FINAL REPORT OF SERIOUS INCIDENT INVOLVING M/s JET AIRWAYS ATR 72-500 AIRCRAFT VT-JCL AT BANGALORE ON 15/06/2016

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Foreword

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2012, the sole objective of the investigation of an accident shall be the prevention of accidents and incidents and not apportion blame or liability.

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components. Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

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GLOSSARY

AAIB	Aircraft Accident Investigation Bureau, India
ACM	Additional Crew Member
ACW	Alternating Current Wild
AME	Aircraft Maintenance Engineer
AMSL	Above Mean Sea Level
ARC	Airworthiness Review Certificate
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
AUW	All Up Weight
C of A	Certificate of Airworthiness
CAP	Crew Alerting Panel
CAR	Civil Aviation Requirements
COI	Committee of Inquiry
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DFDR	Digital Flight data Recorder
DME	Distance measuring equipment
DGCA	Directorate General of Civil Aviation
DVOR	Doppler VOR
ECI	Eddy Current Inspection
EMM	Engine Maintenance Manual
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FRTOL	Flight Radio Telephone Operators License
hrs	hours
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
LLZ	Localizer
MEL	Minimum Equipment List
MSN	Manufacturer Serial Number
MSSR	Monopulse Secondary Surveillance Radar
NDB	Non-Directional Beacon
Nm	Nautical Miles
PA	Passenger Address
PIC	Pilot in Command
PL	Power Lever
PT	Power Turbine
QRH	Quick Reference Handbook
SB	Service Bulletin
SEP	Safety and Emergency Procedures
SMR	Surface Movement Radar
VFR	Visual Flight Rules
VOR	VHF Omnidirectional Range
UTC	Coordinated Universal Time

FINAL REPORT OF SERIOUS INCIDENT INVOLVING M/s JETAIRWAYS ATR 72-500 AIRCRAFT VT-JCL AT BANGALORE ON 15/06/2016

1.	Aircraft Type	: ATR 72-500
	Nationality	: INDIAN
	Registration	: VT – JCL
2.	Owner	: M/s Constellation Aircraft Leasing Limited
3.	Operator	: Jet Airways.
4.	Pilot – in –Command	: ATPL holder on type,
	Extent of injuries	: Nil
5.	First Officer	: ATPL Holder on type,
	Extent of injuries	: Nil
6.	Place of Incident	: Bangalore Airport
7.	Date & Time of Incident	: 15th June 2016, 1012 UTC
8.	Last point of Departure	: Bangalore
9.	Point of intended landing	: Mangalore
10.	Type of operation	: Schedule Operation
11.	Crew on Board	: 04
	Extent of injuries	: Nil
12.	Passengers on Board	: 67
	Extent of injuries	: Nil
13.	Phase of operation	: Climb
14.	Type of incident	: Air Turn Back due to Smoke in Cabin and Engine fire

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SUMMARY

M/s Jet Airways ATR 72-500 aircraft VT-JCL was involved in an Air turn back due to smoke in cabin and engine fire, at Bangalore on 15.06.2016 while operating flight 9W-2839 (Bangalore-Mangalore). There were 67 passengers on board. There was no injury to the crew however three passengers received minor injuries.

Aircraft took off from Bangalore at 0429 UTC for Mangalore. Immediately after take-off the master caution warning was triggered for a second. Crew continued normally with flight as all parameters seemed normal. After attaining height of around 6000 feet crew got call from cabin crew in-charge informing him of smoke in passenger cabin. Crew carried out smoke checklist, gave PAN PAN call to ATC and decided to return back to Bangalore. The smoke kept on thickening, but source of smoke could not be identified. Passengers were given wet tissues and issued instructions to bend down.

Shortly before landing fire was noticed on RH engine. Crew discharged both the fire bottles and engine was shutdown. A MAY DAY call was given and aircraft landed back at 0453 UTC. Emergency evacuation was carried out on the runway itself. Three passengers received minor injuries during evacuation.

Occurrence was classified as Serious Incident as per the Aircraft (Investigation of Accident and Incidents) Rules, 2012. Committee of Inquiry was appointed by Ministry of Civil Aviation vide its notification Ref AV.15013/3/2016-DG appointing Mr. Jasbir Singh Larhga, Assistant Director AAIB as Chairman and Mr. Dinesh Kumar, Air Safety Officer, AAIB as Member.

Initial notification of the occurrence was sent to ICAO, Transport Safety Board of Canada and Bureau d'Enquêtes et d'Analyses (BEA), France on 16th June 2016 as per requirement of ICAO Annex 13. Mr. Earl Chapman was appointed as the accredited representative, by TSB, Canada and Mr. Vincent Ecalle was appointed as accredited representative by BEA, France under ICAO Annex 13.

1. FACTUAL INFORMATION

1.1 History of the flight:

On 15.06.2016, M/s Jet Airways ATR 72-500 Aircraft VT-JCL was scheduled to operate flight 9W-2839. The flight was to operate Bangalore – Mangalore sector. The flight was under command of an ATPL holder pilot and an ATPL holder pilot as Co-Pilot. There were 67 passengers and 04 crew on board, which included the 02 cabin crew. Total take-off weight was 21205 Kgs.

The schedule departure for Flight 9W-2839 was 0415 UTC. The crew reported for duty at Bangalore Airport well in time and proceeded to the aircraft after completing the flight briefing and medical.

The aircraft was parked at Bay 28. At 0412 UTC the crew started the RH Engine in Hotel mode. After push back from the parking bay, LH Engine was also started. The aircraft thereon started taxiing. Aircraft exited the apron via taxiway H and moved to holding point A1 via taxiway A.

The aircraft then lined up on Rwy 27 for bleeds off take off, after clearance from the ATC. The aircraft took off from Rwy 27 at 0429 UTC. Soon after take-off crew manoeuvred the aircraft to turn right to maintain a heading of 285 degree as per the departure clearance.

The departure from Bangalore was smooth and aircraft continued to climb. As per the statement of cockpit crew, immediately after takeoff, at an altitude of about 4500 feet, master caution warning was triggered. The warning light flashed for about 1 second on the instrument panel. Crew looked out for any abnormal reading on the panel, however no other abnormality or any other alert was observed. No alert was seen on instrument panel either. Crew checked all operating parameter which also continued to be normal. Thereafter, crew continued with the climb and routine checklists.

As per statement of the cabin crew seated at the forward jump seat, he noticed some unusual smoke few minutes after take-off. He then called the Cabin Crew In-Charge (CCIC) on interphone to inform him. The CCIC confirmed that it was smoke and called the cockpit crew informing them of light white smoke in cabin.

PIC stated that he received information about smoke in cabin while aircraft was at an altitude of approximately 6000 feet. He enquired about the colour, odour and nature of smoke and instructed the cabin crew to try and look out for the source of smoke. In the meanwhile the passengers were addressed over the PA system and asked to take protective breathing position.

As per statement of cabin crew, after being released by the pilot they got up from their jump seat and started looking out for the source of smoke. Cabin crew checked the forward cargo compartment, aft cargo compartment, lavatory, overhead bins and air vents. They were however, unable to identify the exact source of smoke. CCIC again called the PIC to inform him that the source of smoke could not be identified and smoke did not have any particular smell. The smoke kept on intensifying but cabin crew was not able to pin point the source of smoke.

As the aircraft climbed to 8000 feet, pilot requested ATC for holding altitude of 8000 feet. Smoke memo actions were carried out by the crew. After completing the smoke checklist PAN-PAN call was made to Bangalore ATC and it was informed that aircraft will be returning back. Unidentified smoke checklist and suspected electrical smoke checklist were then carried out.

Cabin crew was also informed of the decision to turn back. At around 04:37 UTC crew informed the Bangalore ATC of the smoke in cockpit and requested shortest vectors to Rwy 27. ACW total loss checklist was then carried out and after finishing the checklist, descent and approach checklist were carried out.

Passengers were informed about the turn back on PA system. Meanwhile, the smoke kept on getting thicker. CCIC was instructed to prepare for emergency evacuation on the runway.

As the cabin crew prepared themselves and aircraft for emergency evacuation, passengers on the starboard side reported seeing flames on the engine. CCIC could not see anything from her seat and went to an AME seated on seat 18F, who was travelling as a staff (ACM). He confirmed that, he too noticed fire on the right engine.

Meanwhile in cockpit at about 04:48:22 UTC, No 2 Engine fire warning came "ON" while on approach at about 1200 feet altitude. CCIC also informed the PIC of engine fire.

After carrying out in-flight engine fire checklist and severe mechanical damage checklist "MAYDAY" call was given. The fire warning continued even after 02 squib discharges. The fire warning stopped when aircraft was at about 200-100 AGL.

