REPORT
OF
THE COMMITTEE OF INQUIRY

ACCIDENT INVOLVING KING AIR C-90 AIRCRAFT VT-EFF *NEAR BHAOGAON DISTT. MAINPURI*

ON

30TH SEPTEMBER 2001

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DIRECTOR FLIGHT SAFETY
INDIAN AIRLINES LTD.
NEW DELHI

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NEW DELHI.

COMMITTEE OF INQUIRY
ACCIDENT TO KING AIR C-90 AIRCRAFT REGN. NO.
VT-EFF ON 30th SEPT., 2001 IN DISTT. MAINPURI

PAGE NO.

REPORT OF THE COMMITTEE OF INQUIRY ON THE ACCIDENT INVOLVING KING AIR C-90 AIRCRAFT VT-EFF NEAR MAINPURI ON 30TH SEPTEMBER 2001 AT 1331 hrs.

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a) Aircraft

Type	**King Air C-90**
Manufacturer	**Beechcraft Now Raytheon Aircraft Corporation**
Regn. No.	VT-EFF
SL No.	LJ-705
Nationality	INDIAN
Year of Manufacture	1977
Certificate of Airworthiness	No. 1882 Valid till 24.10.2001

b) Engines

Manufacturer	Pratt and Whitney
Type	PT 6A-21
Sl.No.	Left (Port) PCE 24383 Right (Stbd.) PCE 25376

c) Details of Regn./Ownership

Name of owner	Birla Global Finance Ltd. New Delhi
Name of Operator	Jindal Strips Ltd., New Delhi.
Certificate of Registration	No.2170/4 in Cat. 'A'
Validity of Lease & Regn.	17.12.2004

d) <u>Details of occupants & injuries</u>

Pilot-in-Command	Capt. Vivek Kumar Gupta – CPL Fatal
Second-pilot	Capt. Ritu Malik – CPL Fatal
Passengers	Six Fatal

e) Location of Accident

Village-Bhainsrolli
Near Mota Railway Station
Police Station Bhaogaon

Distt. Mainpuri (U.P)
Latitude 27^0 28' 29" North
Longitude 079^0 15' 16" East
Elevation 143 Meters AMSL

f) Date and Time of Accident **30th** Sept.,2001 at approx. 1331 hrs.

g) Summary

King Air C-90 aircraft belonging to Birla Global Finance Ltd., leased and operated by Jindal Strips Ltd. New Delhi took off from Delhi on 30th Sept.,2001 at 1241 hrs. with Capt. Vivek Kumar Gupta as Pilot-in-Command and Capt. Ritu Malik as second pilot. The aircraft bound for Kanpur had six passengers (Pax) on board in addition to the crew. The aircraft was cleared to cruise at FL-150. Enroute it reported Aligarh as estimated. Short of next reporting point KADAS the aircraft was about 10 miles right of track for which permission was obtained and the pilot requested for direct routing to Kanpur. Capt. was advised by ATC Lucknow, to co-ordinate with Gwalior and Agra for traffic information. The last transmission from the Pilot-in-Command as monitored by Lucknow ATC was "Stand by one" thereafter, the aircraft had no contact with any of the ATC Units and it crashed at approx. 1331 hrs. near Mota Railway Station/Kali River, Police station Bhaogaon, Distt. Mainpuri, killing both crew members and all six passengers on board. Information about the crash was passed by Police Authorities, Mainpuri to Lucknow ATC and then to Delhi.

h) Initiation of Investigation

On receiving information about the accident Shri P. Shaw, Dy. Director (Air Safety), DGCA along with his team of officers and representatives of the operator and maintenance agency i.e. M/S India International Airways reached the site of the accident and started investigation immediately with the help of local Police and Civil Authorities. The team was further supplemented by Sh. K. Gohain, Dy. Director General, DGCA and Capt. Ron Nagar, Flight Operations Inspector, Flight Inspection Directorate, DGCA.

i) Appointment of Committee of Inquiry

The Govt. of India, Ministry of Civil Aviation constituted a Committee of Inquiry under Rule 74 of Aircraft Rules 1937 to investigate into the

accident vide Notification No. AV 15013/9/2001-SS dated 3.10.2001. The constitution of Committee is as follows:

Capt. D.V. Singh, Director Flight Safety, Indian Airlines Ltd.
Air Cdme. P.B. Badhwar, Director, IGRUA, Fursat Ganj
Sh. K.B. Batra, Chief Engineer, BSF, Ministry of Home Affairs
Mr. P. Shaw, Dy. Director Air Safety, DGCA

The Committee visited the site of accident on 5.10.2001 and carried out detailed examination of wreckage as well as eyewitnesses. On return to Delhi the Committee visited M/s India International Airways, the maintenance agency of the aircraft and M/s Jindal Strips Ltd., the operator of the aircraft. The Committee also visited M/s Taneja Aerospace and Aviation Ltd., Bangalore where some major modifications involving structural work were carried out in the year 1999. The Notification of Committee was published in the leading Newspapers of Delhi, Kanpur , Gwalior and Mainpuri both in English and Hindi. Special efforts through the Distt. Administration were made to encourage people to come and make statements about the accident and also to search for the aircraft parts in the surrounding areas of the crash site.

The committee conducted public hearings at Delhi on 19th & 20th November 2001 and at Mainpuri/Bhainsrolli on 21st & 22nd November 2001 to examine the earlier witnesses and admit any new witnesses. The committee associated M/s National Aerospace Laboratories, Bangalore for carrying out complete fractographic analysis of the damaged/failed parts.

1. FACTUAL INFORMATION

1.1. History of the Flight

1.1.1. Capt. Vivek Kumar Gupta, Pilot-in-Command of King Air C-90 Aircraft VT-EFF belonging to M/s Jindal Strips Ltd., received meteorological, communication and ATC briefings at IGI Airport, for clearance of flight on 30th September 2001 from Delhi to Kanpur. Capt. Gupta

completed his pre-flight inspection of the aircraft and signed the Pilot's Acceptance Certificate. There were six passengers and two crew members on board the ill fated aircraft viz:

1. Mr. Madhav Rao Scindia
2. Mr. Rupinder Singh
3. Mr. Ranjan Jha
4. Mr. Gopal Singh Bisht
5. Ms. Anu Sharma
6. Mr. Sanjiv Sinha
7. Capt. Vivek Kumar Gupta
8. Capt. Ritu Malik

1.1.2. As per Air Traffic Control (ATC) tape recording Capt. Vivek Kumar Gupta established RT contact with ATC Surface Movement Controller (SMC) at 0658 UTC, IGI Airport on VHF R/T frequency 121.9 MHz. The Pilot informed ATC that 08 souls were on board the aircraft and requested for permission to start aircraft engines. At 0659 permission to start the engines was accorded by the ATC Surface Movement Controller. At 07:02 UTC the pilot requested taxy clearance and initiated to taxying via taxi track Echo to runway 27, intersection Delta Holding point runway 10. At 07:06 UTC Pilot entered runway 27 and obtained ATC clearance for flight to Kanpur via Air route R 460 E , flight level 150 and he was allotted departure SQUAK 3327. The aircraft was thereafter asked to change over to Aerodrome Controller on 118.1 MHz.

1.1.3 The pilot established contact with Aerodrome Control on VHF R/T frequency 118.1 MHz at 07:08:46 UTC and received permission to line up on runway 10 at intersection Delta. The Aerodrome Controller gave ALIGARH-2 departure with instructions to climb straight ahead up to 5 miles and then resume normal navigation. The aircraft got airborne at 07:11 and at 07:11:52 it changed over to Terminal Area Radar (TAR) on frequency 127.9 MHz .

1.1.4 The pilot on establishing contact with Terminal Area Radar (TAR) Controller received communication of being identified on the Radar and he was asked to climb to FL–150 expediting climb through 3600 ft. at 07:13:20 UTC, the pilot reported climbing through 3600 ft. for FL-150. The aircraft was vectored to intercept Radial 127 of Delhi VOR and changed over to Route Surveillance Radar (RSR) on 120.9 MHz at 07:21: 50 UTC.

1.1.5 At time 07:36:45 UTC RSR Control called the aircraft terminating radar services with position information Aligarh and to report establishing RT contact with ATC Lucknow. At 07:49:30 UTC the pilot called RSR Controller and confirmed about establishing contact with ATC Lucknow. The pilot also received approval for changing over to Lucknow. However, the pilot requested traffic information for descend and he was informed that there was no reported traffic. He was instructed to descent in co-ordination with Lucknow and Chakeri

1.1.6 At 07:50:37 UTC the pilot called RSR Controller for deviation by 10 degrees to right of track due weather which was approved by the Controller. At 07:56:30 UTC the pilot reported abeam KADAS and in contact with Lucknow and Kanpur, and also requested permission to set course direct to Kanpur. The RSR Controller advised him to coordinate with Lucknow and apprise him that there was no reported traffic with Delhi ATC. The pilot then changed over to Lucknow and Kanpur.

1.1.7 As per recording on ATC tape at Lucknow the pilot had established contact with ATC, Lucknow at 07:47 UTC and transmitted his flight details "DELHI TO KANPUR, FL-150, ESTIMATE KADAS 0800, AT KANPUR 0820, ROUTING DIRECT KADAS TO KANPUR" . At 07:52 UTC the pilot requested ATC Lucknow for deviation by 10 miles right of track due weather and he was advised to coordinate with ATC Delhi. At 07:58 UTC the pilot reported his position abeam KADAS maintaining FL-150 and in contact with Kanpur . The pilot had also informed that there was no traffic with Delhi and requested

for direct routing to Kanpur. ATC Lucknow advised the pilot to coordinate with Gwalior and Agra for local flying if any with Gwalior. The pilot responded ,"STAND BY ONE', and this was the last communication from the pilot as on ATC tape.

1.1.9 Around this stage the aircraft was overhead Distt. Mainpuri (U.P). The area was heavily covered with thick rain clouds associated with thunderstorm and lightening. It was raining heavily at Mainpuri and the surface wind was from the West to East . As per villagers they had heard the aircraft sound in mids of rain, thunder and strong wind . As understood by them with help of sound from the engine the aircraft flew from the West to East and before Kali river the aircraft turned right and crash landed in an open cultivated field at Bhainsrolli village in Mainpuri Distt.(U.P). As per eyewitnesses they had also seen the aircraft when it was low and during last phase of its flight. The villagers have also mentioned about noticing the aircraft with red flames.

1.1.10 On crash landing the aircraft got engulfed in flames and substantially consumed in the fire. All the occupants received fatal injuries and burns however, no one on the ground received any injury.

1.2 INJURIES TO PERSONS:

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	2 (TWO)	6 (SIX)	NIL
SERIOUS	NIL	NIL	NIL
MINOR/NONE	NIL	NIL	-

1.3 DAMAGE TO AIRCRAFT

The aircraft was destroyed totally in the accident and major portion of the aircraft was consumed in the fire.

1.4 OTHER DAMAGE

Near about 1 acre of potato cultivation was destroyed as result of accident.

1.5 PERSONNEL INFORMATION

1.5.1. Pilot-in –Command

1.5.1.1

NAME	-	**CAPT. VIVEK KUMAR GUPTA**
Date of birth	-	28th July, 1968
Age	-	33 years 2 months

Details of License-

- Commercial Pilot's License No.	-	2702 issued on 16th November 93 & Valid till 8th Oct., 2001
- FRTO NO.	-	4564 Valid till 14th Sept., 2002
- RTR License No.	-	21070 Valid till 22nd May 2002
- Last Med. Exam.	-	9th Oct., 2000
- Endorsements (As PIC)	-	TB-20, King Air C-90 & C-90A

1.5.1.2 Capt. Vivek Kumar Gupta was a product of Indira Gandhi Rashtriya Udan Academy and got his Private Pilot's License No. 4319 issued on 23rd February 1989 and CPL No. 2702 form the same Academy on 16th November 1993. Subsequently he got his endorsement on King Air C-90 on 7th October 1994. He commenced his flying training on 22nd March 1988 and was instructed by Capt. S.K. Bhatia, AVM S. Subbaramu. His skill test was carried out by Capt. A.K. Sinha. He was earlier employed with M/s Khemkas i.e. NEPC Airlines and joined Jindal Group in December 1998. His last IR check was carried out on 10.02.2001 by Capt. M .M Verma. His license remained suspended w.e.f. 4th February 1998 to 25th January 1999 vide order No. 1-132-88-L dtd. 25th January 1999. Capt. V.K. Gupta underwent medical examination on 09.10.2000 at the Air force Central Medical Establishment, New Delhi and was found to be medically fit subject

to wearing of corrective glasses while exercising the privileges of his license. His flying experience was as follows:-

			Total Hrs.
i)	Total Flying Experience		1596.30
ii)	Total Flying Exp. as PIC		1309.30
iii)	Total Flying Exp. as PIC on C-90		894.25
iv)	Flying Exp. during last	90 Days	33.35
		30 Days	8.50
		07 Days	NIL
		24 Hours	NIL

1.5.2 Second Pilot

1.5.2.1	Name	:	Capt. Ritu Malik
	Date of Birth	:	01st May 1980
	Age	:	21 Years 04 Months
	Details of License	**:**	
	- Commercial Pilot's License No.	:	3811 issued on 20-04-2000 Valid till 19th April 2002
	- FRTO No.	:	7849
		:	Valid till 19th April 2002
	- RTR No.	:	9957
		:	Valid till 27th Sept., 2004
	- Last Med. Exam.	:	11th Dec., 2000
	- Endorsements	:	Cessna 152A, King Air C-90

Capt. Ritu Malik was a Flying Club product (Haryana Institute of Civil Aviation, Karnal) and apart from being a Commercial Pilot was also a Computer Engineer from MD University, Rohtak, Haryana. Capt. Ritu Malik got her endorsement on type (C-90) from Indira Gandhi Rashtriya Udan Academy and this was her first flight after endorsement as Second Pilot on King Air C-90 Aircraft. Her

