for information VID-139 is active.
	Tower	VIA	We request a shorter circuit Sir, climb to 2500 ft. and report down wind. Will call you down wind.
	VIA	Tower	Affirm (.) Clear for take off, wind 230/13 kts.
	Tower	VIA	VIA.
	Tower	VIA	VIA is rolling.
0842	VIA	Tower	Roger.
0844	Tower	VIA	Tower VIA down wind 28.
	VIA	Tower	Report, report final Rwy 28.
0844	Tower	VIA	Roger.
0847	Tower	VIA	VIA may we turn base.
	VIA	Tower	VIA affirm, report final Rwy 28.
0847	Tower	VIA	Call you final Rwy 28 VIA.
0849	Tower	VIA	Delhi VIA finals 28 touch and go.
0849	VIA	Tower	VIA clear for touch and go Rwy 28 wind 300/12 kts. Report down wind Rwy 28.
0850	Tower	VIA	Victor India.

0851	VIA	Tower	VIA make a short circuit and report final Rwy 28.
0851	Tower	VIA	Short circuit VIA.
0852	VIA	Tower	Affirm. No. 1 closing for ILS approach 28.
0852	Tower	VIA	Roger, VIA.
0853	VIA	Tower	VIA make a short circuit and report final Rwy 28.
0853	Tower	VIA	We are left down wind call you final.
0855	VIA	Tower	Roger. (Area talking with Lucknow. Conversation between VIA & Tower overlapped)
0856	VIA	Tower	Climb to 3500 ft. Reaching 35 turn left, report left hand down wind Rwy 28.
0856	Tower	VIA	Roger, VIA copied O.K.
0900	VIA	Tower	VIA report position.
	Tower	VIA	3500 ft. and down wind heading Sir.
0900	VIA	Tower	Roger.
0901	VIA	Tower	VIA make a long approach after this landing to accomodate departure.
0901	Tower	VIA	Roger, VIA.
0902	VIA	Tower	VIA descent to 2500 ft. QNH 1014 HPA. Report leaving 3500 ft.
	Tower	VIA	leaving 3500 ft. for 2500 ft. extending down wind.
0902	VIA	Tower	Roger.
0903	Tower	VIA	Delhi, VIA. Can we turn in now.
	VIA	Tower	Affirm. Report final Rwy 28.
0903	Tower	VIA	Roger.
0904	VIA	Tower	VIA confirm final Rwy 28.
0904	Tower	VIA	We are 5 ILS DME, Sir.

0905	VIA	Tower	Roger. Clear to land, clear for touch and go Rwy 28 .... Report left hand down wind.
0905	Tower	VIA	VIA.
0908	VIA	Tower	VIA report turning left.
0908	Tower	VIA	We are turning left now VIA for Down Wind.
0909	VIA	TWR	VIA make a short circuit and report final Rwy 28.
0909	Tower	VIA	VIA.
0910	Tower	VIA	Down wind VIA 28.
	VIA	Tower	VIA Roger. Report final Rwy 28.
0910	Tower	VIA	Roger. VIA.
0911	____	Tower	VIA Roger. Contact Delhi Approach 127.9.
0911	Tower	VIA	Confirm this is for VIA.
0911	VIA	Tower	Negative. VVT contact 127.9.
0912	Tower	VIA	VIA finals 28 down three green.
0912	VIA	Tower	Clear touch and go Rwy 28. Wind 270/14 knots report left hand down wind (Transmission overlapped by Area Talking to Nagpur)
0913	Tower	VIA	Can you switch on the VASI light VIA.
	VIA	Tower	India Alfa, VASI light already switched on from Tower.
0913	Tower	VIA	Roger. We have it visible now from one and half miles, thankyou.
0915	VIA	Tower	VIA report turning left.
0915	Tower	VIA	Turning left now, VIA.
0916	VIA	Tower	VIA make a long approach and report final.
0916	Tower	VIA	Roger. VIA.
0918	Tower	VIA	Tower/VIA can we turn finals? We are