Around 30 seconds before the landing, cabin crew started shouting the brace command to the passengers. The aircraft landed at Rwy 27 at about 0453UTC on a single engine. The crew carried out evacuation after informing the PIC. Passengers on Seat 1A and 1F were asked to open exit and throw hatch door.

Cabin crew assisted the passengers in evacuation and jumped out of the exit after evacuating all the passengers. The first officer evacuated thereon and the PIC was last to evacuate.

The emergency vehicles reached the site immediately and assisted the crew and passengers. After the emergency personnel cleared the aircraft, the PIC towed the aircraft to the stands at 0513 UTC, The runway operation resumed at 0521 UTC. A total of 05 departures and 07 arrivals were delayed due to unavailability of Runway.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR	Nil	03	Nil

1.3 Damage to Aircraft :

Apart from the damage to engine due to fire the aircraft did not receive any damage. During initial inspection the following damages were found on the Engine.

(i) No 6 and 7 bearing vent tube were cracked.

Fig 1

(ii) One blade of the 2nd stage power turbine was found fractured at the base.

(iii) Another blade of the 2nd stage power turbine was found fractured close to the middle.

(iv) Nick marks and damage were noticed on many other Power Turbine blades.

(v) The power turbine shroud housing showed impact damage

(vi) Shroud had some material missing from it.

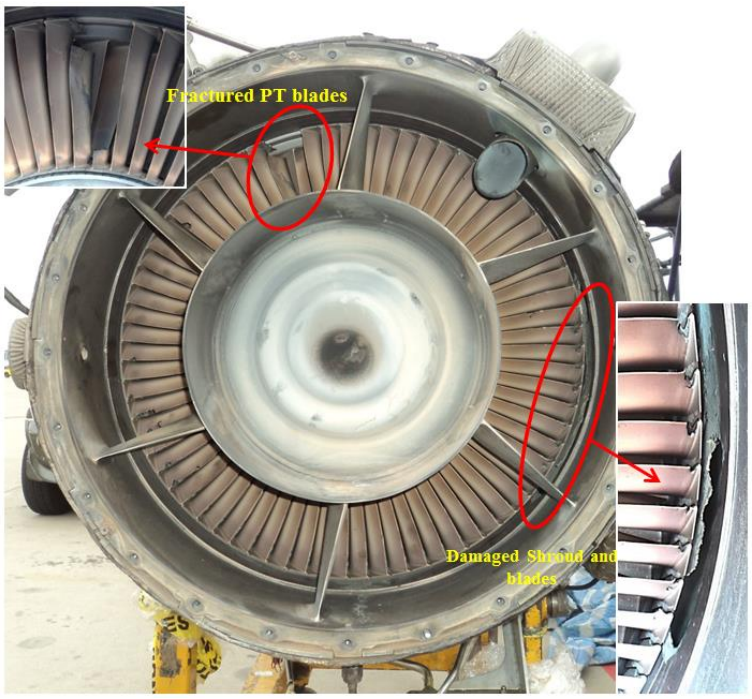

Fig 2

The aircraft was put into service after Engine change and necessary maintenance actions. Aircraft was made serviceable and operated its first flight after incident on 17.06.2016.

1.4 Other damage: NIL

1.5 Personnel information

1.5.1 Pilot – in – Command

AGE	:	25 Years
License	:	ALTP Holder
Category	:	Aeroplane
Validity of License	:	16.10.21
Endorsements as PIC	:	22.01.2016
Date of Med. Exam.	:	18.11.2015
Med. Exam valid upto	:	17.11.2016
FRTO License Validity	:	24.02.2019
Total flying experience	:	3267:40 Hrs
Experience on type	:	299:47 Hrs
Experience as PIC on type:		245:37 Hrs
Total flying experience during last 365 days	:	370:16 Hrs
Total flying experience during last 180 days:		303.23 Hrs
Total flying experience during last 30 days	:	70:12 Hrs
Total flying experience during last 07 Days	:	06:12 Hrs
Total flying experience during last 24 Hours	:	06:12 Hrs

1.5.2 Co-Pilot

AGE	:	29 Years
License	:	CPLHolder
Category	:	Aeroplane
Validity	:	16.02.2020
Endorsements as PIC	:	28.12.2010
Date of Med. Exam	:	26.01.2016
Med. Exam valid upto	:	24.01.2017
Total flying experience	:	1003:44 Hrs
Experience on type	:	788:28 Hrs

Total flying experience during last 365 days	:	757:38 Hrs
Total flying experience during last 180 days	:	339:00 Hrs
Total flying experience during last 30 days	:	55:34 Hrs
Total flying experience during last 07 Days	:	08:57 Hrs
Total flying experience during last 24 Hours	:	06:12 Hrs

Both the operating crew were not involved in any serious incident/ accident in past. Both the operating crew were current in all training and had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the incident flight.

1.6 Aircraft Information:

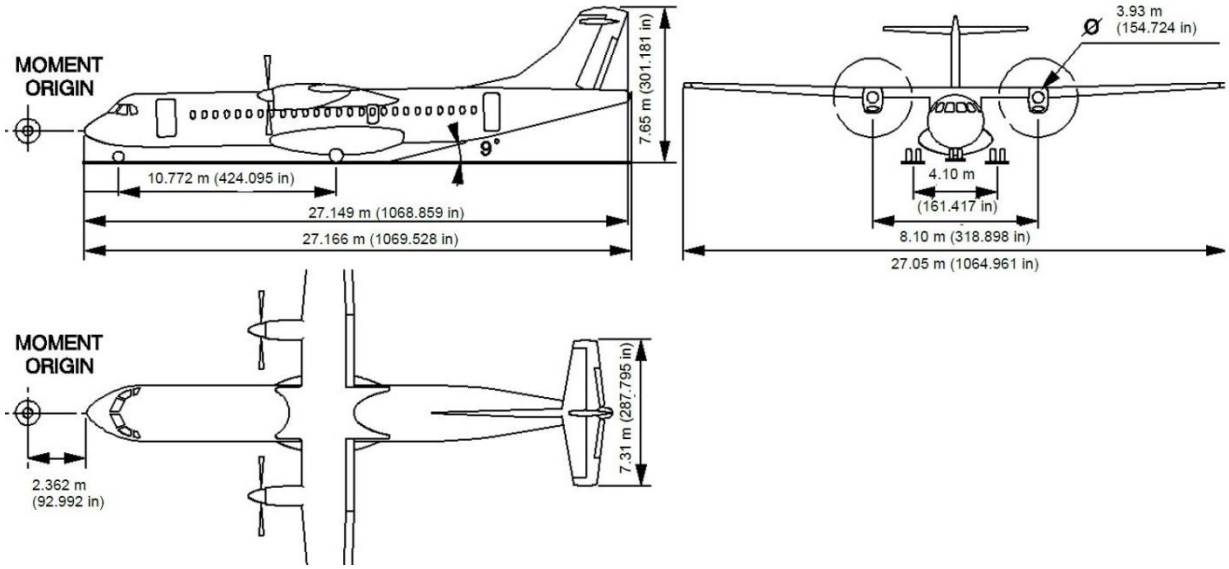

Fig 3

ATR-72 aircraft is certified in the Transport Category, JAR25 and ICAO annex 16 for day and night operations, in the following conditions when the appropriate equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition :

- VFR and IFR
- Flight in icing conditions.
- Reverse thrust taxi (single or twin engine)

Minimum flight crew requirement is two. It can seat a maximum of 74 passengers as limited by emergency exit configuration. It has a length of 27.16 m and

wingspan of 27.05 m. Wing reference area is 61m^2. Maximum permissible Take-off weight is 22500 Kg and maximum permissible landing weight is 22350 Kg.

Aircraft is equipped with Pratt and Whitney PW127M turboprop engine. This engine is equipped with two centrifugal impellers driven by independent axial turbines, a reverse flow annular combustor and a two-stage power turbine which provides the drive for the reduction gearbox. The engine is primarily divided into two modules: a reduction gearbox module and a turbomachinery module. The modules are joined to form a rigid unit and provision is made for the installation of airframe equipment on the engines.

The turbomachinery consists of four sections, contained in six casings. The casings are bolted together at flanges.