Endorsement Test day/night and IR Test were carried out by Air Cdme. Praveen Badhwar on 22nd August.,2001, 4th September 2001 and 3rd September 2001 respectively. Capt. R.R. Rao was her simulator instructor and she had flown for 15 hours on King Air C-90A aircraft and 10 hours on simulator at IGRUA. Capt. Ritu Malik was medically examined on 11th Dec.,2001 by Air force Central Medical Establishment and was found to be medically fit. She joined the Jindal Group in September 2001. Her flying experience was as follows:-

			Total Hrs.
i)	Total Flying Experience		271.40
ii)	Total Flying Exp. As P1		189.40
iii)	Total Flying Exp. On Type		19.40
iv)	Experience during last	90 Days	19.40
		30 Days	4.40
		07 Days	NIL
		24 Hours	NIL

1.6 AIRCRAFT INFORMATION

1.6.1 King Air C-90 aircraft Sl.No. LJ 705 is a low wing light weight transport aircraft powered by two turbo-prop PT6A-21 engines and is capable of carrying six passengers plus two crew members and was manufactured by M/s Beechcraft Corporation now known as M/s Raytheon Corporation Witchita Kansas USA in the year 1977. The aircraft is fully equipped with instrumentation, weather radar and auto pilot system and hence operational for operations by day and night. Aviation Research Centre (ARC) under cabinet secretariat was the first owner of the aircraft from the year of manufacture 1977 to 1987. The first Certificate of Airworthiness (C of A) bearing no. 1882 was issued by Civil Aviation deptt. on 12th May 1987. Present C of A indicates the aircraft registered under normal category and sub-division pax aircraft. The C of A was last renewed on 16.04.2001 and was valid till 24.10.2001. The max. authorized all

up weight of aircraft as per C of A is 4377.18 kgs. The aircraft was registered vide Certificate of Registration (C of R) no. 2170/4 in category 'A' on 22.12.1997 with M/s Birla Global Finance Ltd., New Delhi as the owner and M/s Jindal Strips Ltd., New Delhi as the operator. The maintenance agencies of aircraft have changed from ARC (the original owner) to Indamer Co. Bombay to Saraya Aviation, New Delhi. The aircraft was last maintained by M/s India International Ltd., New Delhi. Jindal Strips Ltd. has operational set up of their own and is in possession Air Taxi Operator (ATO) permit with VT-EFF designated for Air Taxi Operation. The aircraft was sent to Taneja Aerospace & Aviation Ltd. for replacement of both engines after overhaul, change of both the propellers, installation of GPS, auto pilot and transponder. Aircraft was repainted at TAAL and C of A was renewed after wt. and balance check.

1.6.2 M/s India International Airways carried out Phase II inspection as the last major inspection on 21.07.2001. Last Flight Release Certificate (FRC) was issued on 25.9.2001. Hot Section Inspection (HSI) on engine no. 1 was carried out by Saraya Aviation on 02.05.2001. Radio certification was valid till 02.10.2001 and Aero mobile license no. A350 valid till 31.12.2001. Prior to the last flight aircraft flew on 27.9.2001 with Wg Cdr.(Retd.) M.M. Verma in command on Delhi/Kulu/Chandigarh sector and no snag was reported.

1.6.3 Details of maintenance standards, incidents/accidents met by this aircraft during its ownership with ARC are not available. However, after this aircraft was purchased by Indamer Co. Bombay in the year 1987 on as is where is basis and thereafter during its history as a Civil registered aircraft, the incidents/accident reported in the log books are as under:-

i) On 19th Sept.,1993 aircraft made a belly landing at Pune and remained on ground till the beginning of 1995 during which period major repair of the aircraft bottom surface including change of stringers, skins, bulk heads along with major

changes of landing gear system was carried out by Indamer Co. Bombay as per the approved repairs schemes;

ii) The aircraft had abrasion marks and propeller tip bent on Left Hand Side (LHS) as a result of landing at unpaved runway at hospet on 28th May,1997. Rectifications were carried out and the aircraft declared serviceable by Indamer Co. Bombay.

The record of flying hours prior to commencing the flight on 30th September 2001 is summated and given hereunder:-

1.6.4. **AIRFRAME HOURS**

I	Total Hours since new	8083:00
II	Total landings since new	7008:00
III	*Hours* since last C of A renewal (on 16.04.2001)	89.05
IV	Hours since last Ph.II (on 28.07.01)	25:20
V	Hours since last FRC (on 25.09.01)every 50 hrs./30 days	02:45

1.6.5.

	ENGINE HOURS	**Left**	**Right**
I	Engine Serial No.	PCE24383	PCE25376
II	Hours since new	6661:05	4083:35
III	Hours since last overhaul (TBO 3600 hrs.)	3113:00	572:25
IV	Date of overhaul Date of H.S.I.	08.08.1991 02.05.2001	11.08.99 Not due
V	Hours since C of A	89:05	89:05
VI	Hours since FRC (on 25.09.01)	02:45	02:45
VII	Hours since last Ph.II	25:20	25:20

1.6.6 **PROP HOURS**

I	Propeller Serial No.	FY1905	FY1904
II	Hours since new	572:25	572.25
III	Hours since Last O/H	572.25	572.25
IV	Hours since Cof A renewal	89.05	89.05
V	Hours since last FRC	2.45	2.45
VI	Hours since ph.II	25.45	25.45

1.6.7. The only snags reported and the rectification work done after the C of A renewal on 16.04.2001 is as follows:

Transponder U/s - U/S Transponder replaced with Serviceable Transponder Sl.No. 83503239 checked on ground and found satisfactory.

1.6.8. At the time of take off, the aircraft had all up wt. of 4464.906 kgs. against authorized max. take off wt. of 4590.909 kgs.as per weight schedule and 4377.18 kgs. as per C of A.

1.6.9. The primary flight controls consisted of ailerons, elevators and rudder and are operated manually from dual cockpit controls. Secondary flight controls consisted of:

i) Electrically operated flaps

ii) LHS aileron trim tab and rudder tab

iii) Electrically operated trim tab operated by split switch on the control column.

iv) The position of the electrically operated flaps is indicated in the cockpit on flap position indicator . The aircraft can be electrically trimmed by auto pilot without effecting manual operation.

1.6.10. Stall warning system is available to give audiovisual indication of the on set of stall condition. Discrete signal from lift transducer and sensing unit closes the circuit to warning horn and indicator light at speeds 7 to 9 miles per hour above the stalling condition. The transducer is protected against icing by heating elements on the vane and mounting plate to facilitate system operation during inclement weather.

1.6.11. The complete airframe is a semi monocoque construction. The fuselage is pressurized to the skin between bulkhead at FS 84:00 and FS 298:00. The wing center-section is integral part of the fuselage. The cabin entrance door on the left side of the fuselage swings down. Emergency exit hatch is installed on the right hand side of the fuselage at the rear cabin window. Individual passenger seats are provided and the front seats may be installed facing either forward or aft . In case of VT-EFF the forward seats were facing aft.

1.6.12. The wing consists of a center-section and two outboard wing assemblies. Centre-section provides structural support for engine nacelles and outboard wing assemblies. Outboard wing assemblies are attached to the center-section with eight tension bolts located at the spar attachment point on each wing. The center-section and outboard wing assemblies are semimonocoque box construction having two main spars (front & rear) of I section and two sub spars. The 2area between sub spar and main spar is used to route engine controls, plumbing and wiring etc. Subspar located forward of the rear spar provides tunnel for control cables & shafts and serves as fuel wall for bladder tanks from root rib to the nacelle. The major fittings in each wing & center section provides supporting structure/attachment points for flap actuator, flap tracks, flaps, aileron, main landing gear, drag legs and landing gear doors.

1.6.13. The empennage in the zone 300 is between FS-340:00 to station 393:90. The fin keel surface starts from FS-255:50 and ends at

station FS-352:00. Similarly the bottom stabilizers are located between FS-277:00 to station 415:96. The fin starts at FS-352:00 and ends between station 380 and 393:90. Rudder is hinged at three-hinge points to the fin and has rudder trim tab operated mechanically from the cockpit. The horizontal stabilizer is in zone 350 attached to the fuselage at station 340 to 380:00.

1.6.14. The engine PT 6A–21 fitted on this aircraft incorporates auto feathering system by means of dumping oil from the propeller governor to enable the feathering springs to start feathering the propellers as soon as engine torque meter oil pressure drops below 6.5 PSI at power settings of 90% N1 or greater. The system is actuated by placing the auto feather arm switch in the left sub panel to the arm position. Once the governor oil pressure drops to zero and the propellor on the effected engine are feathered fully, the auto feathering system of the other engine is disarmed through the hook up between high pressure switches and arming relays of the right and left system. For testing purposes the auto feather arm switch is equipped with the test position by which the power switch in pedestal can be by passed to check out the system with power levers retarded below 90% N1 position.

1.6.15. This aircraft was originally installed with 3 bladed hartzell propeller which continued in operation with the aircraft till Raisbeck engineering modification was carried out. The change from 3 bladed propeller to 4 bladed constant speed reversing and feathering propeller model HC-D4N-3C along with dual aft body strakes covered under Supplementary Type Certificate STCSA3593 NM and STCSA4010 NM was carried out by M/s Taneja Aerospace Aviation Limited. These modifications as a measure of improvement in efficiency are approved by FAA and manufacturers have not commented either in favour or against this modification. The 4 bladed propeller installed on this aircraft has got a anti icing system which operates in the manner as it does on a 3 bladed propeller. The leaflet on Raisbeck engineering modification indicates increase in all

up weight from 4,377.18 kgs. to 4590.909 kgs. but the same was not reflected by M/s Taneja Aerospace Aviation Limited in the revised weight schedule or in the Certificate of Airworthiness Performa because the proposed increased in all up weight was subject to changing the aircraft tyres to ten ply rating but VT-EFF had only eight ply rating tyres. However, a revised weight schedule was issued by M/s India International Airways on 2nd July 2000 and max. all up weight has now been authorized as 4590.909 kgs. since M/S India International Airways has changed over to ten ply rating tyres.

1.6.16 As stated in the preceeding paragraphs, the log-books available from the beginning were scrutinized to check the following :-

i) The reasons for difference in all up weight mentioned in the C of A Performa (4377.180 kgs.), weight schedule provided M/S Taneja Aerospace and Aviation Limited(4377.180 kgs.) dated 17th Nov.,1999 and subsequently declared by India International Airways (4590.909 kgs.). The Committee asked Indian International Airways to comment on the permissibility increase in all up weight of the aircraft if the Raisbeck Engineering Modification was done partially. IIA stated that all up weight increase is linked to carrying out the modification to be done inclusive of change of main tyre from 8 ply to 10 ply rating and duals aft body strakes.

ii) In the aircraft log-book no. 3 & no. 4 discrepancies in the next higher phase inspection to be carried out were noticed and the maintenance agency was asked to explain as to how phase II inspection was carried out whereas actually phase III inspection should have been done in conformity with AIC circular no. 4 of 2000 w.e.f. i.e. 5th Sept.,2000. The Quality Control Manager attributed the cause to new schedule not having been approved and in any case phase II inspection was carried out between 7th Sept., 2000 to 13th Sept.,2000. Subsequently phase III inspection was carried out between

13th Oct.,2000 to 19th Oct.,2000 after downgrading the schedule by 80% as called for in the AIC 4 of 2000. However, it has been revealed that the complete phase inspection from phase I to phase IV has been completed in time and all subsequent inspections have been carried out as per the revised schedule prior to the date of accident. This minor variation from the concept of continuous maintenance system has not attributed to the cause of accident either directly or indirectly.

iii) The Quality Control Manager explained the reasons for carrying out the duplicate inspection on 23rd March 2000 (a day earlier than the main inspection was completed (24th March 2000) that it was a typographical error and asked for condoning the same.

1.7 METEOROLOGICAL INFORMATION

1.7.1 Met . Briefing and Weather at Departure Station

Capt. Vivek Gupta , Pilot-in-Command of the flight received Met. Briefing at IGI Airport on 30th Sept.,2001 at 05:43 UTC. He was given the Met. Forecast folder covering enroute weather conditions which included possibility of isolated turbulence with rain, moderate to severe turbulence and icing in Cumulonimbus(CB) clouds. He was briefed that visibility was likely to reduce to 1500 meters from 4000 meters in thunderstorm with rain.

1.7.2 As per the Met. Briefing Officer the pilot was also briefed about the synoptic situation for the route and development of cycir over South West, Uttar Pradesh and adjoining North Madhya Pradesh. During briefing the Pilot asked for Kanpur metar however, the Briefing Officer could not provide him that as it was not available. The pilot, at his request, was provided with 05:30 UTC Lucknow metar. He was shown and briefed on the latest 04:45 UTC Delhi radar report.

On the radar report there were two significant cumulonimbus cloud echoes - - one at 110 degrees 30 NMs having 6 kms. height and the other were at 160 degrees 25 NMs having 6 kms. height.

1.7.3 The pilot after getting the Met. Briefing went through the satellite picture display unit and got himself self-briefed of 03:00 UTC satellite picture.

1.7.4 The aircraft taxied-out at 07:05 UTC from the tarmac of IGI Airport and got airborne at 07:11 UTC from runway 10. The prevailing surface wind was 090^0, 15kts.

The current weather observations pertaining to IGI Airport from 06:30 UTC to 07:30 UTC are reproduced below:

METAR VIDP 300630Z 12010 DT 3500 HZ FEW 040 FEW040CB SCT100 32/20 Q1008 TEMPO 1500 TSRA (.)

METAR VIDP 300700Z 12012KT 3500HZ FEW040 FEW040CB SCT100 30/19 Q1008 TEMPO 1500 TSRA (.)

METAR VIDP 300730Z 10010KT 3500HZ FEW040 FEW040CB SCT100 31/20 Q1007 TEMPO 1500 TSRA (.)

1.7.5 The current weather observations of IGI Airport on the day as recorded in Para 1.7.4 above had 1 to 2 Octas of CB clouds at 4000 ft. (1200 meters) with the trend forecast – temporary visibility reducing to 1500 meters in Thunder Storm with rain was recorded and reported through out the period from 05:30 to 07:30 UTC.

1.7.6 **Weather at Terminal and Adjoining Stations**

1.7.6.1 **IAF, Agra** -- Current weather observations of IAF Agra are reproduced below:

METAR VIAG 300530Z 32010/15KT 2000 TS/RA 4ST006 4ST008 2SC/CU020 1CB030 6AS090 25/XX 1006(.)