			6 ILS DME.
0918	VIA	Tower	Affirm, report finals Rwy 28.
0918	Tower	VIA	VIA.
0921	VIA	Tower	VIA Delhi Tower.
	Tower	VIA	Go ahead Sir.
	VIA	Tower	After this touch and go Rwy in use will be 27, after touch and go climb on Rwy heading to 3500 ft. further climb with Delhi Radar.
0921	Tower	VIA	Copied Sir, after take off climb 3500 ft. on Rwy heading. We will call you down wind Rwy 27.
0922	VIA	Tower	Rwy heading 3500 ft.
	Tower	VIA	Rwy heading 3500 ft. Will call you down wind Rwy 27 thereafter.

Prepared by

[redacted]

(A.K. Sharan)
Asstt Director Air Safety

'D'

Spool No. 150 channel No.9, city fire stn.hot line

0926 Twr Hello- एक हमारा
अच्छा एक हमारा हम Tower से बोल रहे हैं।
VTSIA Sahara Airways-Hello-Hello-Hello एक aircraft one aircaft call sign is VTSIA B-737 Sahara Airways Boeing Type is B-737 call sign of aircraft is VTSIA type is B-737 crashed on
हाँ
Hello-
Hello Sir
-----Sound of ring-----

Sd/-
(R.K.KHARE)
A.A.O

Sd/-
(S.Khan)
A.T.O

Tape transcript of spool No.150 channel No.2 Dated 8.3.94 (SIREN)

0923 Sound of Siren

24 All stations All stations this is tower
VIA Sahara Airways B-737 has crash landed on south of Rwy 28 near terminal II

Spool No.150 channel No.10 Tele.N.Extn.488 (TWR)

0927 Twr Hello Wso मैं Twr से बोल रहा हूँ

Wso हाँ बोलिए

Twr यह VIA Sir, Sahara India का just touch and go के बाद turned left and toppled Aircraft landed near terminal II

Twr ACFT landed near Tml.II

Wso Which one

Twr It became a big fire ball

Wso VIA
Which one

Twr IA

Wso IA-Oh God
Type of ACFT

Twr B-737 it was doing local flying just after touch and go Rwy 28 it turned and near terminal II it crash landed

Sd/-
(R.K.KHARE)
A.A.O

Sd/-\
(S.KHAN)
A.T.O

Spool No.150 channel No.10 telephone No.Extn.487/...
(both extns. 480 + 487 are on channel No.10) 480 → Briefing officer.

0928 Twr Hello twr
Liasion Hello liasion
Twr एक aircraft crash हो गया है बात न करना अभी
City Fire को कर जरा
Hello
Hello
Hello Briefing Officer Twr this side sir,एक airceaft crash हो गया है
VTSIA
Briefing Officer TSIA
Twr VTSIA
Type is B-737 Sahara Airways का Sir crashed sir,
B.O. अच्छा total on board
Twr T.O.B sir,strip पर लिखा है sir,
B.O अच्छा मेरे को information क्यों नहीं थी
Twr एक मिनट sir,hold करिये।
Twr Sir,4 persons on board
B.O All safe or not
Twr Just a minute sir,
B.O यह Duty Officer को दे जरा
Hello
safety serices का Status क्या है.
Twr Hello
B.O Hello Bokade यह aircraft crash हो गया और मुझे बताया नहीं लोग मुझसे पूछ रहे हैं।
Twr वो crash हो गया न अभी बतायेंगे
B.O ----------Survvival का क्या हाल है। Fuel on board सारा कुछ
Twr अभी पता कर के बता रहें हैं।
B.O. अच्छा पता करके बताओ।

Sd/-
(R.K.KHARE)
A.A.O

Sd/-
(S.Khan)
A.T.O

E

RELEVANT CVR TAPE TRANSCRIPT IN CONNECTION WITH ACCIDENT TO SAHARA INDIA BOEING 737 AIRCRAFT VT-SIA AT IGI AIRPORT, PALAM ON 8.3.1994