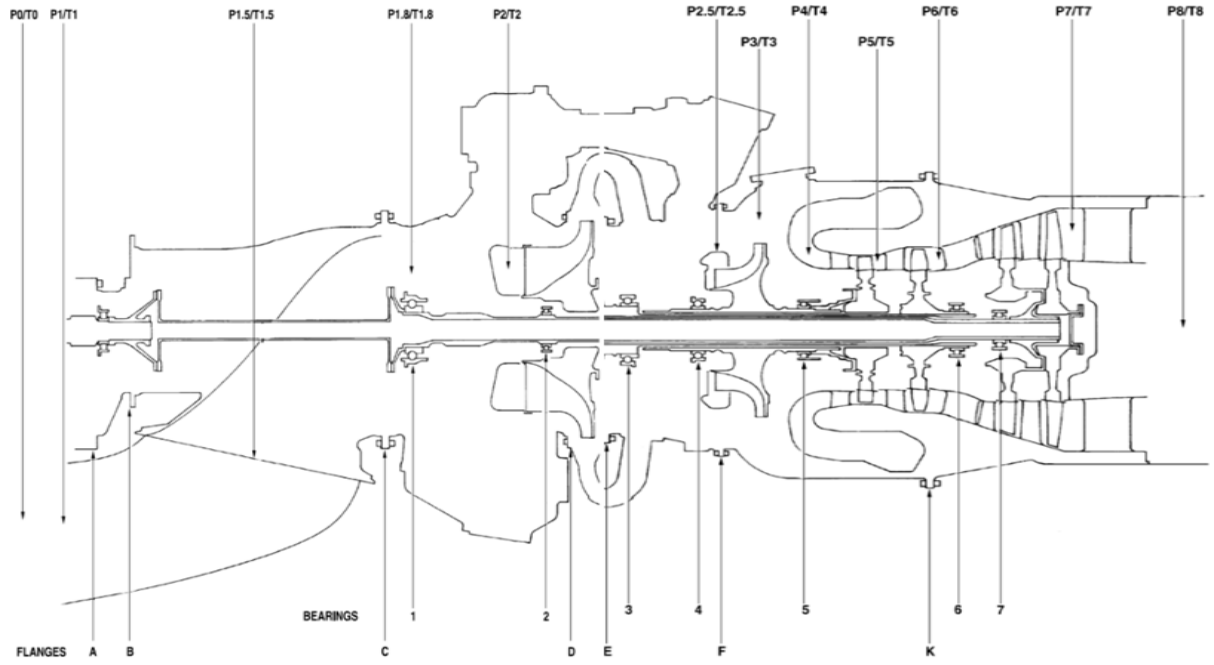

Fig 4 : Flange and bearing stations

1. Air Inlet Section

The air inlet section consists of the front inlet case and the rear inlet case bolted together at flange C. The rear inlet case joins the front case to the low pressure (LP) diffuser case at flange D. The case contains two bearings (No. 1 and 2) and seals for the power turbine shaft. Mounting pads are provided for accessories. The engine oil tank forms part of the casing.

2. Compressor Section

The compressor section comprises the Low Pressure (LP) and high pressure (HP) independent centrifugal impellers. These are contained within the LP diffuser case (flange D to E) and the intercompressor case (flange E to F) and the front of the gas generator case (flange F to K). Diffuser pipes connect the diffuser case, which contains the LP impeller, to the intercompressor case. Two ball bearings (No. 3 and 4) are housed in the intercompressor case. The No. 5 roller bearing is contained in the gas generator case.

3. Combustion Section

The annular reverse-flow combustion chamber is contained in the gas generator case. The fuel manifold is mounted around the exterior of the gas generator case, with spray nozzles which protrude into the combustion chamber liner. Two igniter plug bosses are provided on the gas generator case, with corresponding bosses in the liner.

4. Turbine Section

The LP and HP turbines are housed in the rear of the gas generator case, and the power turbines (PT) in the turbine support case. Concentric shafts connect the two-stage power turbine to the gearbox and the single-stage LP and HP turbines to the impellers. The central PT shaft is supported by the No. 1 (ball), No. 2 (roller) and No. 7 (roller) bearings. The intermediate LP turbine shaft is supported by the No. 3 (ball) and No. 6 (roller) bearings. The HP turbine shaft (integral with impeller) is supported by the No. 4 (ball) and No. 5 (roller) bearings.

The details of main bearing are as below;

Bearing No.	Position	Type of Bearing
1	Power Turbine Shaft	Ball
2	Power Turbine Shaft	Roller
3	Low Pressure Impeller	Ball
4	High Pressure Impeller	Ball
5	High Pressure Impeller	Roller
6	Low Pressure Turbine	Roller
7	Power Turbine Shaft	Roller

The air is bled from either low and/or high bleed port of each engine to operate the air conditioning system of the aircraft.

Aircraft Air Conditioning System

The air conditioning system is provided to keep the environment in passenger compartment and flight compartment to pressure temperature humidity and cleanliness required for comfort of passenger and crew on the ground as well as flight.

The pressurised air bled from each engine is ducted to two identical independent air cooling units (packs) installed respectively in the left and right landing gear fairing.

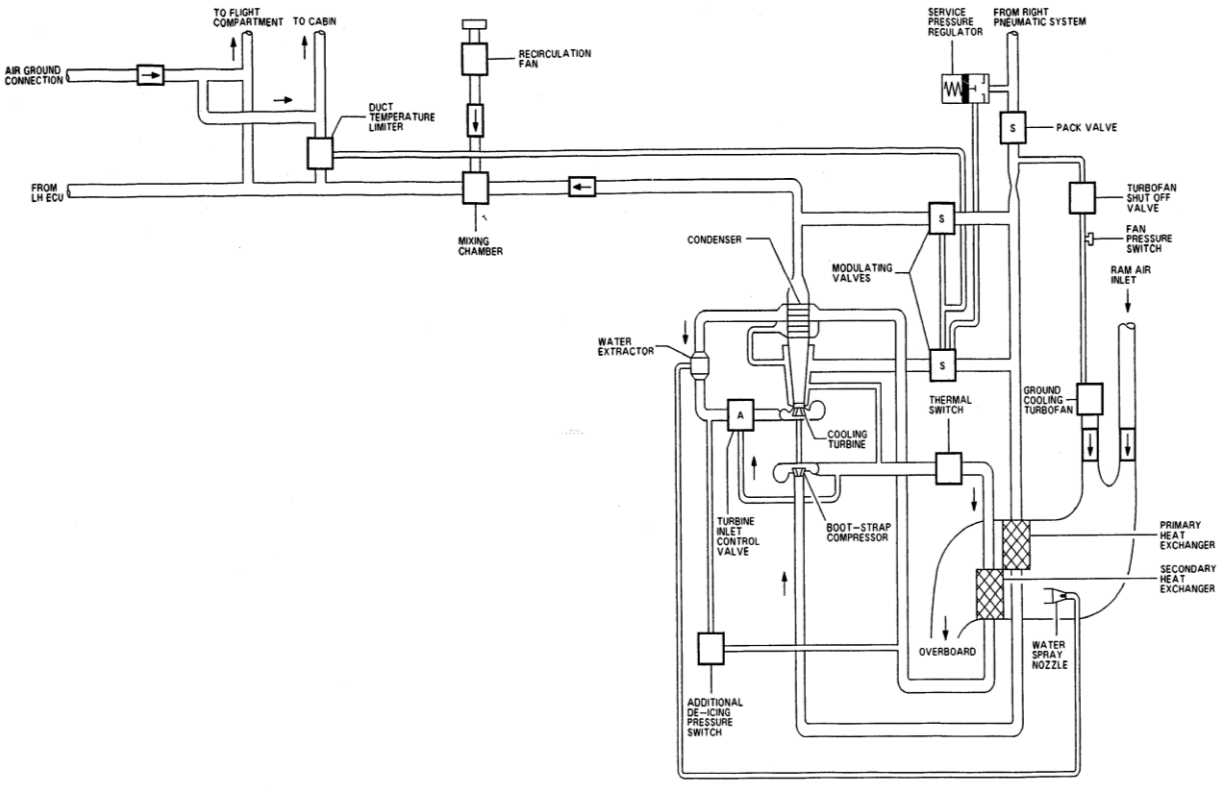

Fig 5: Air-conditioning system - Schematic diagram

Bleed air from each engine feeds the unit on its respective side through a pressure regulating and shut off valve (pack valve) and through a service pressure regulator which transmits a pressure to the modulating valve. The bleed air is then pre-cooled by an air heat exchanger and routed to the air conditioning pack.

The air conditioning pack limits the airflow to the pressurised compartments taking into account the pressurisation system performances. It also cools the bleed air down to a selected temperature and removes condensed water in order to maintain humidity level in cabin and flight compartment. The cooling is done in an air to air heat exchanger and expansion of pressurised bleed air.

There is a recirculation fans in each pack that recirculate an amount of cabin air and add it to the fresh air coming from the pack. The conditioned air is distributed in the flight compartment and cabin via ducts.