METAR VIAG 300630Z 32010/20KT 2500 TS/RA 4ST006 4ST008 2SC/CB025 6AS090 25/XX 1006(.)
METAR VIAG 300730Z 09005KT 2500 95TS 4ST006 4ST008 2SC/CB025 6AS090 27/XX 1005(.)

METAR VIAG 300830Z 09005KT 2500 95TS 4ST008 1TCU/CB040 6AS090 27/XX 1005(.)

METAR VIAG 300930Z 09005KT 2500 95TS 4ST008 3SC015 1CU/CB025 7AS090 27/XX 1004(.)

1.7.6.2 The observations indicate thunder storm with rain. Thunderstorm was reported by the station throughout the period with multi-layered low clouds associated with convective clouds . From 05:30 to 07:30 UTC 4 Octas of Stratus Clouds at 600 Feet (180M), another layer of 4 Octas of Stratus Clouds reported at 800 feet (240M) and 2 Octas of SC/CB at 2000 Feet (600 M) and 2500 Feet (750M) respectively are reported.

1.7.6.3 **IAF Kanpur (Chakkeri)** -- Current weather observations of IAF Chakkeri- from 05:30 to 09:30 are reproduced below:

METAR VICX 300530Z 09010/20KT 6000 2SC/1CU020 1CI250 34/XX 1000(.)

METAR VICX 300630Z 09010/20KT 8000 2SC/CU020 2SC030 34/XX 1000(.)

METAR VICX 300730Z 09010/15KT 8000 2SC030 2SC/CU035 1CI250 35/XX 1000(.)

METAR VICX 300830Z 09010/15KT 8000 2SC/CU030 1CI250 36/XX 1003(.)

METAR VICX 300930Z 09010/15KT 6000 2SC/CU030 35/XX 1003(.)

There was no significant cloud reported by the Station.

1.7.6.4 **Met. Centre Lucknow**-- Current weather observations from 05:30 to 09:30UTC as documented by Met. Centre Lucknow are reproduced below:

METAR VILK 300530Z 14008KT 6000 FEW025 SCT030 33/26 Q1007 NOSIG(.)

METAR VILK 300630Z 12008KT 6000 SCT025 SCTO30 34/25 Q1006 NOSIG(.)

METAR VILK 300730Z 12008KT 6000 SCT025 SCT030 34/25 Q1006 NOSIG(.)

METAR VILK 300830Z 12010KT 6000 SCT025 SCT030 35/25 Q1004 NOSIG(.)

METAR VILK 300930Z 12008KT 6000 SCT025 SCT030 34/25 Q1003 NOSIG(.)

No significant cloud was reported by the Station

1.7.6.5 **Met. Centre Gwalior** -- Current weather observations from 05:00 to 09:00 UTC are reproduced below:

METAR VIGR 300500Z 05002KT 5000 HZ SCT018 SCTO025 BKN100 30/25 Q1007(.)

METAR VIGR 300600Z 16003KT 6000 SCT020 SCT025 FEW040CB 32/25 Q1007(.)

METAR VIGR 300700Z 20003KT 6000 SCT020 SCT030 FEW040CB BKN100 32/33 Q1005(.)

METAR VIGR 300800Z 32005KT 6000 SCT018 SCT025 FEW035CB 32/23 Q1004(.)

SPECI VIGR 300830Z 32006KT 2000 TSRA FEW008 SCT018 FEW035CB BKN100 29/23 Q1005(.)

METAR VIGR 300900Z 32008KT 3000 TSRA SCT010 SCT018 FEW035CB BKN100 26/24 Q1005(.)

1.7.6.6 As per the observation 1 to 2 Octas of CB cloud at 4000 Feet (1200 M) was reported at 0600 & 0700 UTC. At 0800 UTC, the base of the CB cloud lowered to 3500 feet (1050 M). SPECI was reported at 0830 UTC when the visibility had reduced from 6000M to 2000M with associated Thunderstorm and rain. At 0900 UTC station reported visibility 3000M associated with Thunderstorm and rain.

1.7.6.7 Synops of Mainpuri , Etawa , Lucknow and Gwalior with plain language interpretation are attached with the report as Appendix – F-1 & F-2.

1.7.7 Satellite Imageries

Satellite Imageries of 03:00,06:00,08:00 and 08:30 UTC of 30th Sept.,2001 have been obtained from India Meteorological Department and are attached as Appendix – F-3 & F-10

i) Inference from Satellite INSAT-I D Visual and Infra-Red imageries picked up at time 03:00UTC is attached as Appendix – F-3 & F-4.

It is inferred from the imageries that there were scattered weak to moderate convection seen in cloud cluster oriented in NE-SW direction with Southern boundary stretching along central parts of West Uttar Pradesh plains. Coldest cloud top temperature were of the order of –03 deg. C around point marked in IR imagery and isolated low and medium cloud at Mainpuri (point market in imagery)

ii) Inference from Satellite INSAT – 1D Visual and Infra-Red (IR) Imageries picked up at 06:00 UTC attached as Appendix- F-5 & F-6 is as below:

There was cooling of cloud top from 03 UTC. Coldest cloud top temperature around Mainpuri was of the order of – 30.0 deg. C (at point marked in IR imagery of 06 UTC) and 2 deg C of clouds at Mainpuri.

iii) Inference from Satellite METEOSAT Water Vapour and Infra-Red Imageries picked up at 08:00 UTC attached as Appendix-F-7 & F-8 is as below:

The convection was now intense with coldest cloud top temperature of the order of – 55 deg C were seen near Mainpuri. As seen from the Water Vapour & IR imagery the Southern boundary of cluster of convective cloud had moved southward. Mainpuri was just close to this Southern boundary and just inside the convective cloud mass referred above. (Mainpuri marked as in IR imagery)

iv) Inference from Satellite METEOSAT Visual and Infra-Red imageries picked up at 08:30 UTC attached as Appendix – F-9 & F-10 is as below:

Intensity of the convection in the band was increasing as cloud top temperatures were of the order of –66 deg C. near Mainpuri. Area of the convective cloud mass has slightly increased and Mainpuri was very close to Southern boundary of the cloud mass & still inside it.

1.7.7.3 Radar Observations

IGI Airport -- Duty Met. Briefing Officer on 30th Sept.2001 who had briefed the Pilot-in-Command of the ill-fated aircraft has stated that he had shown and briefed the Echoes recorded at 0445 UTC on the Radar observations as follows:

RAREP VIDP 42181 300445 UTC WDLY SCT 360/022 035/032 120/077 150/085 180/025 MDT VAR MATRE ALTD 050/05/022 110/06/030 160/06/025=

The cloud echoes were of Moderate Variable Mature altitude at 50 degrees; 22 NM (44 KM) with thickness of convective cloud of 5 KM. The second echo was at 110 degrees; 30 NM (60 km) with thickness of 6 KM. The third echo was at 160 degrees; 25 NM (50 KM) with thickness of 6 KM.

Radar observations recorded at 0545, 0645, 0745 & 0845 UTC are given below:

RAREP VIDP 42181 300545UTC WDLY SCT 360/035 105/100 145/095 200/035 MDT VAR MATRE ALTD 020/06/020 100/06/020 135/05/065=

RAREP VIDP 42181 300645UTC WDLY SCT 020/045 102/095 145/065 120/005 MDT VAR MATRE ALTD 040/04/035 100/06/012 140/05/058=

RAREP VIDP 42181 300745 UTC WDLY SCT 020/035 035/080 115/095 175/120 MDT VAR MATRE ALTD 055/06/058 105/05/075 165/06/100=

RAREP VIDP 42181 300845UTC ISOL 040/074 MDT VAR MATRE ALT 040/04/074 ISOL 190/072 MDT VAR MATRE ALT 190/05/072=

The Radar observations reveal that there were widely scattered clouds up to 0745 UTC giving more evidence of Echoes in the South-East sector of Delhi between IGI Airport-Aligarh areas.

1.8 AIDS TO NAVIGATION

The aircraft for the purpose of navigation was equipped with following equipments:

S/N	EQUIPMENT	Type/Model	Sl.No.
1	GPS,VHF NAV/COM No.1	GARMIN GNS 430	96302320
2	VHF NAV/COM No. 2	Kings KX-165	47300
3	ADF Receiver	Kings KR 87	28310
4	DME Transceiver	Kings KN-63	6754
5	Radio Magnetic Indicator	Kings KI 229	9229

In addition to the above navigational equipment the aircraft was also fitted with Transponder , make Garmin GTX 320 bearing Serial No. 83201364 mode A & C for transmitting position identification and standard pressure altitude (29.92 inches of Hg) information which is picked up by ATC radar for controlling and monitoring progress of the flight. The accidented aircraft on the day was under radar surveillance with ATC IGI Airport, New Delhi. On examining the video recording of the ATC radar display, it has been confirmed that the pilot was on assigned track and had deviated right of track at 42

NM from Aligarh as approved by ATC. Apparently the pilot had no difficulty in navigating the aircraft.

1.9 COMMUNICATIONS

The aircraft was fitted with following equipments for two way RT communication :

S/N	EQUIPMENT	TYPE/MODEL	SL.NO.
1	GPS,VHF- NAV/COM No.1	GARMIN GNS 430	96302320
2	VHF NAV/COM No.2	Kings KX-165	47300
3	HF COM REC/EXCTR	Kings KTR-953	5869
4	HF COM ANT/CPLR	Kings KAC 952	6099
5	HF COM CONTROLLER	King KCU 951	6927

The RT communication since initiation of the flight made by the pilot with ATC Delhi -- Surface Movement Controller, Aerodrome Controller, Terminal Area Radar Controller, Route Surveillance Radar Controller, ATC Agra and ATC Lucknow were on recorded channels on ATC tapes maintained at the Aerodromes. Replay of the ATC tapes covering all the frequencies have confirmed that the pilot and the ATC Controllers had no difficulty at any stage to maintain two way RT communication.

The pilot after reporting ALIGARH had also established RT contact with ATC Kanpur and the communication in the absence of RT recording facility at Civil Aerodrome Kanpur was documented in ATC RT Log Book. As per records the pilot had normal conversation with ATC Kanpur Civil Aerodrome.

1.10 AERODROME INFORMATION

The aircraft met with the accident while flying enroute to Kanpur and cruising at FL–150. The departure aerodrome IGI Airport and the

destination aerodrome Kanpur Civil were operational and had adequate ground facilities for safe take off and landing of the aircraft.

1.11 FLIGHT RECORDERS

The aircraft was neither fitted with any of the flight recorder nor it was mandatory to be installed on the aircraft type. The manufacturer has intimated that CVR/FDR is not fitted on this aircraft.

1.12 WRECKAGE AND IMPACT INFORMATION

The aircraft with its truncated outer wings and tail section was located at village Bhainsrolli, Distt. Mainpuri , Uttar Pradesh under Police Station Bhaogaon. Coordinates of the accident site as established with help of GPS and Area Map are Latitude 27^0 18' 19 " North and Longitude 079^0 15' 16" East at elevation 143 meters above mean sea level .

The accident site is a wide open plain cultivated field and the surrounding was clear of trees/bushes. Trees located at far off distances around the accident site were found undamaged indicating that the aircraft did not pass through any of the surrounding trees before the final impact.

1.12.1 Fuselage

At the accident site fuselage structure was found without its tail section. The complete horizontal tail surface, the vertical fin and the control surfaces along with rear portion of fuselage structure, aft of station no. 372:00, were found separated and missing.

Lower portion of fuselage cell and wing center-section were found flattened and skin pressed-in between frames, stringers, longerons and stiffeners. Major portion of fuselage lower half was found buried in the cultivated field. Fuselage interior and upper structure were

found extensively consumed in post impact fire and destroyed. There was no evidence of pre –impact fire.

Available portion of fuselage is from station no. 35.69 to 372.00. The nose cone which is made out of synthetic material was found separated and lying adjacent to the wreckage with its lower surface crushed and damaged however, the nose cone had retained its shape.

Upper Left portion of fuselage structure adjacent to station no. 228 i.e. forward of main door housing was found split along the frame. The lower portion of the fuselage structure was still integral with nose and rear section of the fuselage. The partially separated rear section of the fuselage had rolled to its left by about 90 degrees.

Forward half of the fuselage ahead of the aircraft main entry door was pointing towards magnetic heading 350 degrees whereas rear half of the fuselage was on magnetic heading 330 degrees. Apparently upper structure of the fuselage on account of heavy vertical impact had opened up along station no. 228.

1.12.1.1 **Nose Section**

Nose section of the fuselage from station no. 35.69 to 94.00 was found in shape. Upper portion of nose section skin ahead of windshield was found wrinkled without any evidence of telescopic action.

Upper half of fuselage frames including front pressure bulkhead and vertical panel of baggage compartment were found inclined forward.
Baggage compartment panel on port side and Avionics Compartment panel on the starboard side were found detached and lying at a distance of about 5' ahead of its position. No evidence of fire damage or soot deposit was noticed on the detached panels.

The nose section was apparently crushed vertically on impact and its top structure including the skin drifted forward. Interior of the nose section was found heavily covered with soot deposits with evidence of exposure to fire and high temperature.

1.12.1.2 Fuselage Mid Section

Fuselage mid section from station no. 94 to 228 i.e. from wind-shield to forward of main entry door was found extensively damage and consume in post impact fire.

A portion of fuselage structure along with its skin measuring 56" x 50" from station no. 176.5 to 220 housing two left side passenger windows was found separated and lying around 20 ft. from its position. Outer as well as inner surfaces of the separated structure were found free from evidence of fire damage or soot deposits.

Emergency escape hatch installed on starboard side of the cabin was found separated along with housing structure and was lying next to its position. Operating handle of the emergency escape hatch was in locked position. The complete structure was found heavily damaged on both sides due fire.

Lateral members of seats occupied by the pilots and passengers were found heavily bowed and the bottom supporting structure crushed.

Both the wind –shields of the cockpit were found heavily shattered and damaged with evidence of exposure to profuse heat and fire. The complete cockpit as well as mid section of the fuselage interior furnishing and the upper structure were found consumed in post-impact fire .