TIME	FROM	TO	TEXT
08:52:50	CH3		1800 maintain.
08:52:51	CH4		1800 maintain.
08:52:53	CH3		You have speed already na.
08:52:54	CH4		No, you have speed already na.
08:52:55	CH3		First you maintain the speed and then open power.
08:52:58			(ATC conversation with VQC).
08:53:12	CH3		Bolo ji.
08:53:15	CH3		Approach check list.
			(ATC conversation with VGC).
08:53:26	CH3		_____ Instrument checked, there is no flag, EPR set to go around and bug is 127 K.
08:53:35	CH3		Downwind Victor India Alpha.
08:53:46			(ATC conversation with VJP).
08:53:55	CH3		____ Equipment is OK, OK. But you ____.
08:53:57	ATC	VIA	Victor India Alpha, make a short circuit and report final, Runway 28.
08:54:00	VIA	ATC	We are left down wind sir. Call you final.
08:54:05	CH3		Time set nahi kiya.
08:54:07	CH3		No we will have to do this because we are 1000 feet.
08:54:21	CH3		Flap 15.
08:54:23	CH3		Recall.

TIME	FROM	TO	TEXT
08:54:23	CH4		Checked.
08:54:24	CH3		Altimeter.
08:54:25	CH4		1012.8.
08:54:26	CH3		Speed brakes.
08:54:28	CH4		Armed.
08:54:28	CH3		Landing gear.
08:54:29	CH4		Down three green.
08:54:30	CH3		Flaps.
08:54:32	CH4		Flaps ____.
08:54:32	CH3		Start turning now.
08:54:33	CH3		Start turning.
08:54:39	CH3		We are already 1000 feet hain. And don't descend now because now the circuit is different. On profile we will have a look at it and then we descend further.
08:54:47	CH3		You can take flap 25 if you like. OK.
08:54:51			(ATC transmission with some aircraft).
08:54:56	CH3		Don't descend, don't descend.
08:55:01	CH3		Keep this heading on, look for the runway till there. Chalo.
08:55:05	CH3		_____ up kar lo, runway dekho. Phir lo.
08:55:09	CH3		Still time to go.
08:55:10	CH3		Now we can turn. As you turn.
08:55:14	CH3		Turn turn.
08:55:22	CH3		Thora late kiya na.

TIME	FROM	TO	TEXT
08:55:24			_____.
08:55:26	CH3		Bank bank.
08:55:27	CH3		25. You have 25 flaps.
08:55:28			(Altitude alert horn).
08:55:31	CH3		30 and 40. Check kar lo pehle.
08:55:36	CH3		40 green, check list complete.
08:55:39	CH3		Let the speed rise.
08:55:43	ATC	VIA	Victor India Alpha cleared for touch and go. Now runway in use 28, wind 320 07 knots. ____ climb 3500 feet. Reaching 35, turn left report left hand down wind runway 28.
08:55:54	VIA	ATC	Roger Victor India Alpha copied OK.
08:55:57	CH3		Three hundred feet.
08:55:58			(ATC transmission with VJP).
08:56:10	CH3		Speed thori zaida hai na boss.
08:56:17	CH3		Open now power so that we don't go down.
08:56:29	CH3		Centre line.
08:56:31			(ATC transmission with flight VAA 855).
	CH3	-	Check list kar le.
08:56:51	CH3		____ straight rakh straight.
08:56:55	CH3		Open up.
08:56:57			(ATC transmission with VJP).
08:57:03	CH3		OK.
08:57:09	CH3		Positive climb.