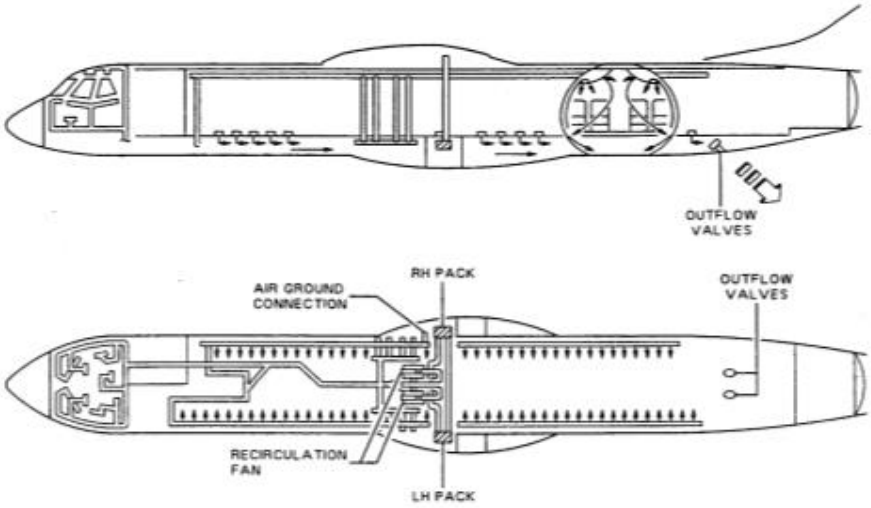

Fig 6: Air distribution system

The cabin conditioned air distribution system receives air in a mixing chamber from the right pack and circulating fan. Main duct distributes the conditioned air to two distribution ducts, which are routed above overhead stowage compartments.

The flight compartment conditioned air distribution system receives air in a mixing chamber from the Left Pack and relevant circulating fan. A duct distributes the air from mixing chamber into the flight compartment.

Air is then evacuated to ventilate under-floor area, electric and electronic racks, battery and lavatory. After this air is discharged overboard by means of cabin pressure control system which maintains pressure corresponding to an altitude compatible with crew and passenger comfort.

Aircraft VT-JCL (MSN 791) was manufactured on 26.05.2008. The aircraft is registered with DGCA under the ownership of M/s Constellation Aircraft Leasing

Limited. The aircraft is registered under Category 'A' and issued Certificate of registration No. 3756/2.

The Certificate of Airworthiness Number 4065 under "Normal category" and subdivision “Passenger / Mail / Goods” was issued by DGCA on 27.05.2008. The certificate of airworthiness specifies minimum operating crew as “two” and the maximum all up weight as “22800 Kgs”. The validity of the Certificate of Airworthiness is subject to the valid Airworthiness Review Certificate or unless suspended/cancelled by DGCA. The Airworthiness Review Certificate was valid up to 24.05.2017.

The Aircraft held a valid Aero Mobile License No A-006/WRLO-08 at the time of incident. This aircraft was operated under Air Operator Permit No S-6A and operations specifications which were issued on 26.11.2015. As on the day of incident the aircraft had logged 24999:50 Airframe Hours and 20782 cycles.

The aircraft and its Engines are being maintained as per the maintenance program consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance program approved by DGCA.

Accordingly, the last major inspection A4 check carried out on 26.05.2016. Subsequently all lower inspections (Pre-flight checks, Service Checks, Weekly Checks) were carried out as and when due before the incident.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine has been complied with as on date of event.

The aircraft was equipped with PWC Engine PW127M. The left engine S/N ED039 was manufactured in August 2010 and had logged 16269 Hrs and 13994 cycles. The last scheduled Boroscopic inspection of LP Impellor on LH engine was carried out in Dec 2015.

The right Engine S/N AV0112 was manufactured in Sept 1999 and had logged 39016 Hrs. and 33264 cycles on the day of incident. The Right engine was overhauled in Nov 2014 and last scheduled boroscopic check of Hot Section and L P Impeller was done in May 2016.The last A4 check on Right engine was carried out

on 26.05.16. The engine had also undergone RH fuel nozzle replacement on 11.06.2016. There was no defect report on the engine on the previous flight.

1.7 Meteorological information

The aircraft took off from Bangalore airport at 0429 UTC and landed back at 0453 UTC. The METAR obtained from Bangalore airport for the date of incident from 0400 UTC to 0500 UTC are quoted as below;

" METAR VOBL 150400Z 27012KT 9999 SCT012 BKN080 23/19 Q1014 NOSIG

METAR VOBL 150430Z 27012KT 9999 SCT012 BKN080 24/19 Q1014 NOSIG

METAR VOBL 150500Z 27012KT 9999 SCT012 BKN080 25/19 Q1014 NOSIG "

The METAR indicated good weather and visibility of more than 10 kms from 0400 UTC to 0500 UTC. The winds were consistent, with bearing 270º and velocity 12 kts. There were scattered clouds at 1200 feet.

1.8 Aids to navigation

Bangalore airport is equipped with following Radio Navigation and Landing Aids.

AID	ID	FREQ (MHZ)	HRS OF OPS
DVOR 1	BIA	116.8	24 Hrs.
DME 1	-	1094/1157	24 Hrs.
DVOR 2	BIB	114.5	24 Hrs.
DME 2	-	1179/1116	24 Hrs.
ILS (CAT 1) LLZ 27	IDEV	108.3	24 Hrs.
GP 27	-	334.1	-
ILS DME 27	-	1044/981	-
LLZ 09	IBAN	109.3	-
GP 09	-	332.0	-
ILS DME 09	-	1054/991	-
ASR	-	2860	-
MSSR	-	1030/1090	-
SMR 1	-	9490	-
SMR 2	-	9375	-

1.9 Communications

Details of various Channels on Aerodrome control and Approach control are as given below.

UNIT	CALLSIGN	FREQ (MHZ)	HRS OF OPERATION
AERODROME CONTROL SERVICE			
CLEARANCE DELIVERY(CD)	BANGLORE DELIVERY	121.825	24 Hrs.
SMC	BANGLORE GROUND	121.650	24 Hrs.
TWR	BANGLORE TOWER	124.350	24 Hrs.
APPROACH CONTROL SERVICE			
APP	BANGLORE APPROACH	121.250 , 127.750	24 Hrs.
ASR	BANGLORE RADAR	119.450	24 Hrs.
DATIS	BANGLORE INFORMATION	128.675	24 Hrs.
EMERGENCY		121.500	24 Hrs.

Aircraft maintained positive communication with the ATC throughout the flight.

1.10 Aerodrome information

Bangalore Airport is operated by M/s Bangalore International Airport Limited. ATS services are provided by the M/s Airport Authority of India. ICAO nomenclature for the airport is VOBL. The geographical co-ordinates of the airport are 13º 11’ 55.92” N and 77º 42’19.7” E. The elevation of the airport is 915 meters (AMSL). The runway is 2750 meters in length and 45 meters in breadth. The orientation of the runway is 09/27. The detail of runway distances is as below;

Runway No.	Code	Elevation (Ft.)	TORA (M)	TODA (M)	ASDA (M)	LDA (M)	RESA (M)
09	4E	3001	4000	4000	4000	4000	240 X 90
27	4E	2917	4000	4000	4000	4000	240 X 90

R/W & Taxi Tracks markings are standard as per Annex- 14 and Rescue & Fire fighting Services of category 8 are available.

1.11 Flight recorders:

Aircraft was equipped with L3 Communication DFDR, model no. FA2100. Part number of the DFDR was 2100-4043-00 and Serial No. was 000511431. The DFDR was removed from the aircraft post-incident and downloaded at CVR/FDR Lab of DGCA. Only last 10Hrs of data was downloaded from the unit. Assistance of accredited representative appointed by BEA, France was taken to decode the raw data. The data was decoded by BEA and following are the events quoted from the DFDR report.

Time	Event
04:12:12	NH #2 left 0% and increased up to 70%. PLA#2 value: 11°
04:14:21	Ground speed values increased around 1/2 kt. The heading changed from 187° to 276°.
04:15:09	The propeller brake of engine #2 was released.
04:15:37	NH #1 increased from 0% to 65%.
04:16:10	Ground speed values back to 0 kt.
04:16:25	NP #2 increased and reached 71%
04:16:54	NP #1 increased and reached 71%
04:17:54	Ground speed values increased.
04:23:38	Ground speed values back to 0 kt.
04:27:39	Ground speed values increased. The heading value decrease (left turn).
04:28:44	Magnetic heading reached 270°
04:28:58	PLA #1 and PLA #2 moved forward, from GI to the notch in 3 s
04:29:03	NP #1 and NP #2 reached 100%
04:29:14	IAS values reached 72 kt increasing
04:29:18	Small rudder inputs were recorded during 11 s. The lateral acceleration values oscillated in a very small range (between -0.06 g to 0.07g)
04:29:30	The All gear squat switch values changed from 1 to 0, followed 1 s later by the Main Gear squat switch. The IAS value was then 113 kt. The recorded selected altitude value was 6,960 ft The recorded selected IAS value was 118 kt The recorded selected heading value was 272 °. The selected longitudinal mode was the IAS mode. The selected lateral mode was the heading mode.
04:29:56	The airplane rolled to the right and the magnetic heading increased to 285° (reached at 04:30:59)
04:30:00	The recorded selected heading value increased to 286°.
04:30:11	The master warning triggered around 1 s.
04:30:16	The recorded selected IAS values increased to 148 kt.
04:30:20	The auto pilot engaged.