Anti-collision light assembly installed at lower surface of the fuselage mid-section was handed over to the committee on 22nd November

2001 at Bhainsrolli Village by a villager. Top glass cover of the light assembly was found missing, however, the bulb was intact. Filament of the bulb was found stretched and elongated downwards from the installed position.

Most of the cockpit instruments, and panels housing circuit breakers/switches were destroyed in the fire.

1.12.1.3 Fuselage Rear Section

Rear section of the fuselage from station no. 228 to 372 i.e. from frame forward of aircraft main entry door up to the available structure of tail section had rolled to its left by about 90 degrees however, bottom skin and the structure were attached with the mid fuselage.

Bottom skin of the fuselage was found pressed-in between stringers, longerons and frames. Belly of the fuselage aft section, rear of the pressure bulk-head had flatten and the skin structure on either side more or less equally wrinkled. The observation indicates that the rear cells of the fuselage had hit the ground on its belly and subsequently rolled to its left.

Rear section of the fuselage, primarily RH side structure was found badly affected and consumed in post impact fire.

1.12.2 Wings and Centre-Section

Both wings were found rigidly bolted with wing center-section and the center-section was structurally integral with the fuselage cell.

Outer wing structure of both the wings was found torn and separated. About 7 ft. of the port wing, outboard of the wing to center-section attachment along with trailing edge flap was found in its position. Major portion of the wing structure especially the area

housing fuel tanks were found consumed and badly damaged on post impact fire. Similarly on RH wing , the structure housing fuel tanks were profusely consumed in post-impact fire. About 7.5 ft. of front spar and 11 ft. of rear spar from wing to center-section attachment were found in position.

About 32 inches of port side inner aileron along with trim tab was found torn and separated from its remaining structure . Similarly, about 32 inches of starboard aileron was found torn and separated from its structure. The aileron surfaces were found separated from the respective wings along with hinged fittings. The leading surfaces were found flattened at places and around the area of tearing .

Evidences on wing top skin pulled out of riveted joint and saw pattern tearing along rivet row at several location on the wing structure were noticed.

Examination of wing trailing edge flaps outboard structure on both the wings along with retrieved separated portion of inboard aileron have revealed that at some stage of the flight the wing structure had considerably flexed rearwards crushing the inboard edge of the aileron against outboard edge of the flap surface.

A portion of unburnt rear spar on the starboard wing outboard of wing fuel tanks bear distinct evidence of wing spar folding upwards as well as twisting clockwise as viewed from the cockpit . The rear spar was also bent rearwards.

Trailing edge flaps were found attached to the wing structure. All the flap surfaces were fully up and also all four actuators of the flap surfaces were in confirmatory to the flaps remaining fully retracted.

The separated structure of outer wings were found torn in number of pieces and spread up in the areas towards East and North East of the main wreckage covering up to 3 to 4 kms. It is pertinent to

mention that Mainpuri Distt. was severely affected by thunderstorm associated with rain and strong winds from the Westerly direction when the aircraft was passing overhead this area.

Wing center-section was found structurally rigid and attached with the fuselage as well as the wings . The structure housing fuel tanks were extensively consumed and destroyed in post-impact fire.

Top flange of wing center-section spars were found tilted forward i.e. the top flange of spar beams had move forward with respect to the bottom flange.

The bottom flange of the front spar about 22" from the wing attachment point on RH side and about 24" from wing attachment on LH side were found buckled upward, confirming structural deformation due compression load on bottom flange of the spar.

1.12.3 Landing Gears

All three landing gears were found fully retracted in their respective housings with doors in closed position. However, landing gear lever in the cockpit was jammed in down position. It is quite probable that with deformation of fuselage upper structure the cable operated by the lever might have got pulled thereby shifting the lever to down position.

1.12.3.1 Vertical Tail Surface (VTS)

Vertical Tail Surface (VTS) i.e. Fin was retrieved in undamaged condition from nearby village. The VTS was found about 600 meters East of the accident site .

The surface was found and separated from its root attachment with fuselage rear structure. The pattern of structural deformation i.e. outward opened flanges and buckled structure at the torn edge of

the spars were indicating that the VTS had encountered abnormal load rearwards at the time of structural separation.

The dorsal fin made out of synthetic material was found attached with fuselage structure. On the RH side of the fin surface about 27 inches from its tip a semi circular impact mark measuring about 6 inches in diameter was observed with black smear .

The rudder control surface was not attached with the VTS . The hinge fittings on the fin for attaching the rudder control surface were found torn and separated from the fin.

1.12.4 Horizontal Tail Surface (HTS)

1.12.4.1 Port HTS

Port Horizontal Tail Surface was found torn and its structure stripped in number of pieces. Leading surface of the structure was found with deep and blunt chordwise dents . The structure had opened up from a deep dent with chordwise tear at about 32 inches from root. The main spar up to the 7th rib towards tip was found naked and bent rearwards at 3 locations. A separated piece of outboard structure measuring about 60 inches from tip and retaining leading edge surface along with tip cap was found deeply dented on its leading edge. Deep crimpling of skin surface was also noticed. The evidences available on leading surface and scoring on outer skin signify chordwise hit by blunt objects.

1.12.4.2 Starboard HTS

Horizontal Tail Surface of the starboard side was found separated from fuselage structure and torn primarily in two pieces. The outer piece was about 59 inches long and the inboard piece was 32 inches long. The leading surface at the location of tear initiation has a deep chordwise dent. Outer portion of separated HTS has an evidence of severe twist in clockwise direction as seen from root. The separated surfaces revealed evidences of chordwise hits on the leading edge surface, with subsequent tearing and twisting of the structure.

1.12.4.3 Elevators

Both port and starboard elevator surfaces were found torn and separated along with respective attachment fittings on the HTS trailing edge. Port and stbd. elevator surfaces were also found separated from each other at the root flange fitting. Elevator horn of both sides housing mass balance at outer ends were found torn and separated. The elevator surfaces were found torn and buckled appreciably. On LH elevator the trimmer surface was found attached and with its skin torn at 22 inches from its inboard end. The inboard surface of LH elevator trimmer was also dented from bottom and deformed. Elevator trimmer on RH side was bent from bottom and in the process of getting separated from elevator surface along with its hinge fitting.

1.12.5 Engines and Propellers

1.12.5.1 Port Engine

Port engine was found separated from the attachment points at the wing and was lying 45 inches forward and 54 inches outward. Upper aft cowling was in position. Front upper cowling had separated and was lying near the engine. Lower cowling was found crushed. Firewall was found crushed and had fire damage. Fire damage was

observed aft of the fire bulk head. However, there was no fire damage forward of the bulk head. Generator was found out of its clamped fitting.

1.12.5.2 **Port Propeller**

The port propeller with its drive shaft was found separated from the engine. All the blades were in feathered position. Spinner was found flattened from the side. Three blades were found buried in the ground. Slight fire damage was observed on the exposed blade.

1.12.5.3 **Starboard Engine**

It was found separated from the attachment points at the wing attachments and was lying 45 inches forward and 120 inches outward. Firewall was damaged due to fire and impact. Severe fire damage was observed aft of the fire bulkhead. Front upper cowling was in position. Aft cowling was found extensively burnt. Metal puddles were observed.

1.12.5.4 **Starboard Propeller**

It was attached with the engine and all the blades were in feathered position. Fire damage was observed on propeller blades. The blades were found bent. Spinner was found flattened from side.

1.13 MEDICAL AND PATHOLOGICAL EXAMINATION

In the accident all occupants i.e. the two flight crew and all six passengers received fatal injuries including burns. The flight crew Capt. Vivek Kumar Gupta and Capt Ritu Malik were found fastened respectively on left and right seats in the cockpit.

1.13.1 Past Medical Records

1.13.1.1 Capt. Vivek Kumar Gupta (Pilot-in-Command)

Capt. Vivek Kumar Gupta, 33-years-old pilot was born on 27 July 1968. His past history reveals that he was declared Temporarily Unfit for Initial Issue of CPL on account of Divergent Squint in May 1988. He was declared fit in Feb 1989. He then reported for medical examination in Oct. and Nov. 1991 when an "Initial Issue Medical Exam" was redone since the individual had not got regular medical examinations done as required in the intervening period. He was advised exercises for his eyes at AIIMS, New Delhi and was found fit for Class I medical assessment on 04 Jan. 1992. Since then the Pilot had been having regular medical examinations and his last medical exam held at AFCME, New Delhi found him 'Fit-Class I Medical Assessment.' No limitations had been imposed on the pilot, except an advice to reduce weight.

1.13.1.2 Capt. Ritu Malik (Second Pilot)

Capt. Ritu Malik, 21-years-old female pilot was born on 01st May 1980. Her last medical examination was done at AFCME on 1st Dec.

2000. She had been assessed Fit-Class-I Medical Assessment, without any limitations. Her past history did not reveal any abnormality.

1.13.2 **Post Mortem Findings**

Post mortem examinations in respect of both pilots as well as all six passengers were conducted on 01 October 2001 from 0730 hrs. to 1530 hrs. at the All India Institute of Medical Sciences, New Delhi. The bodies were flown to Delhi from Agra, where they had been brought by road. Post mortem examinations were conducted by a team of Forensic Medicine Specialists from AIIMS, headed by Dr. T.D. Dogra, Head of the Deptt. Forensic Medicine. All post mortems were attended by Wg. Cdr. Deepak Gaur, DDMS(CA) as Expert Representative from DGCA. In addition to the gross examination of the bodies, the following samples/investigations were also carried out:-

a) Blood Samples for Carboxyhaemoglobin Analysis from bodies of aircrew and Late Shri Madhavrao Scindia. These were dispatched to Institute of Aerospace Medicine (IAM), IAF, Bangalore for analysis the same day by air through DGCA escort.

b) Piece of skin from body of Capt. Vivek Kumar Gupta for histopathological analysis at IAM, IAF, Bangalore. (also dispatched through DGCA escort)

c) Complete X-rays in respect of both aircrew.

All injuries sustained by the occupants of the aircraft have been summarized and tabulated in a matrix as reproduced below:-

Name	Burns	Perineum	Head& Face	Lower Limbs	Upper Limbs	Clothes
Capt. V. Gupta	75% Deep	Tear + # Symph Pubis	Mult # Brain exposed	Mult # bilat	Mult # bilat	Partly burnt more over upper half
Capt. Ritu Malik	100% deep-mod	Lacerated extensive	Mult # Brain tissue coagulated	Mult # bilat	Mult # bilat	Burnt & stuck to charred skin
M.R. Scindia	Superf burns, Total <40%	Lecerated Extensive	Mult # Brain matter partly absent	Mult # bilat	Mult # bilat	Partly Burnt
Rupinder Singh	Back only	Lacerated	Mult # Brain matter absent	Mult # bilat	Mult # bilat	Partly burnt
Ranjan Jha	Superf burns 80%	#Symph pubis	Contused laceration Rt frontal region	Mult # bilat	Mult # bilat	Partly burnt
Anju Sharma	Superf Burns <70%	#Symph Pubis & mult #pelv	Crush injury flattening anteropost	Mult # bilat	Mult # bilat	Partly burnt
GS Bisht	90% deep	Mult # Pubis	Mult # Brain matter absent	Mult # bilat	Mult # bilat	Partly burnt
Sanjiv Sinha	Superf thorax Lt leg	Lacerated extensive	Mult # Brain matter absent	Mult # bilat	Mult # bilat	V minor burm damage

1.13.3 **Injury Analysis**

The pilots and one passenger, Mr. Gopal Bisht sustained extensive and deep burn injuries. All other passengers sustained superficial burn injuries, which in their case could not have been the cause of sudden death. Perineal tears and lacerations were seen in five cases

and the other three had some public fractures. It can be inferred that all the occupants, including the aircrew, sustained severe decelerative injuries in the 'Z' (vertical) axis i.e. from buttocks upwards. This would mean that the aircraft impacted the ground with substantial vertical speed, which was enough to produce severe bony and internal injuries to the occupants. Similarly all occupants except Mr. Ranjan Jha, sustained extensive injuries to the face and head. This possibly was due to forward flexion on impact, also all occupants suffered injuries to the upper and lower limbs. Fractures, both simple and compound were seen mainly over the tibia-fibula and forearms. Fracture pelvis was also seen in four cases. Such injury patterns are common in accidents of light slow speed aircraft. Except for the aircrew, there was no evidence of injuries sustained due to seat belts. The seat belt was found in place, in a burnt condition on the waist of Capt. Ritu Malik.

1.13.4 **Timing of Burns**

The following facts helped in concluding that burns sustained by the occupants were peri-mortem (around the time of death):-

a) Carboxyhaemoglobin analysis report from IAM, Bangalore did not show presence of Carboxyhaemoglobin in any of the blood samples evaluated. This meant that there was no Carbon Monoxide poisoning of the bodies from whom the samples were tested. In turn, this meant that there was no smoke or fire in the cockpit and passenger cabin while the occupants were alive.

b) Evidence of presence of soot particles in the larynx and trachea of the occupants was suspected and confirmed in only one case – the Captain of the aircraft. Severe post/perimortem burns can produce such evidence. All other occupants did not reveal evidence of soot particles in their larynx/trachea.

c) Cause of death, in case of the pilots and Mr. Gopal Bisht, could have been due to decelerative injuries, or burns or both. However, in the case of all the other passengers, death occurred only as a result of decelerative injuries. This makes it highly probable that all the occupants died of decelerative injuries, and therefore, that the burns were post mortem/peri-mortem.

1.13.5 **Inference from X-Rays**

Complete post-mortem X-rays were carried out for both the pilots. X-ray did not reveal any metallic fragments in the soft tissue of the pilots. In the case of Capt. Vivek Kumar Gupta, there were fracture-dislocations of the C1 and C2 vertebra. In the case of Capt. Ritu Malik, spine showed anterior listhesis of the C2 over C3? Fracture C1 body and mild anterior wedging of D11 and D12 vertebrae. Multiple fractures of all four limbs in case of both the aircrew were noted. These findings suggest:-

a) There was no explosion on board, such as would have created metallic shrapnel to penetrate soft tissues of the pilots.

b) The pilots sustained severe decelerative forces in the vertical ('Z) axis, which produced fractures in their spines at various levels.