TIME	FROM	TO	TEXT
08:57:10			(_____ superimposed with ATC transmission with VJP).
08:57:31	CH3		Security altitude.
08:57:33	CH3		V2 plus 15, Flaps five, climb thrust.
08:57:41	CH3		And maintain speed 172 knots.
08:57:43			(ATC transmission with other aircraft).
08:57:43	CH4		After take-off.
08:57:44	CH3		And 172 knots. 172 knots.
08:57:47	CH3		Not with this. This is alright but this. Put it up.
08:57:51	CH3		Samjhe.
08:57:52			(____ superimposed with ATC transmission with other aircraft).
08:57:56	CH3		Climb thrust and then attitude positive.
08:57:59	CH3		You don't have to touch this ____ speed at all. At this time you are in a fixed rate of climb.
08:58:03	CH4		After take-off check list.
08:58:04	CH3		OK.
08:58:07			(Altitude alert horn).
08:58:08	CH3		Samajh gaye bat abhi abhi dekho. 270 ____ 272, 172 chahye aab to. 172 ke liye climb. Thora sa aur kar lo nose up, nose up.
08:58:18	CH3		We will level off at 3500 OK.

TIME	FROM	TO	TEXT
08:58:27	CH3		Yeh sara attitude ka kamal hai Pramod. Aap jo flying karte ho na chauda degree pakar ke jaao all the way. Security attitude V2 plus 15, Flap five climb thrust and lower this, phir se baat karen ge aap ke sath.
08:58:41	CH3		Chal turn kar lein aab.
08:58:45	CH3		At 172, speed increasing.
08:58:54			(ATC transmission with VJP).
			____.
08:59:22	CH3		The height is OK isn't it but speed is little more. So what we can do, keep the power little off.
08:59:39			(ATC transmission with VJP).
08:59:43	CH3		Pramod aandar dekh ____ we will try with 30.
08:59:45	CH3		____1300 karo let us see how ___ Superimposed with ATC transmission with VMZ.
09:00:28	ATC	VIA	Victor India Alpha report position.
09:00:30	VIA	ATC	3500 and downwind heading Sir.
09:00:33	ATC	VIA	Roger.
09:00:36	CH3		Height neeche ja rahi hai. Thora sa upar kar.
09:00:39	CH3		Trim kar le. Try and feel without any pressure.
09:00:46	ATC	VIA	Victor India Alpha, make a long approach. After this landing we are ready for one departure.
09:00:51	VIA	ATC	Roger Victor India Alpha.

TIME	FROM	TO	TEXT
09:00:52	CH3		We will do ILS this time OK.
09:00:53	CH4		OK.
~~09:01:01~~	~~CH3~~		~~Just climb to thirty five~~ hundred.
09:01:03	CH3		Ek minute main tumhe batata hoon ek minute. Just show me.
09:01:05	CH3		One sec let me just see it.
09:01:11			(____ Superimposed with ATC transmission with VJP).
09:01:26			(ATC transmission with VMZ).
09:01:29	CH3		Attitude.
09:01:30	CH3		Han attiude just about four degrees and speed is OK. I need fuel flow of about 14 so I adjust to 14. Attitude four degree and fuel flow (____ superimposed with ATC transmission).
09:01:39	ATC	VIA	Victor India Alpha. Descent to 2500 feet, QNH 1014. Report leaving 35.
09:01:46	VIA	ATC	Leaving 35 for 2500 Victor India Alpha and extending down wind 28.
09:01:51	ATC	VIA	Roger.
09:01:52			(Altitude alert horn).
09:01:55			(ATC transmission with VAA).
09:01:57	CH3		At this time it won't come. I know, at this time (____ superimposed with ATC transmission).
09:02:12			(ATC transmission with VMZ).
09:02:28	CH3		Let us do ILS preparation as we are on ILS na.