04:30:21	NP #1 and NP #2 values decreased from 100 % down to 82%
04:30:27	Flaps recorded position decreased.
04:31:28	The recorded selected altitude value increased to 13,960 ft.
04:34:03	The IAS mode disengaged. No longitudinal upper mode was engaged. The recorded pitch angle value decreased from 9.7° down to 6°.
04:34:18	The recorded pitch angle values stayed fix at 6° during 53 s.
04:35:09	The longitudinal Altitude Capture mode engaged.
04:35:24	The recorded selected altitude value decreased down to 8,080 ft.
04:35:27	The vertical speed mode engaged, with a selected vertical speed of -400 ft/min.
04:36:02	The longitudinal altitude mode engaged quite immediately in track mode.
04:36:31	The selected heading decreased to 270 ° (i.e., the knob was turned to the right increasing from 285° to 359 ° and then from 0° to 270°).
04:37:02	The selected heading value decreased down to 216 ° (stable during 8 s). Then the selected heading values decreased gradually.
04:38:05	The selected heading values reached 116° and stayed fix.
04:40:11	The selected heading values decreased reaching 91° in 3 s and stayed fix at this value.
04:43:03	The recorded selected altitude value reached 5,480 ft.
04:43:04	The longitudinal vertical speed mode engaged, with a selected vertical speed value of -100 ft.
04:43:06	The selected vertical speed value was set to -800 ft.
04:43:14	The selected vertical speed value was set to -1,500 ft.
04:43:26	The selected vertical speed value was set to -1,400 ft.
04:43:45	The longitudinal altitude mode engaged. The selected altitude value was changed, reaching 7160 ft in 4 s
04:44:20	The selected altitude value decreased down to 5,360 ft in 4 s. The longitudinal vertical speed mode engaged, with a selected vertical speed value of -300 ft/min
04:44:25	The selected vertical speed value changed to -700 ft/min
04:44:30	The selected vertical speed value decreased down to -2,100 ft/min, reached in 6 s, then increased back to -1,500 ft/min.
04:45:27	The longitudinal altitude mode engaged, quite immediately in track mode.
04:45:32	The selected magnetic heading value decreased from 90° to 0° in 5 s.
04:46:29	The selected magnetic heading value decreased from 0° to 301° in 4 s.
04:46:45	Localizer mode armed then Glide mode armed
04:47:05	NP #1 and NP #2 increased and reached a few seconds later 100%
04:47:53	The lateral localizer mode engaged. At the same time, the longitudinal Glideslope mode engaged. Both modes engaged quite immediately in track mode.
04:48:22	Master warning triggered during 2 s
04:48:29	Master warning triggered during 6 s
04:48:33	PLA #2 retarded to FI in 4 s
04:48:36	Auto pilot disengaged
04:48:37	NP #2 began decreasing slowly

04:48:40	maximum lateral acceleration (0.1G left side slip) and rudder input up to 13° left
04:48:43	Yaw damper disengaged and rudder inputs corrected (up to 24° left).
04:48:45	NP #2 dropped from 90% down to 0 in 6 s
04:48:50	Fuel flow #2 reached 0 – Master Warning triggered and stayed engaged till the end of the flight
04:51:03	All upper mode cancelled (500 ft RA)
04:52:47	Main landing gear touch the ground
04:53:26	NP #1 dropped from 70 % down to 0 in 6 s
04:53:51	Fuel flow #1 reached 0
04:53:58	NH #1 reached 0%

Aircraft was also equipped with L3 Communication CVR, Model no A200S. The part number of CVR was S200-0012-00 and the serial number was 02200. The CVR was also removed from the aircraft post- incident and complete download of the same was carried out at CVR/FDR Lab of DGCA. Following output files were created after the download.

1. CAM – HQ ; Duration 31 min 04 seconds
2. CAM – SQ ; Duration 02 hrs 03 min 44 seconds
3. CH1 – HQ ; Duration 31 min 11 seconds
4. CH2 – HQ ; Duration 31 min 16 seconds
5. COMB – SQ ; Duration 02 hrs 02 min 59 seconds.

The recordings were audible and clear. It was observed from the all relevant checklists were performed by the crew. The PIC was informed of smoke in cabin by the cabin crew. Crew gave a PAN PAN call to ATC and requested vector back to Bangalore. Cabin crew continuously briefed PIC of situation in cabin. PIC was also informed of fire observed on RH engine by passengers and an AME on board. Pilot declared MAYDAY just before landing and gave evacuation command immediately after aircraft lands and halt.

1.12 Wreckage and impact information:

The aircraft carried a safe emergency landing on Rwy 27 at Bangalore which was also the departure airport, and evacuated passengers on the runway.

Apart from damage to engine, there was no other damage and aircraft was put back into service after Engine change and necessary inspections.

1.13 Medical and pathological Information:

The crew had undergone pre-flight medical at Bangalore before departure as per requirement of CAR Section 5, Series F, Part III and the same was satisfactory.

All passengers were evacuated safely during the emergency evacuation on the runway. 03 Passengers received minor injury during evacuation and were provided necessary treatment by the duty doctor at the Airport. The passengers were treated for minor injuries which included bruises, contusion and sprain

There was no injury to the pilots or the cabin crew. As per CAR the crew underwent post occurrence medical examination at Bangalore. The test reports were satisfactory.

There was no evidence that performance of flight crew was affected by any physiological factors or smoke in cabin.

1.14 Fire:

Fire was reported on the No 2 Engine during flight at an altitude of approximately 1200 Feet. The fire warning continued in the cockpit even after 02 squib discharges and stopped just close to landing.

Fig 07

1.15 Survival aspects:

The cabin crew distributed wet tissues to the passengers to help them breathe in smoke, and called for protective breathing position. The crew carried out emergency landing and evacuated passengers on the runway immediately after landing due to thick smoke in cabin.

Local standby was declared at airport at 1013 Hrs IST which was converted to full emergency at 1020 Hrs IST. The emergency vehicles were already on alert when aircraft came for landing and reached the aircraft immediately after it came to halt at a distance of approximately 1775m from the threshold.

Cabin crew instructed the passengers at seat 1A and 1F to open the exit hatch doors after evaluating the conditions outside for safety. Both hatch doors were opened and passengers evacuated from both port and starboard side. The incident was survivable.

1.16 Tests and research

1.16.1: The Right engine of the aircraft was removed after the incident for inspection and repairs. The fuel and Oil sample were taken from the engine and sent to the Oil testing lab at DGCA.

The oil sample passed the specification test for appearance, colour, density, viscosity, flash point and pour point.

1.16.2: The Engine was sent to PWC for detailed examination. Strip examination of the engines was carried out in September 2016 in presence of Chairman, COI and Accredited Representative appointed by TSB Canada. The salient findings of the investigation report as below;

- The engine externals showed no evidence of high temperature exposure
- The high pressure turbine (HPT) and low pressure turbine (LPT) could be rotated freely. The power turbine (PT) could be rotated only partially before it would bind.
- The turbo machinery magnetic chip detector (MCD) showed some metallic slivers (Fig 08).The reduction gearbox (RGB) MCD was clean.

Fig. 08

- The Nos. 6 and 7 bearings oil scavenge and vent transfer tubes were found loosened with the metal tip seal gasket on the scavenge tube end significantly worn

(**Fig 09).** The Nos. 6 and 7 bearings oil pressure transfer tube was fractured showing a flat fracture surface morphology indicative of fracture by fatigue.

Fig 09

- The PT stator shroud housing showed impact damages with material loss (Fig 10).