1.13.6 **Other Inferences**

All the occupants were fully clothed although clothes were partially burnt. It can be concluded that there was no structural failure at altitude, of those parts of the aircraft that housed the occupants (cockpit and passenger cabin), such that could have torn the clothes off the passengers due to ram air. By virtue of the fact that all the bodies were recovered from within or just adjacent to the crashed

aircraft, it can be further surmised that all occupants were within the aircraft at the time of the crash.

1.14 **FIRE**

Extensive portion of the aircraft wings, center-section and fuselage cell were consumed and destroyed in post impact fire. On the aircraft wreckage there was no evidence to indicate pre- impact i.e. in-flight fire. The villagers who had seen the aircraft in air have mentioned about noticing flames on rear of the aircraft.

Post mortem reports on the deceased have also revealed absence of carbon monoxide indicating that there was no fire/smoke inside the cabin/cockpit.

1.15 **SURVIVAL ASPECTS**

Fuselage cell of the aircraft housing the cockpit and the cabin was intact with the wing center section including the fuel tanks along with landing gears , both the engines and the propellors. Intensity of the impact as revealed on wreckage examination especially the occupants' seat it confirms that the ground impact was with appreciably high vertical momentum. Similarly the post-mortem report on the deceased have revealed that the death was due to impact injuries .

Under the above circumstances the accident was not survivable.

1.16 **TESTS AND RESEARCH**

1.16.1 The team of Air Safety Dte. Of Civil Aviation Department and representatives of India International Airways visited the site to carry out in depth examination of wreckage and examined the witnesses who had practically seen the aircraft in the last mode of the trajectory. Two scientists from NAL dealing with fatigue and structure were also involved. Committee of enquiry also carried out

their investigation of wreckage and examination of witnesses after briefing by the Dy. Director, Air Safety, Mr. P. Shaw. The wreckage was then brought to S'Jung Airport and laid in hangar no. 3 in the same manner as it was at the original site.

1.16.2 Since the copy of distress messages received from Indian mission Control center Bangalore for transmission of Emergency Locator Transmitter (ELT) did not contain any message emanating related to the aircraft VT-EFF, the services of Aircraft Radio Maintenance Engineer (ARME) from Border Security Force (BSF) and M/s India International Airways (IIA) were requisitioned. The report and the physical condition of ELT indicates unlikelihood of its operation.

1.16.3 Drawing the cue from the type of GPWS fitted in Airliners, efforts were made to ascertain if the GPWS of VT-EFF had activated and if the last mode (S) activation could be simulated from the left over memory circuit of GPWS. The complete cross section Aircraft Radio Maintenance Engineer dealing with these types of GPWS fitted on general aviation aircraft were found to be unanimous in stating that there is no memory circuit in these types of GPWS.

1.16.4 As seen from the wreckage, associated engine controls, instrumentation and other relevant inputs, it is seen that there was no sign of engine fire and that the possibility of both the engines having been feathered by the crew members in flight is not ruled out.

1.17 ORGANISATIONAL AND MANAGEMENT INFORMATION

1.17.1 Aircraft owned by Birla Global Finance Ltd. and operated by Jindal Strips Ltd. headed by Capt. Navin Jindal as Executive Vice Chairman and Managing Director. In the aviation wing, he is assisted by a number of pilots and a Manager Aviation Mr. Shatrughan Gaur. During the course of Safety Audit, M/S Jindal Strips Ltd. were having Air Taxy Operator's Permit under which this aircraft VT-EFF was

registered. They had however, not exercised the privileges of Air Taxi operator as yet. The operational office is located in Jindal House in Bhikaji Cama Place and the maintenance of the aircraft is contracted out to M/s India International Airways who are a DGCA approved maintenance agency. In addition to this Aircraft, M/S Jindal Group also operates an executive Jet and Super King Air B-200 aircraft.

1.17.2 The ill fated flight was made at the request of Mr. O.P. Khanna, Private Secretary to Late Shri Madhav Rao Sindhia. The aircraft VT-EFF was offered for use by his entourage for a private visit to Kanpur without any monetary consideration.

1.18 ADDITIONAL INFORMATION

1.18.1 Capt. V.K. Gupta as per the records had flown recently with Capt.S. Chandra, Capt. Amit, Capt. Bansal and Capt. M.M. Verma. The services of Mr. Bhardwaj who was in attendance along with AME, Mr. G.R. Kanda and a Technician, Mr. Dalip Sowain were utilized for handling at the time of last aircraft departure. The Committee has examined the officials of M/s India International Airways (IIA), No. of times and the relevant information has been brought on records.

1.18.2 Similarly, since the aircraft was last maintained by M/S IIA on day-to-day basis and M/S Taneja Aerospace and Aviation Ltd. for some specific jobs. The Committee carried out quality audit of both these organizations as per the checklist provided by DGCA. The work carried out by both these organizations was found to be within the scope of their approval and was duly certified by AME's /authorized persons. The system of monitoring was also found to be adequate so that the aircraft was not overflown either on account of schedule maintenance or an account of lifed parts. Even the quality Audit carried out by Airworthiness Authorities (preceding inspection carried out by the Committee) did not notice anything adverse . However, minor deficiencies like the need to change the format of log cards

(so that connectivity interim of history of the component is easier) was brought to the notice of QCM. The Committee found the stores in good condition but no lifed component was available. Consumables relevant to King Air C-90 aircraft were available in adequate quantity and stored properly. The cases of overwriting though not pertaining to the accident were also brought to the notice of QCM of IIA.

1.18.3 Similarly quality audit of the Aviation set-up of M/S Jindals Strips Ltd. was carried out by the Committee of Inquiry and the deficiencies so noticed during the audit were brought to the notice of M/S Jindals Strips Ltd. Subsequently, the Committee visited M/S Jindal Strips Ltd. again on 12th Nov., 2001. The deficiencies made good were put-up to the Committee and the minor changes in the lay out of various documents were brought to the notice of Manager Aviation. The details of duties and responsibilities of the Aviation set-up were asked to be prepared and displayed on the Notice Boards for each individual of the orgnisation. Member-Secretary of Committee of Inquiry asked the Manager Aviation to bring out the details of flying done by the crew of the ill-fated aircraft in writing including the flying done with organizations other than M/S Jindal Strips Ltd.

1.18.4 The public hearings after due notification have been held on 19th & 20th November 2001 at Delhi and from the 21st to 23rd November 2001 at Mainpuri (U.P.).

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

In the absence of Flight Data Recorder and Cockpit Voice Recorder, the Committee felt lot of gaps between what was stated by the witnesses and that revealed from the examination of wreckage. Therefore, the Committee visited Air Traffic Control to see the route followed by VT-EFF on secondary surveillance radar. Lot of useful

information could be gathered from the routing shown on the screen of SSR. Efforts were made to photograph the complete routing following by the VT-EFF from the radar screen but the same could not be done despite co-opting the services of General Manager(Flight Safety) and well experienced photographer from the open market. Therefore, tracings have been prepared to depict the path following by VT-EFF up to Abeam Kadas with special reference to the last phase of flight when the aircraft disappeared from the radar screen.

The tracing of the relevant Radar plots and the legend are given at Appendix-A.

Expanded tracing of the last two minutes of Radar Plots with legend are given at Appendix-B.

The History of Flight Path of C-90 Aircraft from Primary and Secondary Radar of Delhi and Tape Transcripts of Delhi and Lucknow are given at Appendix-C.

ATC Tape Transcripts from Delhi are given at Appendix-D.

ATC Tape Transcripts from Lucknow are given at Appendix-E.

Satellite Imageries are given at Appendix- F.

Similarly, the services of specialists of National Aerospace Laboratories (NAL) were requisitioned and various options of configuration in which the aircraft could have impacted with the ground were studied to assess the type of aerodynamic loads that the aircraft would have experienced prior to the impact. These computer Graphics were co-related with the assessment of wreckage examination.

2. ANALYSIS

The Committee has examined all the evidence brought on record and have conducted indepth studies of the ATC tapes, post mortem reports, wreckage examination, meteorological reports and prevailing enroute weather including weather at the crash site. The Flight Data Recorder and Cockpit Voice Recorder (CVR/FDR), which are vital tools for accident investigation are not installed on this category of aircraft as these devices, are not a mandatory requirement as per ICAO.

2.1 Maintenance / Airworthiness Standards of Aircraft

The Committee checked the record of maintenance inspections carried out on the ill-fated aircraft vis-à-vis the approved inspection schedule for a period of three years preceding the date of accident i.e. 30th Sept.,2001. Since the aircraft had crossed 20 years of in service life, the present periodicity /schedules w.e.f. 4th Sept.,2000 followed is as under as per AIC circular no. 4 of 2000 dated 4th Sept.,2000:

i) Phase I ---- 160 hrs/4 months
ii) Phase II --- 320 hrs./8 months
iii) Phase III---- 480 hrs./12 months
iv) Phase IV---- 640 hrs./16 month
v) Renewal of C OF A – Every six months.

On scrutiny of log books, it is found that the aircraft was due for Phase I inspection on 9th of June,1999 but it was actually carried out on 15th of June, 1999. Similarly, instead of carrying out Phase II inspection on 8th Dec., 1999 Phase I inspection was carried out on 10th Oct.,1999 and C of A was renewed at TAAL under the QC coverage of M/s India International Airways. It is understood that the reduction off 20% in terms of periodicity for aged aircraft was

not applicable prior to 4th Sept.,2000, but even then the old Phase II schedules should have been carried out as stated above. Another typographical error was noticed in which the duplicate inspection of controls was carried out by the second AME before the actual first inspection was carried out and certified.

Quality Control Manager of M/s India International Airways was summoned to explain the deficiencies. The QCM admitted the typographical error of duplicate inspection being carried out and signed on a day earlier by mistake whereas actually the duplicate inspection was carried the day after. The relevant records of having called an approved person from another organization were also produced. Similarly the Log Book entry for having completed all the inspections from Phase I to Phase IV were carried out in the last period of two years and two more phases repeated before the unfortunate day i.e. 30th Sept., 2001. The aircraft had a valid certificate of Airworthiness and no component was due as on date. The minor typographical error of date was therefore, taken as a valid explanation since it had no direct or indirect bearing on maintenance of the aircraft or Airworthiness standards.

2.2 Wreckage Examination

At the crash site the aircraft wreckage had fuselage housing cabin and cockpit, wing centre section, truncated outer wings and without tail section. Remanant of truncated wings and tail section in fragmenants and separated pieces were located in the adjoining villages situated within 3 to 4 kms. East and North East of the accident site. Examination of the main wreckage including the collected fragmenants as detailed in the report under 1.12 Wreckage information has revealed following facts.

i) The aircraft had crashed in a wide-open plain cultivated field and at no stage the aircraft had passed through any of the surrounding trees.

ii) The aircraft had impacted the ground very hard in more or less level attitude.

iii) There is no evidence of pre-impact fire.

iv) The post impact fire was primarily located in fuel tanks and spread to the fuselage interior.

v) Elevator control surfaces and Rudder surface attached with respective Horizontal Tail Surface and Vertical Tail Surface had separated from hinged and operating linkages while the aircraft was in air.

vi) Tearing and separation of horizontal surfaces of tail section had taken place with evidences of chordwise impact damages on leading edge surfaces and were as a result of impact from separated pieces of the outer wings.

vii) Wing trailing edge flaps surfaces on both the wings were fully up position.

viii) All three landing gears were fully retracted.

ix) Both engines were switched off in air and the propeller blades were in feathered condition.

x) No evidence of corrosion on the aircraft structure came to notice on wreckage examination.

xi) Anti-collision light installed on fuselage lower surface was operational when the aircraft had hit the cultivated field.

The failed surfaces of aircraft structure had evidence of fresh tearing however scientists from NAL, Bangalore were invited to examine the failed surfaces and carry out fractographic study. 35 numbers of damaged/failed pieces covering primary load bearing structure that

had failed in the tail section and the outer wings were collected and taken for general and fractographic analysis at NAL, Bangalore. The failed surfaces were studied visually and under stereo-binocular microscope. Some of the selected fracture surfaces were identified for examination at high magnification.

`Based on fractographic analysis by the NAL Scientists following general conclusions have been drawn and annexed with this report:

i) The damage seen on various components are largely due to impact forces.

ii) Metal tearing and fracture as seen on several components are due to tensile/shear loads.

iii) There is no evidence of delayed failure like fatigue/stress corrosion cracking on any of the surfaces observed.

From the above analysis it may be stated that the aircraft was structurally sound to endure normal flight loads, however structure of the ill-fated aircraft had failed in air on account of aerodynamic overloads. The pilot apparently after total loss of flight controls realized that a crash was inevitable, and he had manually switched off the engines and feathered the propellers in air as per the checklist before impact.

2.3 CIRCUMSTANCES LEADING TO THE ACCIDENT

2.3.1 Aircraft with all up weight under 5700 kgs. do not require to be installed with a Cockpit Voice Recorder (CVR) and a Flight Data Recorder (FDR). In the absence of these, arriving at a firm conclusion is difficult, nevertheless from the weather analysis radar plot, R/T, pattern of dispersion of wreckage, the analysis of wreckage and the post mortem reports, one can arrive at a most probable cause with fair amount of certainty.

Decision to Take on the Flight, vis-à-vis the Weather Report at time of briefing.

2.3.2 King Air C-90 VT-EFF took off from Indira Gandhi International Airport at 0711 hrs. The aircraft was given routing via R460 E i.e. Aligarh-KADAS Lucknow and direct to Kanpur. Following this route involves routing from Lucknow for Kanpur. Routing from KADAS to Kanpur direct is a common practice and is subject to clearance from Delhi, Lucknow, Kanpur etc. which in turn is dependant on traffic in the transiting area. Radar contact was lost with the aircraft at 0759 UTC and the aircraft crashed.

2.3.3 Capt. Vivek Gupta was briefed at 0543 UTC at the meteorological office, IGI Airport, New Delhi by Mr. Bhim Sen.

2.3.4 The latest Radar report of 0445 UTC indicated two significant cumulonimbus (CB) cloud echoes, one at 110 degree, 30 NM with its ceiling at 6 km. And the other at 160 degree 25NM once again with a ceiling at 6 km.