TIME	FROM	TO	TEXT
09:02:30			(ATC transmission with flight 855).
09:02:50			(ATC transmission with VJP).
09:02:57	CH3		Yeh 2500 hai na, that's OK.
09:03:00	CH3		Frequency set markers supply is on. Switch is normal sensitivity low.
09:03:07			(ATC transmission with some other aircraft).
09:03:17	VIA	ATC	Delhi Victor India Alpha. Can we turn in now.
09:03:20	ATC	VIA	Affirm report final runway 28.
09:03:22	VIA	ATC	Roger.
09:03:22	CH3		Ten miles.
09:03:27			(ATC transmission with VJP and flight 855).
09:03:33	CH3		We are flap five and we have to intercept the localiser and at glide slope alive we are ____.
09:03:38			(ATC transmission with VJP).
09:03:50	CH3		Turn because we are getting delaying that aircraft is already lined up.
09:03:57	CH3		Ek wait kar raha hai wahan pe hamare.
09:04:07	CH3		Heading 350 is good for you.
09:04:12	CH3		Thik hai.
09:04:14	CH3		OK 345 is good.
09:04:18	CH3		Maintain 2500.
09:04:30	CH3		Localiser alive.
09:04:33	CH3		Start turning.

TIME	FROM	TO	TEXT
09:04:36			____.
09:04:42	CH3		Bank.
09:04:46	CH3		To overshoot turn little bit, pick up localiser again.
09:04:54	CH3		Maintain 2500.
09:04:56	ATC	VIA	Victor India Alpha confirm finals runway 28.
09:04:58	VIA	ATC	We are just five ILS DME Sir.
09:05:01	ATC	VIA	Roger clear to land. Clear for touch and go runway 28.
09:05:04	VIA	ATC	Roger clear touch and go.
09:05:06	ATC	VIA	Affirm and maintain 2500 feet and report left hand down wind.
09:05:11	VIA	ATC	Victor India Alpha Roger.
			(Marker sound).
09:05:13	CH3		Glide slope alive.
09:05:15	CH4		_____ is on Sir.
09:05:16	CH3		Gear down.
09:05:17	CH3		Flap 15. Check list.
09:05:18			(Outer marker crossing sound).
09:05:27	CH4		It is going down na.
09:05:28	CH4		____ Thora-sa glideslope ____.
09:05:30	CH3		Go down.
09:05:32	CH3		It will go down.
09:05:33			(ATC transmission with flight 855).
09:05:36	CH3		Afterwards you should pick up the glide slope.

TIME	FROM	TO	TEXT
09:05:39			(ATC transmission with flight 855).
09:05:48	CH3		Flap.
09:05:51	CH4		Recall.
09:05:52	CH3		Altimeter.
09:05:53	CH4		1014.
09:05:54			(____ Superimposed with ATC transmission with other aircraft).
09:06:06	CH3		You want 30 flap right.
09:06:08	CH3		Your bug is 128 now.
09:06:12	CH3		Dekhna yaar kitni hai.
09:06:14	CH3		Uske baad adjust.
09:06:16	CH3		You have burnt bloody fuel also.
09:06:18			(ATC transmission with other aircraft).
09:06:21	CH3		____ below glideslope. We open little power right and because we have speed, you don't have much correct.
09:06:26			(ATC transmission with flight 813).
09:06:42	CH3		Bolta hai you don't descend.
09:06:45	CH3		So we fly level.
09:06:51	CH3		OK now you go down because otherwise you may go high.
09:06:54	CH3		Nose down.
09:07:01			(ATC transmission with VVT and VRF).
09:07:41	CH3		Rotate.

TIME	FROM	TO	TEXT
09:07:48	CH3		Positive climb.
09:07:49	CH4		Gear up.
09:07:50	CH3		Ho gai teen landings.
09:07:52			(ATC transmission with VRF).
09:08:05	CH3		Vidhul aa ja bahi.
09:08:08	CH3		Flap five. Climb thrust.
09:08:24	ATC	VIA	Victor India Alpha, report turning left.
09:08:27	VIA	ATC	We are turning left now Victor India Alpha for down wind.
09:08:44			(ATC transmission with VVT).
09:09:03	CH3		Yes Sir.
09:09:04	CH3		Comfortable.
09:09:06	CH4		____ Maine check nahi kiya.
09:09:09	CH3		I have not _____.
09:09:14	CH3		Turn.
09:09:15	ATC	VIA	Victor India Alpha, make a short circuit and report finals runway 28.
09:09:19	VIA	ATC	Roger Victor India Alpha.
			(ATC transmission with flight 813).
09:09;32	CH3		2500 maintain.
09:09:37	CH3		2500.
09:09:38	CH3		Attitude four degree attitude will be alright if you take four degree attitude.
09:09:42	CH3		Phir.
09:09:44	CH3		Haan yaa.