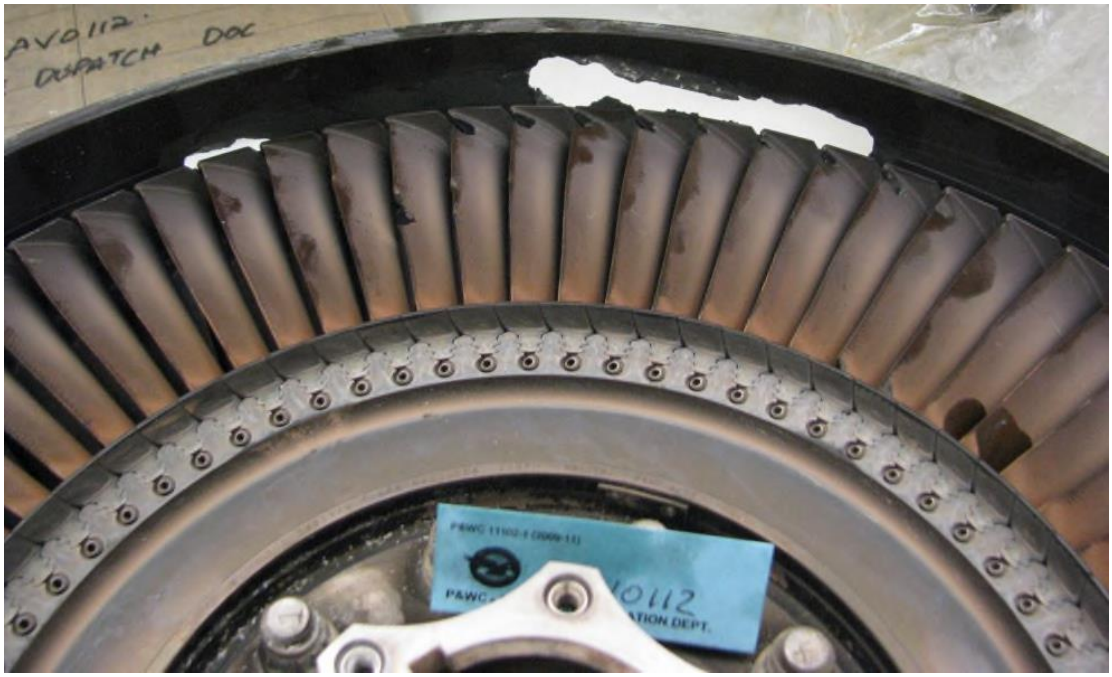

Fig 10

- The first stage PT blades and stator showed no distress. However, the 1st stage stator showed "cooked" oil residue discoloration in the 6 o'clock region (circled) and the inner baffle bolts (arrows) were all fractured (**Fig 11).**
- The Nos. 6 and 7 bearing housing inner turbine duct (ITD) retaining bolts were all fractured (**Fig 12**). The Nos. 6 and 7 roller bearings showed a darkened colour but no distress. The No. 6 and 7 bearing housing air /oil seals showed significant wear of the knife edges and the release of metallic slivers due to the wear (Fig 13).

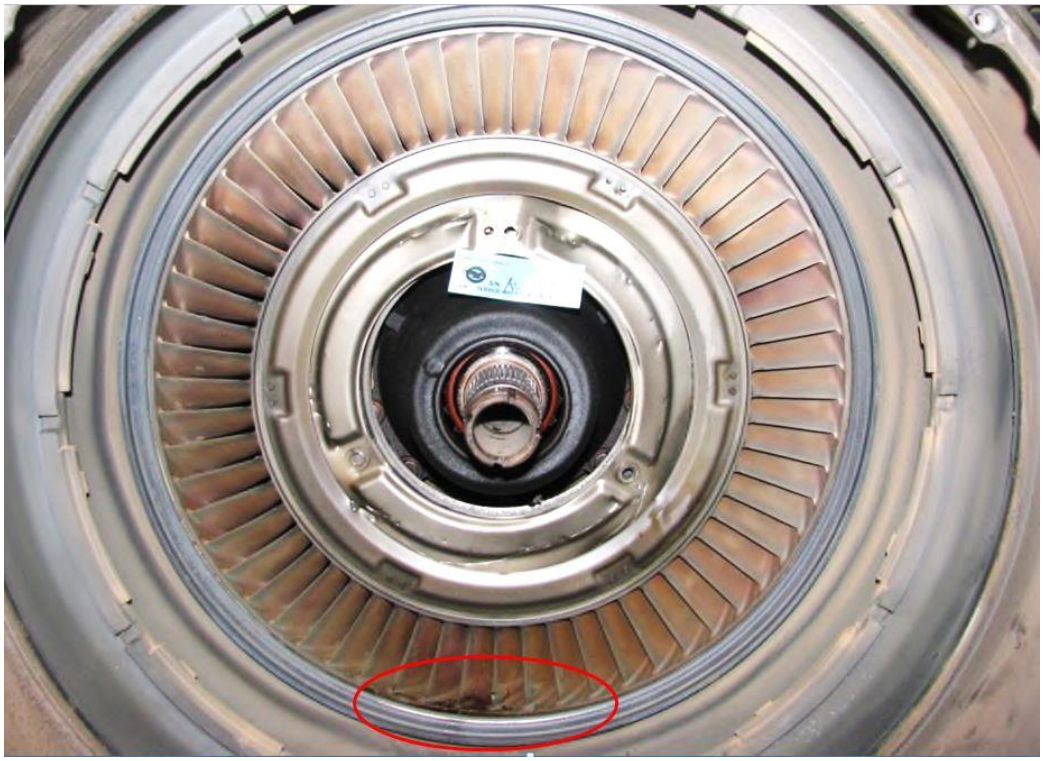

Fig 11

- The Nos. 6 and 7 bearing housing inner turbine duct (ITD) retaining bolts were all fractured (**Fig 12**). The Nos. 6 and 7 roller bearings showed a darkened colour but no distress. The No. 6 and 7 bearing housing air /oil seals showed significant wear of the knife edges and the release of metallic slivers due to the wear (Fig 13).

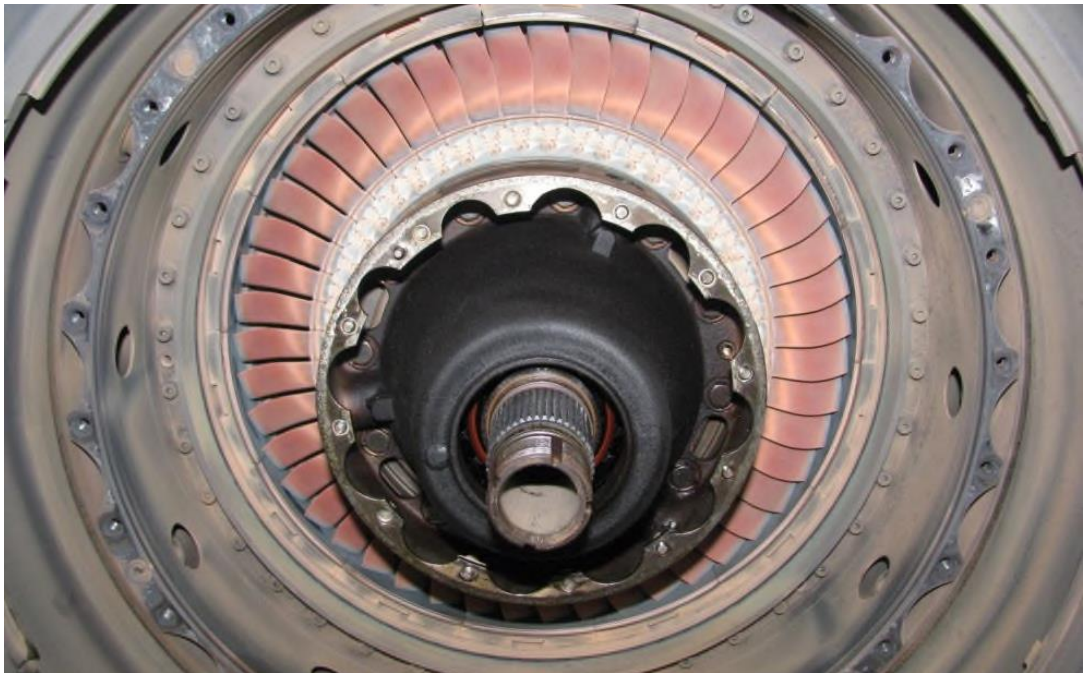

Fig 12

Fig 13

- The LPT blades and stator showed no distress.
- The HPT blades, the HPT stator and combustion liners showed only operational wear.
- The PT shaft showed no intershaft rubbing.
- The LP impeller was oil wetted and showed no evidence of FOD. However airfoil rubbing contact was observed resulting in the raised edges of the impeller airfoils (circled, Fig 14).