2.3.5 The enroute weather briefed was, possibility of isolated thunderstorm with rain,moderate/severe turbulance and icing in CB clouds and a cycir apparently persisting in the lower levels over South West UP and adjoining North M.P.

2.3.6 The METAR of Kanpur was not available, however the METAR of Lucknow which is only 32 NM North East was made available which reported visibility 6000 meters & no significant weather.

2.3.7 The satellite imaging available at the briefing office was of 0300 UTC from ISAT ID. The pilot carried out a self briefing. The visual picture indicated enroute clouding but the clouding was moderate & not intense. Infact the Infra Red image indicated a gap directly on track. Both the picture indicated greater intensity/major clouding on

the left of track. The inputs available to the pilot were limited to what have been given in the above paras.

2.3.8 From these inputs the following can be inferred:

(a) There was general clouding around Delhi with a few CBs. Whilst there was a development on radial 110 degree & 160 degree, the track on radial 127" was clear. The local visibility at Palam was 3500 mtrs. Which was well within the pilots minima. As such there was no reason for the pilot not to undertake the flight.

(b) The enroute weather as briefed by the met officer on duty was isolated thunderstorm with rain, moderate/servere turbulence and icing and a cycir apparently persisting at the lower levels over South West UP and Northern MP. The pilot also did self briefing from the satellite picture of 0300 UTC. The visual picture did indicate clouding across the track short of KADAS but the intensify was not severe. The IR picture indicated a gap in the clouding on the track. It would be pertinent to mention that the life cycle of thunderstorm(CB) is generally 45 mts. and may extend to a maximum of 1 1/2 hours. Therefore, what is reported or seen on the satellite picture a few hrs. earlier may not hold good when the pilot actually transits the area. The scenario as one can see from the briefing and satellite pictures did not warrant a cancellation of flight.

2.3.9 It must be noted that the subsequent satellite pictures being analysed were not available to the pilot . The Visual & IR pictures of ISAT ID of 0600 UTC do indicate intensifying of the clouds and forming into three line squalls just short of KADAS . However, the system could probably be circumvented by a deviation to right of track. The IR picture even at this stage showed a gap in the line squall along the track.

2.3.10 The meteosat satellite pictures have been specially made available by the IMD after the crash during investigations. The 0800 UTC picture is very important as it indicates the actual weather situation when the aircraft was attempting to negotiate the weather at the time of crash (0801 UTC). Both the IR and the water vapor pictures clearly indicate significant intensification by the merging of the three Line Squalls into one very active Line Squall. The gap as visible in the earlier INSAT ID pictures of 0300 & 0600 UTC had closed up. The picture also indicates that the system has moved in a South Westerly direction, thus lying almost across the track unlike earlier when the track was crossing the SW edge of the system. However, as interpreted by the Met. Deptt. and given in their report Mainpuri the scene of accident was just inside the Southern boundary of the convective cloud mass. The top of the system as per the analysis is approximately 45,000 ft. clearly indicating a very active development. The satellite picture also indicates that the said aircraft had managed to negotiate major portion of the weather and would have shortly been out of it into the clear when it crashed.

2.3.11 As per the Meteosat picture of 0830 UTC the temperature further dropped from -55 degrees as recorded at 0800 UTC to -65 degrees C at 0830 UTC. The vertical development of this system extended to 49,000 which is something to be taken cognizance off . The weather as reported by the witnesses on ground of heavy rains, low clouds and strong winds corroborates the intensity of bad weather.

2.3.12 The weather thereafter seems to have dissipated as reported by the ground witnesses and the subsequent flights operating on this route.

2.3.13 In the final conclusion the weather at the time of briefing was negotiable & did not warrant a cancellation of flight. In case the gap in the Line Squall had closed down, a deviation to the right would have enabled the pilot to circumvent the weather. In reality the system had moved SW between 0500 UTC to 0800 UTC changing the situation and enclosing the gap. As per the analysis of the Met.

Deptt. Mainpuri was just closed to the Southern boundary of the convective cloud mass. The reason as to why the pilot who had a weather radar on board did not appreciate the change in situation and deviated further right or return back remains unknown.

2.3.14 The major issue as to why the pilot did not circumvent the weather by a major deviation or return to Delhi is not understood. Two other aircraft one a single engine aircraft from Lucknow to Aligarh belonging to U.P. Government went back to Lucknow & another Helicopter of the Sahara India from Delhi to Lucknow returned to Delhi. However, one must keep in mind that the first one is a single, piston engine small aircraft, which is not designed to negotiate such weather & the latter, a Helicopter which does not have any capability to fly in weather. As per all reports from other aircrew who had flown with Capt. Vivek Gupta it is amply evident that after his last incident where he had damaged an aircraft and had been grounded, the pilot was very cautious and careful and that he did not take any chances. Although the weather was fairly bad as is evident from the Meteosat picture and even very experienced pilots would not have decided to fly through it, Capt. Vivek Kumar Gupta decided to go through the weather. The only possible reason why the pilot decided to continue the flight to Kanpur is probably the latent pressure of flying the dignitaries onboard. This type of latent pressure from eminent people or senior executives in corporate flying could be a factor in general aviation accidents. Though it can not be concluded that this element existed or played a part in continuation of the flight in this case.

Negotiation of Weather

2.3.15 Analysis of Meteosat satellite picture of 0800 UTC indicates a very large coverage across the track commencing from approximately Aligarh and ending just short of KADAS. At 0749 UTC, 42 NM from Aligarh the aircraft started deviating starboard and at 0750 UTC request for a deviation according by 10 NM. Up to 0757 UTC, 64 NM

from Aligarh (15 NM short of KADAS) the aircraft appears to have been flying steady maintaining speed and height. Thus the weather up to this stage was totally flyable. The first indication of entering an up draft begins at 0758 UTC when the aircraft was 66 NM out of Aligarh (13 NM short of KADAS). Analysis of the Meteosat reports of 0800 UTC and 0830 UTC confirms that some cells were still in the developing stage. The aircraft started initially gaining height at 1100 ft./mt. Subsequently the rate of climb increased to 1500 ft./mt. and the aircraft climbed up to Flight Level 170 (i.e. 2000 ft. above its designated height). The Ground Speed appears to have washed off to 150 kts. The last two radar plots at 07:59:12 UTC AND 07:59:22 UTC are coasting plots i.e. only deductions from the trend observed at the previous plots. The aircraft suddenly seems to have gone off the radar horizon despite the fact that it had climbed 2000 ft. The disappearance of the aircraft from the radar despite 2000 ft. gain in height clearly indicates that the aircraft has gone into an unusual attitude ending into a downward spiral where within 10 seconds; the time interval between the radar plots; the aircraft has at that moment gone down below the radar horizon. The rate of descent thus calculated would apparently be above 10,000 ft./mt.

What Happened and how it happened

2.3.16 The Business and Commercial Aviation Magazine of July 2001 has a report on a similar accident to a King Air C-90 in the USA. Fortunately the aircraft was all through under Radar cover from 18,000 ft. till 900 ft. when it disappeared from the radar screen. According to the investigation the aircraft descended from 11,000 ft. to 900 ft. in 47 seconds achieving an average rate of descent of 13,026 ft./minute. In this descent the aircraft reached a speed of 265 kts. when the inflight break up occurred. The manufacturers analysis in this case indicated that the aircraft exceeded the design dive speed VD of 265 kts. before the structural failure occurred.

2.3.17 From practical experience it is found that to enter an unusual attitude in turbulent weather in a C-90 is not difficult. Further to exceed the Vne of 208 kts. is also not difficult, if correct recovery action is not initiated immediately. Finally, it would not take long to reach 265 kts. or more in the spiral.

2.3.18 The C-90 aircraft has a structural limit of 3.29 G(+) and 1.32 G(-). The turbulence speed of the aircraft is 161 kts. As long as the aircraft maintains the speed below this speed no structural damage can take place. Further the designer always has a safety margin above this speed. Keeping this in mind two possibilities exist as follows:

(a) Structural failure due to the updraft.

(b) Structural failure after crossing the Never Exceed Speed (Vne) in a downward spiral.

Structural Failure during the updraft

2.3.19 The aircraft was cruising around 165 kts. The turbulence speed quoted by the manufacturer is 161 kts. During the updraft the aircraft speed appears to have reduced to 150 kts. With the aircraft maintaining speeds within the turbulence speed; despite the magnitude of the updraft/downdraft; the aircraft can not exceed the design structural limits. Further keeping the safety margin maintained by the designer the aircraft could under no circumstances have reached its structural limits, specially as the speeds as per the radar plots were well within limits. Therefore, structural failure due to strong updraft is ruled out as a possible cause.

Structural Failure after crossing Vne (Never Exceed Speed) in a downward spiral.

2.3.20 The C-90 King Air is a small aircraft accordingly with a small wingspan. Smaller the wingspan greater is the rate of roll. In

turbulent weather it gets thrown about very easily due to its low all up weight and high angles of bank are achieved quite easily due to low wing span. The pilot has to be very quick to react to this displacement. From these high angles of bank if not corrected immediately the aircraft enters a downward spiral quite easily. Thereafter in the downward spiral the aircraft would hit its never exceed speed in about 10-15 seconds. Any manoevering action beyond the Vne could lead to structural damage depending on the extent the speed has been exceeded by and the G forces achieved in the recovery manoeuvre. In all probability the 'G' factor would be well above the G limits of the aircraft.

2.3.21 From examination of the wreckage it is apparent that the outer portions of the wings beyond the structural reinforcement have sheered off curling upwards. This clearly indicates that the pilot has commenced recovery action of pulling out of dive at fairy high speeds where the high lift generated had led to the breaking away of the outer 1/3 portion of the wings. Examination of the horizontal stabilizer confirms this as the main spar, which is straight, has formed a bow bending backwards. The outer portion of the right wing on sheering off has hit the right stabilizer with its rear edge which is sharp. This is evident from the deep cut on the right stabilizer. The sheered right wing has also apparently hit the vertical tail plane and rudder. There is a tell tale mark of the rubber boot of the main plane having rubbed the vertical stabilizer. The same portion of the right wing has probably got wedged into the rudder and wrenched it off the vertical stabilizer.

2.3.22 The left tail plane also has a dent indicative of a blunt impact, probably the leading edge of the detached outer left wing. Apparently the outer portion of the left wing got wrenched off in a similar manner.

2.3.23 With just about 2/3 of the wing remaining with the aircraft, only 1/1/2 foot (approximately less than 1/3) of the ailerons and without the

rudder the aircraft apparently seems to have recovered from the spiral after paying a heavy penalty of structural damage. As per the reports of the eyewitnesses the aircraft was seen flying normal rolling from side to side with abnormal sound. The unsteady flight could be attributed to the very limited control surfaces available to the pilot. The abnormal (howling) sound reported by some of witnesses is probably the sound produced by the jagged edges of the remaining wings.

2.3.24 As per a few eyewitnesses the aircraft followed a curved path to the right in the final stages of flight. Approximately 500 mtrs. from the point of impact, the tail plane got detached from the aircraft leaving no control what so ever with the pilot. At this stage the pilot switched off both the engines before hitting the ground. The eyewitnesses who reported that they had seen the tail plane getting detached also confirmed the sudden silence from the aircraft and pitching up and down after the detachment of tail plane. The sudden change in sound was also confirmed by one more witness. The tail plane was located about 500 mtrs. short of the crash site where the eyewitness reported the detachment of tail plane. The uncontrolled pitching motion is something normal which would happen on loss of tail plane.

2.3.25 With the engines having been switched off resulting in washing of speed, and with limited portion of wing surface available to generate lift the aircraft was moving forward with very little speed but with very high rate of descent. This is confirmed by the impact pattern analysis of damaged components and little or no dispersion of wreckage. The damage to the seats' structural members and the post mortem reports of the crews and passengers also confirm the same.

2.3.26 Eyewitness reported two balls of fire from the aircraft trailing along the flight path. Physical examination of the wreckage by the Enquiry Team and the explosives expert proves to the contrary that there was no sign of fire in the air. The possible explanation to this illusion is that the anti-collision light in the heavy rain due to dispersion of light would tend to give such an impression. The eyewitness in whose field the aircraft crashed was at the site and had witnessed it within 100 meters. He has confirmed that there was no fire in the air prior to the impact and that fire occurred only post impact.

2.3.27 On analysis it is clear that the aircraft entered a spiral dive consequent to an unusual attitude and exceeded the Vne. The disintegration of the aircraft started well after exceeding the Vne which took place during the spiral dive or during recovery from the spiral dive. The upward tearing off of the outer 1/3 portion of the wings beyond the structural re-enforcement of the main spar indicates that a pull out was initiated at a very high speed, where the extremely high lift generated tore off the outer 1/3 portion of the wings. The bending backwards into a bow of the main spar of the tail plane confirms the exposure of the aircraft to extremely high speeds. The aircraft finally recovered but only after the outer wings and rudder have broken off from the aircraft. In this condition although the aircraft was somewhat flying straight but the rate of descent would have been very high due to the limited lift being generated with the remaining limited portions of the wings. Finally the disintegration of the tail plane just prior to the crash was the last straw that broke the camels back where all control over the aircraft was lost. The pilot rightly switched off both engines and the aircraft crashed in a flat attitude with very little forward speed and a very high rate of descent. On impact the aircraft caught fire. All occupants of the aircraft sustained fatal injuries due to the impact and the post impact fire.