TIME	FROM	TO	TEXT
09:09:47	VIA	ATC	Down wind Victor India Alpha 28.
09:09:52	ATC	VIA	Victor India Alpha. Roger report final runway 28.
09:09:55	VIA	ATC	Roger call you finals.
09:10:02	CH3		OK. Anti ice off, airconditioning and pressurisation set. Start switches low bug set to 126.
09:10:18	CH3		Abeam.
09:10:20	CH4		Landing gear down, Flaps 15.
09:10:24			(ATC transmission with VVT).
09:10:38			____.
09:10:39	CH3		Recall Checked. Speed brakes armed. Landing gear down three green. Flaps are 15. Checklist complete.
09:10:46			(ATC transmission with VVT).
09:10:53	CH3		OK time up.
09:10:55	CH3		25.
09:11:03	ATC	VIA	Victor India Alpha Roger.
09:11:06	VIA	ATC	Continue.
09:11:07	ATC	VIA	Contact Delhi approach 127.9.
09:11:11	VIA	ATC	Confirm this is for Victor India Alpha.
09:11:27	CH4		____ one thing after a long time.
09:11:31	CH3		And we by about this time, left with 2500 that time.
09:11:56	CH3		Look out, look in, see how ____.

TIME	FROM	TO	TEXT
09:12:00	CH3		I think it is the time to turn now, I think so yes so, we take flap 25 we have flap 25. 1000 feet AGL OK looking good. Attitude. Getting little low and we have to turn little. Thirty degree bank going out. You know all that you must talk to yourself.
09:12:19	VIA	ATC	Victor India Alpha final 28 down. Three greens.
09:12:24	ATC	VIA	Roger clear for touch and go. Runway 28. Wind 270/14 knots. Report left hand down wind runway 28.
09:12:29	VIA	ATC	Victor India Alpha.
09:12:32	CH3		Thiry forty.
09:12:35	CH3		Forty on, Green. Complete check list. ____.
09:13:18	CH3		Still low.
09:13:19	CH3		I think I am still low.
09:13:26	VIA	ATC	Can you switch on the VASI light, Victor India Alpha.
09:13:29	ATC	VIA	India Alpha VASI light is already switch on from tower.
09:13:32	VIA	ATC	Roger, we have it visible now from one, one and a half miles.
09:13:39	CH3		Centre line liya and speed.
09:13:50			(ATC transmission with other aircraft).
09:14:16	CH3		Clear to land.
09:14:18	CH3		Centre line.
09:14:21	CH3		Centre line.
09:14:26			____.

TIME	FROM	TO	TEXT
09:14:28	CH3		Rotate.
09:14:32	CH3		Haan good show.
09:14:35	CH3		Positive climb.
09:14:36	CH4		Gear up.
09:14:36	CH3		Gear up.
09:14:39	CH3		So what next you will do.
09:14:40	CH3		At security altitude V2 plus 15, Flap five, climb thrust and speed by then what should be ____. Yah.
09:14:46	CH4		172.
09:14:47	CH4		Yah. After that ____.
09:14:51			(Altitude alert horn).
09:14:55	CH4		Flap five climb thrust.
09:14:57	CH3		Flap five climb thrust. Please set climb thrust yourself. Put your hands on.
09:15:00	CH3		And speed comes to 172 knots, put the nose up, back to the climb.
			____.
09:15:06			(ATC transmission with other aircraft).
09:15:08	CH3		Turn.
09:15:10	ATC	VIA	Victor India Alpha report turning left.
09:15:12	VIA	ATC	Turning left now Victor India Alpha.
09:15:16	CH3		The speed being low so I reduced my rate of climb, that is it.