Fig 14

- Two of the 2nd stage PT blades were fractured. One of the fractured PT2 blades (P/N 3118204-01) was fractured near the platform and exhibited a small flat

fracture region near the leading edge indicative of fatigue. The other fractured PT2 blade was fractured near the shroud tip and showed a fracture morphology indicative of tensile overload. (Fig 02)

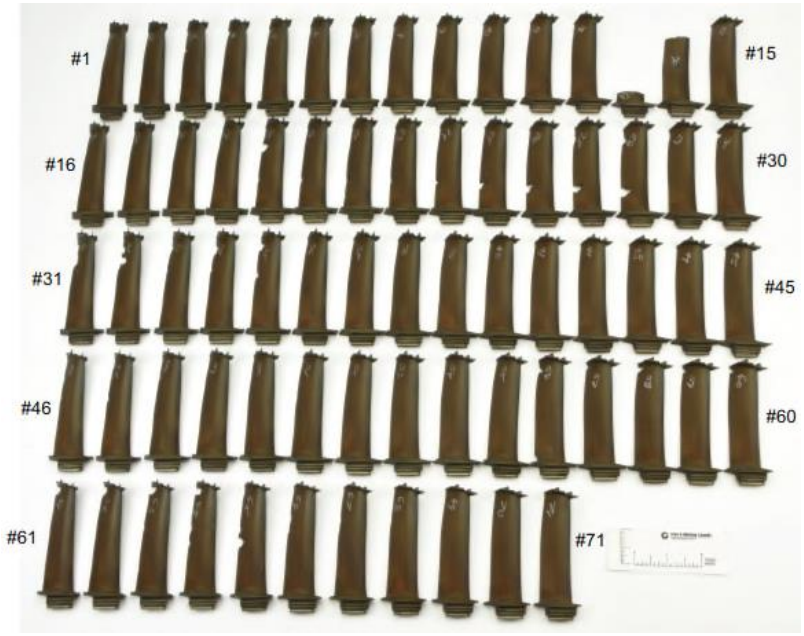

Fig 15

- The fractured blade indicated as blade No. 13 in Fig 15 showed a fractured airfoil at approximately 0.4 inches above the platform on the leading edge (L/E) side. A relatively flat topography with evidence of beach marks and river lines indicative of fatigue cracking was observed at the L/E region. The fatigue region was also observed to occupy a relatively small surface area compared to the overload fracture (Fig 16).

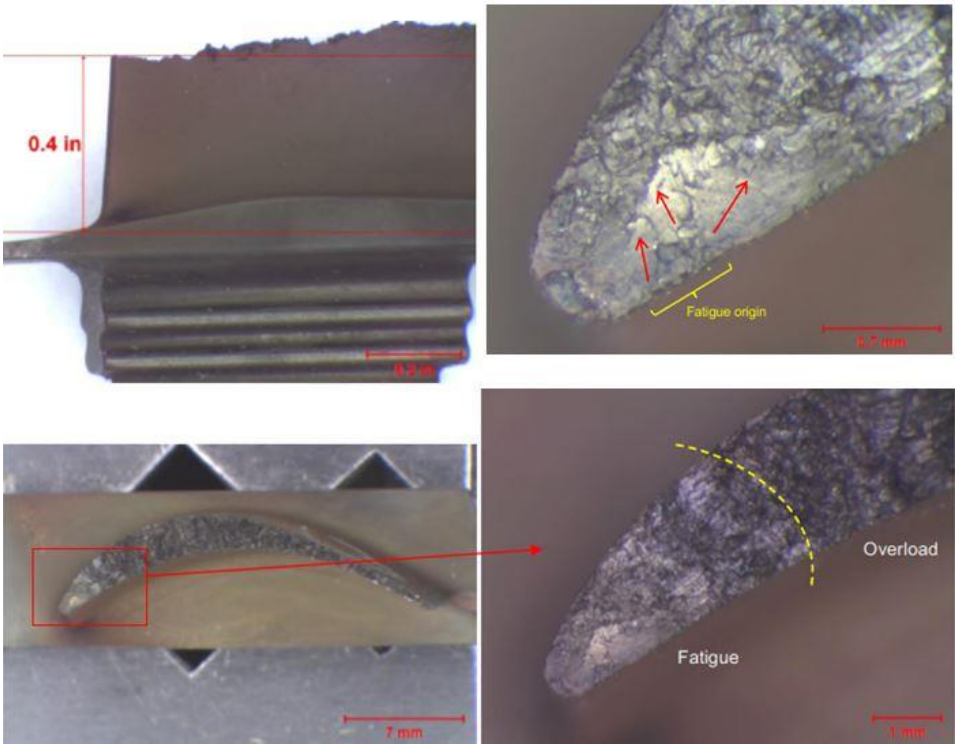

Fig 16

- The fatigue origin initiated along the leading edge on the pressure side of the airfoil propagating towards the suction side and trailing edge (Fig 16)
- Scanning electron microscope examination of the fracture origin region showed an oxidised surface along the pressure side surface (bracket) as well as the leading edge (Fig 17).

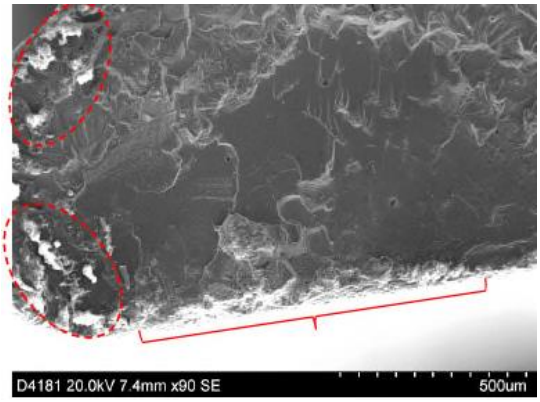

Fig 17

- SEM examination at higher magnification showed the crack propagation (arrows) was emanating from an oxidised region. SEM backscattered electron - energy dispersive spectroscopy (EDS) within the oxidised origin region revealed the presence of a Niobium rich phase.(Fig 18)

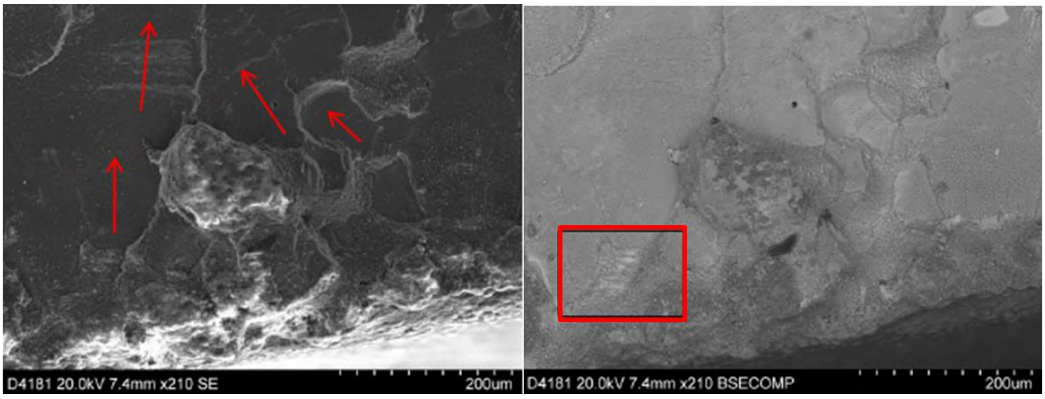

Fig 18

- SEM examination of the fracture surface away from the fatigue propagation exhibited features consistent with fracture by overload (Fig 19).

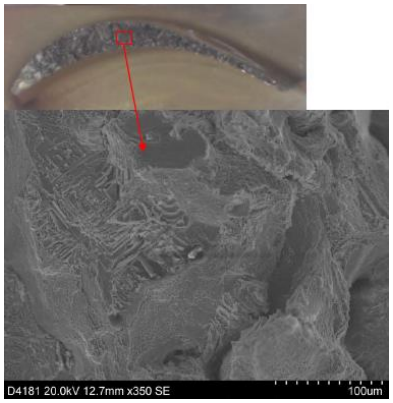

Fig 19

- A metallographic transverse cross-section through the origin area as indicated by the inset in Photo No. 35 was examined by SEM (Fig 20).