3. CONCLUSIONS

3.1 Findings

i) The Certificate of Airworthiness issued by the Directorate General of Civil Aviation and the Flight Release Certificate issued by appropriately licensed Aircraft Maintenance Engineer were valid on the date.

ii) The aircraft loading and its Centre of Gravity were within permissible limits.

iii) The aircraft had sufficient fuel to complete the sector as well as the planned return flight to Delhi.

iv) The pilots were appropriately licensed to undertake the flight.

v) The pilot-in-command Capt. V.K. Gupta prior to commencing the flight had personally received ATC and weather briefings at IGI Airport.

vi) The weather conditions at Delhi and enroute as available to the pilot at the time of briefing had trend forecast, reporting temporarily reduction in visibility to 1500 meters in thunder storm and rain however, the actual weather conditions while commencing the flight were above the required minima.

vii) Weather reports recorded at IAF Station, Agra w.e.f. 0530 to 0930 UTC indicate thunder storm with rain and multi layered low clouds associated with convective clouds.

viii) Document of weather parameter w.e.f. 0530 to 0930 as recorded at IAF Station, Kanpur and Civil Aerodrome, Lucknow reveals no significant cloud/weather.

ix) Met. Reports recorded at IAF Station, Gwalior reveal lowering of CB cloud to 3500 feet and reduction in visibility from 6000 meters to 2000 meters with associated thunder storm and rain.

x) Satellite Imageries of 0300 UTC indicate scattered, weak to moderate convection in cloud cluster oriented in NE-SW direction with Southern Boundary stretching along central part of West U.P. plains.

xi) Intensity of convection in clouds went on increasing after 0300 UTC and imageries picked up at 0800 UTC indicate coldest cloud top temperature of the order of –55 degree C., and at 0830 UTC the cloud top temperature were of the order of –66 degree C., near Mainpuri (U.P.).

xii) The pilot had no difficulty in navigating the aircraft and he had trouble free communication with all the Stations required to be contacted.

xiii) The weather enroute after ALIGARH was active with intense convective cloud cluster.

xiv) The pilot while cruising at FL-150 on air route R460E deviated right of the track at around 42 NMs from ALIGARH and subsequently requested ATC for permission to deviate by 10 NMs right of track due weather which was approved.

xv) The pilot while on the deviated track reported abeam KADAS earlier to reaching the position and requested for direct routing to Kanpur.

xvi) The pilot even on the deviated track could not avoid weather and he had entered in thick weather of convective cloud.

xvii) The aircraft was structurally sound to endure normal flight loads.

xviii) The met. briefing was at best cursory and not comprehensive, as analysed from the briefing records. The pre flying briefing should encompass all aspects and duly recorded in the briefing register as appropriate.

xix) Postmortem reports of the fatally injured occupants onboard the aircraft revealed:

a) The pilots were in sound health and fit to fly the aircraft.

b) Most probable cause of death of the pilots and all passengers was decelerative forces due to sudden impact.

c) All occupants suffered severe decelerative force in the vertical axis, with minimal crush injuries in the horizontal axis. Most of the kinetic energy of the aircraft was therefore, because of its vertical speed at the time of impact.

d) There was no evidence of asphyxiation due to Carbon-Monoxide in-flight, indicating that there was no smoke/fire in the cabin before the impact.

xx) On examination of aircraft wreckage by explosive specialist no primary fragments of bomb as part of detonator, detonators wire, explosive, batteries, micro switches, remote control receivers or any other substance which can be identified as used for preparation and activation of explosive device could be located.

xxi) The pilot-in-command obtained Met. briefing at 0543 UTC. The radar picture shown to him was of 0445 UTC and the satellite imagery was that of 0300 UTC. Analysis of these clearly indicate that decision to take on the flight was in order and did not warrant a cancellation. The flight took off at 0711 UTC.

xxii) Analysis of the subsequent satellite imageries from INSAT-1D of 0600 UTC and meteosat 0800 and 0830 UTC were not available to the pilot. The weather as per these imageries intensified into three line squalls and finally merged into one significant line squall covering a large area. The meteosat imagery of 0800 UTC is very significant as it gives the weather when the aircraft was negotiating the weather and finally disappeared from the radar screen at 0759:22 UTC

xxiii) The aircraft commenced negotiating weather after crossing Aligarh and requested deviation 10 NM out of Aligarh at 0750 UTC. Up to 64 NM out of Aligarh the aircraft was able to maintain steady speed and height which indicate the weather was totally flyable.

xxiv) The first indication of entering into turbulent weather (strong up draft) was at 66 NM out of Aligarh at 0758 UTC.

xxv) The analysis of meteosat imagery 0800 UTC and 0830 UTC indicate that some cells were still in the development stage. ‘

xxvi) The aircraft despite having gained 2000 feet suddenly disappeared below the radar horizon in less than 10 to 12 seconds indicating a rate of descent of more than 10,000 f.p.m. The aircraft apparently entered a spiral dive consequent to the unusual attitude and exceeded the Vne. The disintegration of the aircraft started well after exceeding the Vne and took place during the spiral dive or during the recovery from the spiral dive resulting breakage of the outer 1/3 portion of the wings. The aircraft fully recovered after the spiral and flew somewhat straight and level but with a very high rate of descent. Finally the tail plane separated from the aircraft leading the loss of control prior to crash.

xxvii) The pilot switched off both the engines and aircraft crashed in a flat attitude with very little forward speed and very high rate of descent. The action by the pilot was appropriate to the situation.

xxviii) Apparently the pilot-in-command was very cautious and careful after his previous incident. Although the weather appeared to have been flyable initially, but just short of coming out of weather the aircraft encountered extreme and severe weather which would have been depicted on the aircraft radar screen.

xxix) The question why the pilot did not divert and return to Delhi is not understood. One of the probable reason could be latent pressure from the dignitaries on board. This type of pressure from eminent people or senior executive is not uncommon in general aviation. However, it can not be concluded that this element existed or played any part in the pilot's continuation of this flight.

3.2 Probable Cause

The pilot while flying through active thunder storm at cruise altitude encountered severe updrafts in intense and mature cloud formation and possibly underwent an abnormal and abrupt manoeuvre, most probably a steep spiral dive, resulting in inflight breakage of the aircraft structure on account of aerodynamic overloads leading to total loss of controls followed with heavy impact with the ground causing fatal injuries to all the occupants.

4. RECOMMENDATIONS

4.1 Installation of CVR or a combination of both CVR/FDR should be made mandatory on small twin engine general aviation aircraft where supplementary type certificate by the manufacturer or modification by an organization approved by the regulatory authority is available.

4.2 Where information for installation is available either in the form of duly approved STC by the manufacturer or a modification leaflet by an approved agency, all twin engine aircraft equipped to fly in IMC and/or night operations should mandatorily be installed with coloured weather radar.

4.3 Considering the age of the ill fated G-90 aircraft Reg. No. VT-EFF and the fact that during the preceeding 12 months only one snag had been reported was that of the ATC transponder. It is apparent that the practice of snag reporting is not being observed. The reporting and the rectification of snags for general aviation aircraft needs to be reviewed and reinforced.

4.4 The provision of designating an accountable manager as envisaged in the CAR should be extended to general aviation organizations with a view to make surveillance and safety audit checks more objective and meaningful.

4.5 Enhanced surveillance of approved maintenance organizations for adequacy of required infrastructure as against the specific approved scope of maintenance needs to be enforced to ensure that the infrastructure standards are maintained on a continual basis. The procurement documents should be made available for auditing by such organizations to the regulatory authority.

4.6 The requirement of conducting test flight for renewal of Certificate of Airworthiness be mandated for aging general aviation aircraft.

4.7 Pilots and engineering personnel associated with general aviation organizations should undergo periodic classroom and practical training at any institute of repute duly approved by the DGCA.

4.8 On aircraft equipped with advanced avionics like GPWS, TCAS, ATC transponder, FMS, coloured weather radar etc. the operators should ensure initial and periodic recurrent training for pilots and engineering personnel for affective man-machine interface.

4.9 The Flight Inspection Directorate of the DGCA should have dedicated flight inspectors for general aviation aircraft. In the event that adequate expertise is not available, the services of experienced retired/superannuated pilots from the industry may be utilized on contractual basis. In case if expertise is still not forthcoming, deputation from defence services may be considered.

4.10 The Committee felt that since whether has played a significant contributory role in the accident, it is recommended that in general aviation before exercising the privileges of their license, all new Captains in their first monsoon seasons should undergo monsoon/bad weather operations training with an approved organization. They should also undergo a proficiency check with a approved examiner instructor in actual weather. All existing captains must also undergo similar training and checks within a stipulated time frame.

4.11 The Committee having gone through the details of the weather briefing made available to the pilot before departure feels that the meteorological briefing at airports needs considerable improvement. The infrared and visible satellite pictures by themselves do not give the precise picture, but when the two are compared and plotted together on a single chart by the met officer will give a more accurate representation of the prevailing weather conditions. The satellite pictures are on a black and white monitor without a back up and imageries are available every three hours with the delay of one hour. The satellite imageries viz-a-viz a route forecast is more accurate and factual position of weather than a forecast. The committee therefore recommends that the satellite imageries be made available hourly in colour including imageries from all available sources in adverse weather. A proper briefing on these imageries with trends should be covered by the briefing officer.

Dated: 15th January 2002
Place: NEW DELHI.

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INDIAN AIRLINES LTD.

AIRCDME P. BADHWAR
DIRECTOR IGRUA
FURSAT GANJ (U.P)

SH. K.B. BATRA
CHIEF ENGINEER, BSF
MIN. OF HOME AFFAIRS

SH. P. SHAW
DY. DIRECTOR AIR SAFETY
CIVIL AVIATION DEPARTMENT

LEGEND TO RADAR PLOT APPENDIX -A

VTEFF – C90 FLIGHT INFORMATION AND RADAR RANGE & BEARING PLOT

S.N	TIME	LEVEL	RANGE / BEARING			REMARKS
			ALI	KADAS	KA	
1.	07 35 54	150 150 20	Over Head	293 – 75	306 146	
2.	07 41 44	151 150 19	113 19	293 – 56	308 127	BA 3571 OVER HEAD ALI LEVEL 370 SPEED 530 NM
3.	07 45 25	151 150 19	114 31	293 - 45	310 116	BA 3571 FLT. LEVEL 370 SPEED 530 NM
4.	07 49 10	151 150 18	115 42	292 – 33	311 105	BA 3571 FLT. LEVEL 370 SPEED 540 NM
5.	07 50 35	151 150 18	116 47	289 – 29	311 100	BA 3571 FLT. LEVEL 370 SPEED 540 NM VT-EFF Turn to right
6.	07 51 51	151 150 18	117 50	286 – 26	311 97	INTERCEPTED BA 3571 FLT. LEVEL 370 SPEED 540 NM JAL – LLK
7.	07 54 11	151 150 18	120 57	275 – 20	310 90	VT-EFF further Turn to Rt
8.	07 55 46	150 150 17	121 60	265 – 18	310 86	VT-EFF Reduction of Speed 170
9.	07 55 26	151 150 17	122 62	261 – 17	309 84	VT-EFF Request D Routing
10.	07 56 46	151 150 16	122 63	258 – 16	309 83	
11. 12.	07 58 01 07 58 11	154 150 17 155 150	121 67 121 67	248 – 13 248 – 13	310 79 310 79	
13.	07 59 37	CST 150	121 68	245 – 12	311 78	

LEGEND:- Level, Speed Rate of Climb e.g. 165/150-150↑ 17
165 – Actual Flight Level as per transponder
150 – Designated Flight Level
150↑ - Rate of Climb 1500
17 – Speed in hundred KTS. i.e. 170 KTS.
2 Range and Bearing – e.g. 121 67
121 degree, 67 Nautical Miles.

LEGEND TO RADAR PLOT APPENDIX-B

VTEFF – C90 FLIGHT INFORMATION AND RADAR RANGE & BEARING PLOT

EXPANDED – LAST TWO MINUTES PLOTS

S.No	TIME	LEVEL/SPEED RATE OF CLIMB	BEARING/RANGE	
			KADAS	REMARKS
1.	07 57 11	151 150 16	253 15	
2.	07 58 01	154 150 17 ↑1500	248 13	
3.	07 58 28	158 150 17 ↑1100	247 12	
4.	07 58 37	162 150 17 ↑1100	247 12	
5.	07 59 02	17 ↑1500	247 12	Only on P runway Radar
6.	07 59 12	160 150 160 15	244 12	Only Secondary
7.	07 59 22	170 150 15	246 12	Only Secondary
8.	07 59 37	*CST 13 150 ↑4600	246 12	Only Interplotation. (Deduction) Dropped below Radar Horizon
9.	07 59 47	*CST 13 150 ↑4600	244 12	**Only Interplotation**
10.	07 59 57	No return		No Prediction
11.	08 01 07	Cloud		Return

Note:- CST – Coasting An Interplolation from the last radar pick up – Predicted position.

APPENDIX-C

HISTORY OF FLIGHT PATH OF C-90 AIRCRAFT VT-EFF FROM PRIMARY & SECONDARY RADAR-DELHI AND TAPE TRANSCRIPTS DELHI & LUCKNOW

1. VT-EFF was planned for a flight from Palam, Delhi to Kanpur Civil Airfield. It took- off with two crew members and six passengers from Palam at 07 11 52 UTC (12 41 52 IST).

2. The aircraft was cleared to route via Aligarh KADAS Lucknow (R 460E) and thereafter direct to Kanpur.

3. The aircraft changed to Approach Control Radar frequency immediately after getting airborne at 07 12 07 UTC (12 42 07 IST).

4. At 07 21 58 UTC (12 51 58 IST) the aircraft change from Approach Control Radar to Area Control Radar. It reported over Aligarh at 07 36 45 UTC (13 06 45 IST) and requested for a change over to Lucknow. However, the aircraft maintained contact with both Lucknow & Delhi.

5. At 07 41 44 UTC (13 11 44 IST) British Airways Speed Bird 3571 report overhead Aligarh. The aircraft was cruising at Flight level 370 and at a speed of 530 knots. The aircraft asked for a deviation left by 20 NM due weather.

6. At 07 49 10 UTC (13 19 10 IST) it can be seen from the radar plot that VT-EFF has started deviating right of track.

7. At 07 50 37 UTC (13 20 37 IST) VT-EFF requested for a deviation right of track by 10 NM due weather. At the same time British Airways Speed Bird 3571 reported almost overhead JAL(Jalalabad) the reciprocal track i.e. R460 W due deviation because of weather.

8. At 07 51 11 UTC (13 21 11 IST) the radar plot shows a further turn to the right.

9. At 07 52 00 UTC (13 22 00 IST) VT-EFF also reported to Lucknow that he was 10 miles right of track due weather.

10. At 07 55 46 UTC (13 25 46 IST) the radar plot indicates a reduction of Ground speed which has been reducing progressively and had reduced to 170 knots due change in winds.