TIME	FROM	TO	TEXT
09:15:24	CH3		100 feet to level off so I get my power back.
09:15:28	CH3		Bank.
09:15:31	CH3		Power.
09:15:33	CH3		When you change the power setting, nose will drop, thora us ko trim up, peeche kar do.
09:15:40	CH3		Continue turning and speed getting more so we just get power back a little bit.
09:15:47	CH3		Bank is increasing.
09:15:56	CH3		Kisme se bug liya handy dandy hai kisi aap ke pass.
09:16:09	CH3		Dekhna yeh teen ton kam ho gaya.
09:16:10	CH3		Forty four ton ka dekho kitna hai.
09:16:17	CH3		126.
09:16:18	CH4		126 OK checked.
09:16:22	ATC	VIA	India Alpha make a long approach and report finals.
09:16:25	VIA	ATC	Roger Victor India Alpha.
09:16:26	CH3		____ right.
09:16:27	CH3		OK.
09:16:28	CH3		Descent approach checks. -
09:16:31	CH3		Anti ice off. Airconditioning and pressurisation set. Instrument checked and set no flag. EPR set to go around. Bug set to 126.
09:16:36	CH3		126 set.
09:16:37	CH4		126.

TIME	FROM	TO	TEXT
09:16:38	CH3		OK. After take off list bhul gaye.
09:16:40	CH3		Koi baat nahi.
09:16:45	CH3		Why the speed reduced to 162 knots Sir.
09:16:50			(ATC transmission with flight 812).
09:17:16	CH3		Here he wants to extend. You will have to do ILS now OK.
09:17:21			(ATC transmission with VRF).
09:17:32	CH3		QNH
			____.
09:17:35	CH3		Radio altimeter.
			____.
09:17:40	CH3		Outer marker _____ normal sensitivity low.
09:17:44	CH3		ILS preparation is completed.
09:17:58			(ATC transmission with VRF).
09:18:06	CH3		This is outer marker right. So we turn in after asking him. So as to keep the outer marker on to my left side ____ OK. So you can pick it up nicely.
09:18:42	VIA	ATC	Tower Victor India Alpha, Can we turn finals. We are 6 ILS DME.
09:18:46	ATC	VIA	Affirm. Report finals runway 28.
09:18:48	VIA	ATC	Victor India Alpha.
09:18:52	CH3		Bloody that thing this thing.
09:19:00	CH3		So 172 knots should be the speed han.

TIME	FROM	TO	TEXT
09:19:05	CH3		It is bumpy yaar.
09:19:08	CH3		Bank.
09:19:12			____.
09:19:16	CH3		Aan, ya, you can maintain 2500 feet. Once you pick up the localiser, then you descent further. You know if you are going like this now, glideslope will rise up.
09:19:29	CH3		Maintain 2500.
09:19:37	CH4		Speed 172 knots.
09:19:39	CH3		Yah. Turn on heading 320 radar vector for you.
09:19:44	CH4		Turning Sir.
09:19:45	CH3		OK now localiser alive. Continue.
09:19:47	CH3		Ha ha.
09:19:48	CH3		Late ho gaya.
09:19:52	CH3		Continue.
09:19:54			(ATC transmission with VRF).
09:20:04	CH3		Come on a heading of 260.
09:20:09			(Altitude alert horn).
09:20:11	CH3		Vidhul why are you descending.
09:20:15	CH3		OK heading is coming up.
09:20:19	CH3		260 is good.
09:20:24	CH3		You want to establish on 2000, it is OK.
09:20:27	CH3		It is OK chalo. You are back on the localiser now.
09:20:30	CH3		Back to the localiser.