11. At 07 58 01 UTC (13 28 01 IST) onwards the aircraft started climbing @ 1500'/mt. probably due to updraft. The next two plots at 07 58 27 UTC (13 28 27 IST) and 07 58 28 (13 28 37 IST) indicate a rate of climb of 1100 ft./mt. The next two radar plots at 07 59 02 UTC (13 29 02 IST) and 07 59 12 UTC (13 29 12 IST) indicate once again an increase in rate of climb to 1500 ft./mt. Both these plots are only from the Secondary Surveillance Radar (SSR).

12. The next radar plot at 07 59 22 UTC (13 29 22 IST) is once again only from the SSR and indicates a further drop in speed to 150 knots. This was the last genuine radar plot.

13. The plot at 07 58 01 indicates aircraft at flight level 154, the next plot at 07 58 28 indicates flight level 158. At 07 58 37 the aircraft has further climbed to flight level 162. Thereafter for one rotation of radar at 07 59 02 there is no pick up from the SSR. At 07 59 12 the radar indicates flight level 160 and at 07 59 22 indicates flight level 170.

14. The last two plots at 07 59 37 UTC (13 29 37 IST) & 07 59 47 UTC (13 29 47 IST) are only coasting plots (predicted plots) from the trend observed at the last plot. At this stage the aircraft has probably gone below the radar horizon. The last coasting plot also

predicts a further drop of speed from 150 kts. To 130 kts. and an increase in rate of climb from 1500 ft./mt. to 4600 ft./mt.

15. At 08 01 27 UTC (13 31 27 IST) return from CB clouds were picked up a few NM South West of the last known position of aircraft.

APPENDIX – D-1

ATC TAPE TRANSCRIPT PERTAINIG TO ACCIDENT TO KING AIR C-90 AIRCRAFT, VT-EFF, ON 30-09-2001.

DELHI GROUND: GROUND FREQUENCY 121.9 MHZ.

Time	Call Sign		Text
065805	VFF	:	DELHI GROUND VFF
	GND	:	FF GND GO AHEAD
	VFF	:	GOOD AFTERNOON SIR, REQUEST START UP FROM DELHI TO KANPUR CIVIL ROUTING IS R460 EAST – KADAS, DELHI TO KANPUR LEVEL 150, 08 SOULS ON BOARD, STAND NO. 4
	GND	:	VFF CONFIRM PARKED ON BAY 4
	VFF	:	NEGATIVE SIR, NEXT TO ECHO – HANGAR NO. 4
	GND	:	ROGER AND REQUEST SOULS ON BOARD
	VFF	:	08 THEROUGH SECURITY
065845	GND	:	ROGER
065850	GND	:	FF STAND BY FOR START UP
065922	GND	:	FF START UP APPROVED
065927	VFF	:	VFF GROUND START UP APPROVED
065940	GND	:	VFF DELHI GROUND
070228	VFF	:	DELHI GROUND VFF, REQUEST TAXI PERMISSION
070525	VFF	:	GND VFF, REQUEST TAXI
	GND	:	FF TAXI VIA 'E' RUNWAY 27 'D' HOLDING POINT R/W 10
	VFF	:	ROGER VIA 'E' 27 'D' HOLDING POINT R/W 10 VFF

	VFF	:	CONFIRM INTERSECTION TAKE OFF
	GND	:	AFFIRMATIVE
070643	VFF	:	GND VFF ENTERING R/W 27
	GND	:	APPROVED
070808	GND	:	VFF CLEARANCE
	VFF	:	GO AHEAD, SIR
	GND	:	VFF CLEARED TO KANPUR VIA R460E F150 FOR DEP. SQUAK 3327
	VFF	:	SQUAK 3327 AND CLEARED FOR KANPUR R460E F150FF
	GND	:	CLEARANCE CORRECT, CONTACT OUR 118.1 GOOD DAY
070832	VFF	:	GOOD DAY

APPENDIX – D-3

TOWER FREQUENCY 118.1 MHZ

Time	Call Sign		Text
070846	VFF	:	TOWER FF GOOD AFTERNOON SHORT OF 10 ON 'D'
	TWR	:	FF LINE UP RUNWAY 10 AND WAIT.
	VFF	:	LINE UP RUNWAY 10 AND WAIT FF
070923	TWR	:	VFF ALIGARH –2 DEPARTURE, CLIMB STRAIGHT AHEAD 5 MILES THEN RESUME NORMAL
	VFF	:	CLIMB STRAIGHT AHEAD 5 MILES THEN RESUME NORMAL VFF.
070937	TWR	:	VFF CLEARED FOR TAKE OFF WIND 090 DEG./15 KTS.
	VFF	:	UNDERSTAND YOU WANT ME TO CLIMB TAKE OFF HEADING 5 MILES OR TURN RIGHT.
	TWR	:	ON TAKE OFF HEADING 5 MILES THAN AFTER RESUME NORMAL.
	VFF	:	COPIED SIR FF READY FOR TAKE OFF
071152	TWR	:	VFF AIRBORNE 11 CONTACT DELHI RADAR 127.9
	VFF	:	127.9 THANK YOU, GOOD DAY.

APPENDIX – D-4

AREA CONTROL FREQUENCY 120.9 MHZ.

Time	Call Sign		Text
072150	VFF	:	DELHI CONTROL VFF GOOD AFTERNOON.
	RADAR	:	VFF GOOD AFTERNOON CLIMB AND MAINTAINED F150.
073645	RADAR	:	VFF POSITION ALIGARH RADAR SERVICES TERMINATED REPORT IN CONTACT WITH LUCKNOW.
	VFF	:	ROGER FF
074930	VFF	:	DELHI CONTROL FF
	RADAR	:	GO AHEAD.
	VFF	:	IN CONTACT WITH LUCKNOW SIR F 150
	RADAR	:	FREQUENCY CHANGE APPROVED
	VFF	:	ANY TRAFFIC FOR DESCENT
	RADAR	:	NO REPORTED TRAFFIC, DESCENT IN CO-ORDINATION WITH LUCKNOW AND CHAKERI
075037	VFF	:	DELHI CONTROL FF
	RADAR	:	GO AHEAD SIR
	VFF	:	WASNTS TO 10 DEG. RIGHT OF TRACK DUE WEATHER
	RADAR	:	CONFIRM 10 MILES RIGHT OF TRACK
	VFF	:	AFFIRM
	RADAR	:	APPROVED
075626	VFF	:	DELHI CONTROL FF
	RADAR	:	VFF DELHI CONTROL
075630	VFF	:	SIR IN CONTACT WITH LUCKNOW AND KANPUR, WE ARE POSITONED ABEAM KADAS, CAN WE SET COURSE DIRECT FOR KANPUR SIR.

	RADAR	:	CO-ORDINATE WITH LUCKNOW NO REPORTED TRAFFIC WITH DELHI.
	VFF	:	CHANGING OVER SIR, THANK YOU, GOOD DAY.
082230	SAH 512	:	RADAR SAH 512
	RADAR	:	GO AHEAD
	SAH 512	:	AT THIS POSITION WE ARE PICKING UP EMERGENCY SIGNAL ON 121.5.
082400	RADAR	:	ROGER
071207	VFF	:	RADAR VFF GOOD AFTERNOON, SQUAKING 3327
	RADAR	:	ROGER VFF RADAR IDENTIFIED CLIMB FL150 AND EXPEDITE UNTIL PASSING 3600 FT.
	VFF	:	ROGER EXPEDITE 3600 FT. FOR 150 AND CONFIRM HEADING.
	RADAR	:	VFF NOW TURN RIGHT HEADING 120
	VFF	:	RIGHT 120 FF
071254	RADAR	:	VFF DELHI
	VFF	:	GO AHEAD SIR,
071302	RADAR	:	HAVE YOU CONTACTED KANPUR OF YOUR ARRIVAL SIR.
	VFF	:	AFFIRM SIR
071313	RADAR	:	ROGER
071320	VFF	:	3600 FT. FOR 150
071500	RADAR	:	PROCEED DIRECT TO ALIGARH
	VFF	:	ROGER
071645	RADAR	:	VFF TURN RIGHT HEADING 150 INTERCEPT 127 R DPN

	VFF	:	PLEASE SAY AGAIN SIR
071657	RADAR	:	TURN RIGHT 150 HEADING INTERCEPT 127 R DELHI
071700	VFF	:	150 HEADING INTERCEPT 127 R FF
071746	VFF	:	RADAR FF
	RADAR	:	GO AHEAD SIR.
	VFF	:	I THINK WE NEED TO CHECK 137 OR 127 DIRECT TO ALIGARH
	RADAR	:	127
072158	VFF	:	VFF IN CONTACT RADAR 120.9 GOOD DAY.
	RADAR	:	GOOD DAY.

APPENDIX – E-1

TAPE TRANSCIPT OF VHF 118.6 OF DATE 30.09.2001 OF VILK AERODROME

TIME	FROM	TO	DESCRIPTION
0741	SAH513	TWR	5 DME
	TWR	SAH513	CLEARED TO LAND, WIND 120 DEGREES 08 KTS.
	SAH513	TWR	CLEARED TO LAND SAH513
0743	SAH907	TWR	OUT OF FL170, TURNING RIGHT TO RESUME NORMAL.
	TWR	SAH907	ROGER, REPORT IN CONTACT WITH VARANASI CONTROL
0744	TWR	SAH513	BACK TRACK, VACATE VIA 'C' STAND NO. ONE
	SAH513	TWR	BACK TRACK 'C' STAND ONE
	SAH513	TWR	MARSHELER IN SIGHT RWY VACATED
	TWR	SAH513	OVER TO MARSHELER
0747	VFF	LK	DO YOU READ
	TWR	VFF	GO AHEAD
	VFF	TWR	DELHI TO KANPUR, FL150, ESTIMATE KADAS 0800, AT KANPUR 0820. ROUTING DIRECT KADAS TO KANPUR
	TWR	VFF	SAY AGAIN ETA KANPUR
	VFF	TWR	0820
0748	TWR	VFF	ROGER, MAINTAIN FL150, REPORT PASSING KADAS
	VFF	TWR	FF
0752	TWR	SAH907	

	VFF	TWR	
	TWR	VFF	GO AHEAD
	TWR	VFF	GO AHEAD
	TWR	VFF	
	VFF	TWR	10 MILES RIGHT OF TRACK DUE WEATHER
	TWR	VFF	IN CO-ORDINATION WITH DELHI, CONFIRM
	VFF	TWR	AFFIRMATIVE
0753	VFF	TWR	ROGER REPORT ABEAM KADAS
0758	VFF	TWR	
	TWR	VFF	GO AHEAD
	VFF	TWR	ABEAM KADAS, FL 150, NO TRAFFIC WITH DELHI, IN CONTACT WITH KANPUR, REQUEST DIRECT ROUTING TO KANPUR.
	TWR	VFF	REPORT IN CONTACT WITH KANPUR
	VFF	TWR	WE ARE IN CONTACT WITH KANPUR, REQUEST DIRECT ROUTING TO KANPUR.
0758	TWR	VFF	DIRECT ROUTING IN CO-ORDINATION WITH GWALIOR AND AGRA ANY LOCAL FLYING CHECK WITH GWALIOR
	VFF	TWR	STAND BY ONE
0802	VZC	TWR	
	TWR	VZC	GO AHEAD
	VZC	TWR	CHECKING OVERHEAD LUCKNOW 0800, ESTIMATING JAL 0823 NEXT

	TWR	VZC	REPORT PASSING JAL, IN CONTACT WITH DELHI.
0803	VZC	TWR	WILCO
0804	SAH513	TWR	WE HAVE INFORMATION 'L' 1004,42 THROUGH SECURITY. REQUEST START UP FOR VARANASI LEVEL 190.
	TWR	SAH513	42 COPIED, TEMPERATURE 34, QNH1004, STAND BY FOR START UP.
0805	TWR	SAH513	START UP APP0ROVED, RWY 09.
	SAH513	TWR	START UP APPROVED, RWY 09

Sd/	Sd/	Sd/
RAM LAL	**P.C. GUPTA**	**A.K. BHARDWAJ**
D.G.M. (ATS)	Asstt. Manager (Com.)	Asstt. Director (Operations)
AAI,LUCKNOW	AAI, LUCKNOW	DGCA, (HQ), NEW DELHI

ANNEXURE – F_1

SYNOPS OF 30TH SEPT. 2001	MAINPURI		ETAWAH	
ELEMENTS TIME	0300 UTC	1200 UTC	0300 UTC	1200 UTC
SURFACE WIND	CALM	270/02 KT	110/02 KT	110/02 KT
VISIBILITY (In Range)	4000-9999M	4000-9999M	4000-9999M	4000-9999M
WEATHER	NO WEATHER	NO WEATHER	NO WEATHER	NO WEATHER
CLOUD	SKC	8 OCTA CUMULUS	3 OCTA CIRRUS	3 OCTA CIRRUS
TEMPERATURE/DEW POINT	26/25	32/21	26/21	33/25
PRESSURE (a.m.s.l.)	1007.3 hpa	1004.2 hpa	1005.2 hpa	1002.5 hpa

ANNEXURE – F2

SYNOPS OF 30TH SEPT. 2001	LUCKNOW			GWALIOR		
ELEMENTS TIME	0300UTC	0600UTC	0900UTC	0300UTC	0600UTC	0900UTC
SURFACE WIND	110/08KT	110/08KT	110/10KT	505/02KT	160/03KT	320/08KT
VISIBILITY (In Range)	4000-9999M	4000-9999M	4000-9999M	4000-9999M	4000-9999M	4000-9999M
WEATHER	HAZE	NO WEATHER	NO WEATHER	HAZE	HAZE	THUNDER STORM
CLOUD	1 Octa Cirrus	3 Octa SC 3 Octa Cu	3 Octa SC 4 Octa Cu	3 Octa AC	3 Octa SC 3 Octa Cu 1 Octa CB	3 Octa SC 3 Octa SC 1 Octa CB
TEMPERATURE/ DEW POINT	31/26	34/25	35/25	28/24	32/25	26/24
PRESSURE (a.m.s.l.)	1006.8	1006.2	1002.9	1006.4	1005.9	1004.4