TIME	FROM	TO	TEXT
09:20:39	CH3		Glideslope alive.
09:20:42	CH4		Landing gear down.
09:20:43	CH3		Gear down.
09:20:44	CH4		Flap.
09:20:44	CH3		Fifteen.
09:20:45	CH3		Check list.
09:20:46			(Outer marker crossing sound starts).
09:20:49	CH3		Localiser pakar lein pehle.
09:20:52	CH3		Pick up your localiser.
09:20:54	CH3		OK start switches.
09:20:56	CH3		Recall.
09:20:58	CH3		Altimeter.
09:21:00	CH4		1014.
09:21:01	CH3		Speed brakes.
09:21:02	ATC	VIA	Victor India Alpha Delhi Tower.
09:21:05	VIA	ATC	Go ahead.
09:21:06	ATC	VIA	Roger after this touch and go runway in use will be 27. After touch and go on runway heading, climb 3500 feet further climb with Delhi radar.
09:21:15	VIA	ATC	Copied Sir. After take-off to 2500, runway heading and will call you down wind for 27 Victor India Alpha.
09:21:20	ATC	VIA	Runway heading 3500.
09:21:22	VIA	ATC	Copied 3500 and we call you down wind for 270.
09:21:26	CH3		Han ji.

TIME	FROM	TO	TEXT
09:21:28	CH4		Flap 25.
09:21:34	CH4		____ Flap two five Sir. Altitude ____.
			(ATC transmission with other aircraft).
09:21:35	CH3		Getting too high isn't it.
09:21:37	CH3		So you do something.
09:21:40	CH3		What do we do.
09:21:41	CH4		Undercarriage down.
09:21:42	CH3		You have to take flap otherwise.
09:21:43	CH4		Sir flap 25.
09:21:44	CH3		OK.
09:21:47	CH3		Still we are very high.
	CH4		Flaps 30-40 Sir.
09:21:58	CH3		Thirty forty aaye ga he nahi mere pas 170 knots pe.
09:22:00	CH3		But any way get the speed first.
09:22:07	CH3		OK glideslope. Picking up the glideslope. It is going up.
09:22:11			(ATC transmision with VRF).
09:22:16	CH3		Add power now onwards otherwise you will be low.
09:22:22	CH3		Speed it up.
09:22:23	CH3		Trim trim trim trim nose down.
09:22:26	CH4		Nose down?
09:22:27	CH3		Ya because the pressure is coming in no.
09:22:28			____.

TIME	FROM	TO	TEXT
09:22:29	CH3		Speed speed. Look at your speed.
09:22:36	CH4		We are on visual now.
09:22:37	CH3		Visual to hai speed bhi to laao.
09:22:42	CH3		Going below bug na.
09:22:44	CH3		Ya ya I am going down down down nothing happens.
09:22:48			____.
09:22:49	CH3		Han just stuck to it.
09:22:50	CH3		Nothing happens to Boeings.
09:22:51	CH3		Just stuck to it yaar.
09:22:53	CH3		Ya.
09:22:54	CH3		Nothing happens.
09:22:55			(Touchdown sound).
09:22:58	CH4		Ke gal hai yaar.
	CH3		Chal straight. Runway seeda lagana.
09:23:07	CH4		____ rotate.
09:23:09	CH3		Rotate.
09:23:12	CH3		Nothing is happening.
09:23:14	CH3		Let's see what to do now.
09:23:16	CH3		Positive climb.
09:23:18	CH3		Gear up.
09:23:26			(Horn sound).
09:23:28	CH3		Rudder rudder rudder.
	CH3		Na na leave leave.

TIME	FROM	TO	TEXT
09:23:30	CH3		Leave leave.
	CH4		Leave leave leave leave.
09:23:31	CH3		Ya aa...
09:23:33			(Stick shaker sound)
09:23:37	CH4		Aah.
09:23:37			(Crash Sound).

Note : CH3 - Channel 3 (Pilot's channel) of the Cockpit Voice Recorder.

CH4 - Channel 4 (Area channel) of the Cockpit Voice Recorder.

(V.K. Chandna)
Director Air Safety

(M.S. Sharma)
DGCA Flight Inspector

(Lalit Gupta)
Asst. Director Air Safety

(R.S. Passi)
Asst. Director Air Safety