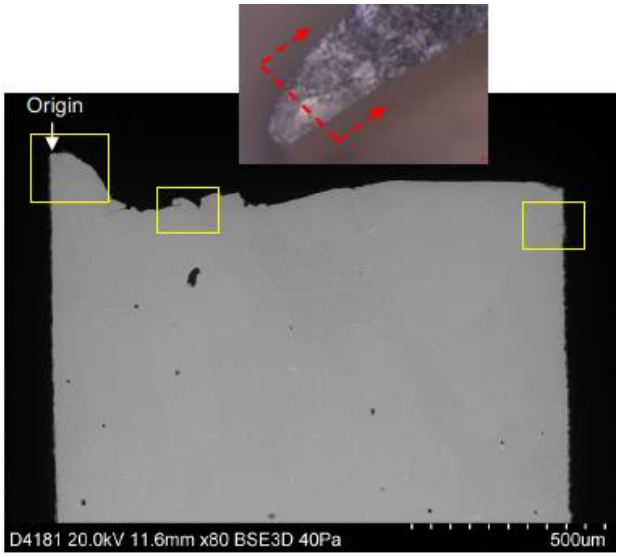

Fig 20

- SEM examination at higher magnification of the boxed region at the origin in Fig20 showed the presence of an oxidized layer / corrosion along the leading edge and on the fatigue origin region of the fracture surface (Fig 21). A secondary oxidized crack connected to the fracture surface was also observed in the region of the fracture origin.

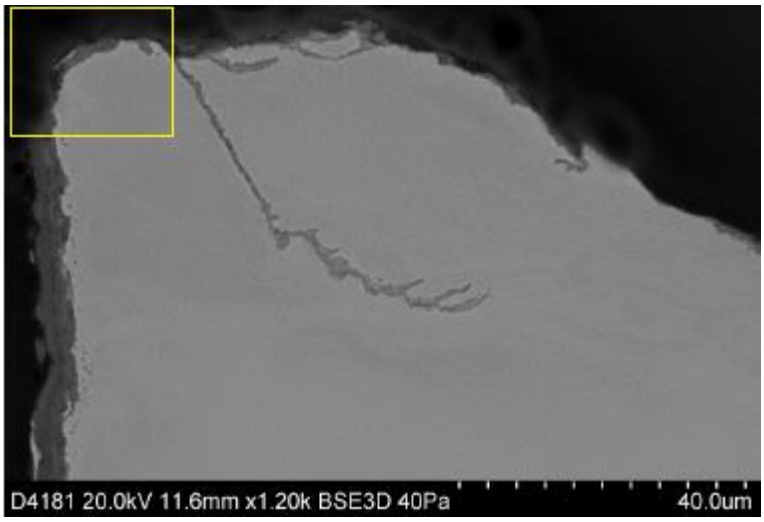

Fig 21

- SEM examination at higher magnification of the boxed region at the origin in Photo No. 36 showed the presence of a few Sulphur and Chromium rich precipitates ahead of the oxidation layer / corrosion front along the leading edge and fracture surface, which is indicative of sulphidation (Fig 22). Although the cause of the fatigue crack initiation could not be determined with certainty the

presence of sulphidation may have been a contributing factor to the fatigue crack initiation process.

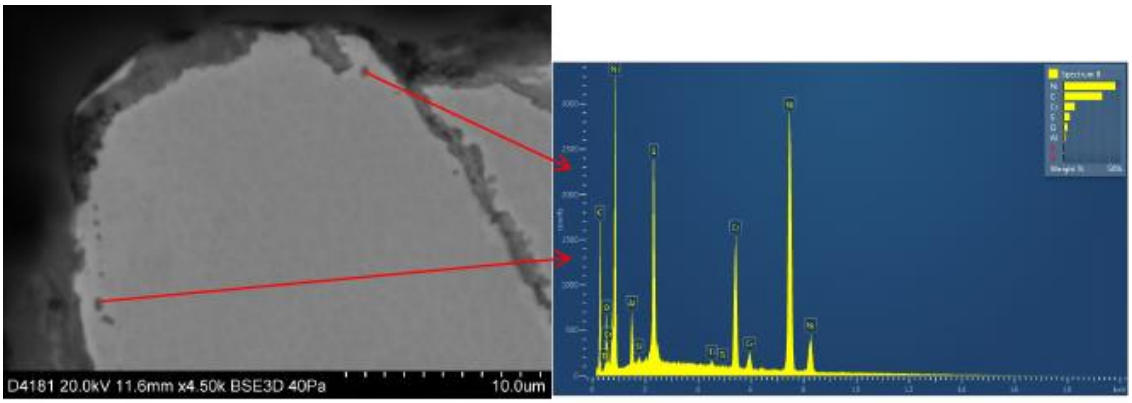

Fig 22

- The crack shown in the middle yellow box in Fig 20, adjacent to the fatigue origin region, exhibited an oxidised crack associated to a Niobium rich phase (Fig 23) most likely as an interdendritic complex carbide based on the SEM - EDS analysis results.

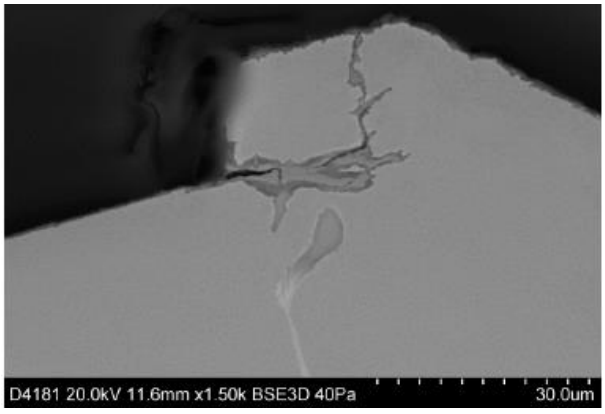

Fig 23

- SEM examination at higher magnification of the boxed region away from the fracture surface along the suction side of the airfoil as indicated by the boxed region on the right side of the airfoil in Fig 21 showed the presence of an oxidised crack associated with a Niobium-rich phase (Fig 24).

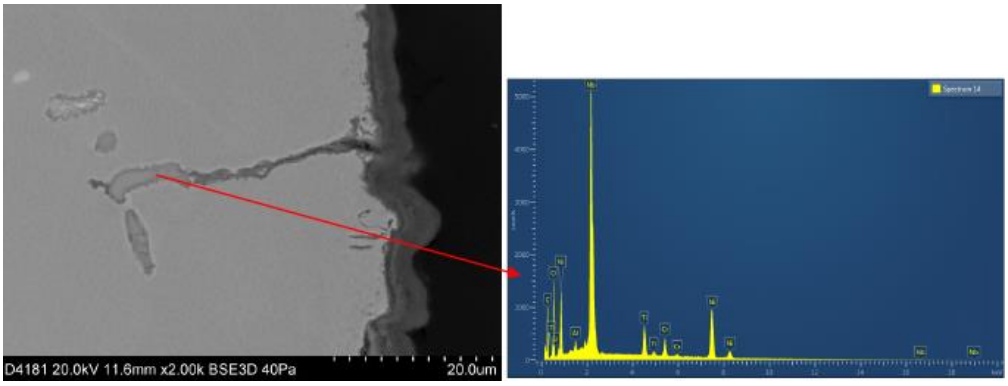

Fig 24

- SEM examination of the microstructure underneath the fracture surface showed slightly rounded gamma prime precipitates (left side, Fig 25) compared to quasi-cuboidal gamma prime precipitates in the root area (right side, Fig 25). This indicates an essentially unaffected microstructure.

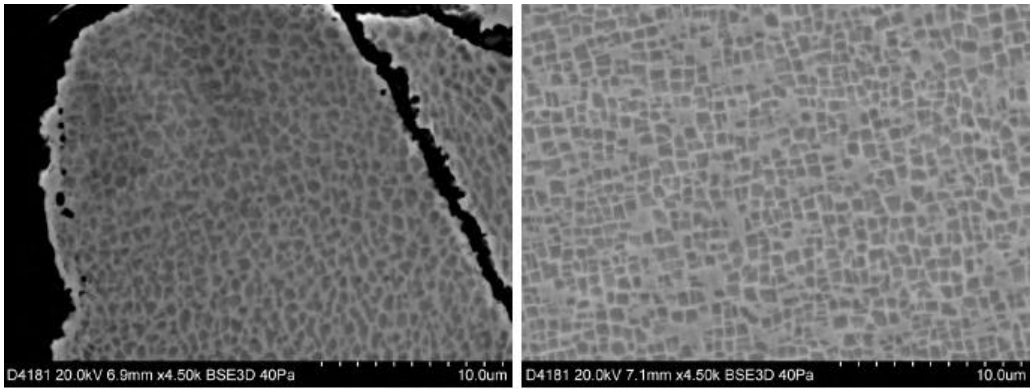

Fig 25

- SEM-EDS standard less semi quantitative analysis of the base material on a polished surface of blade No. 13 showed that the proportions of the major elements detected were consistent with the drawing material requirements.
- Examination of fractured blade No. 14 (left side, **Fig 26**) showed the blade had fractured approximately 2.4 inches above the platform. The fracture surface morphology was indicative of fracture by overload (right side, Fig 26). No evidence of fatigue was observed.

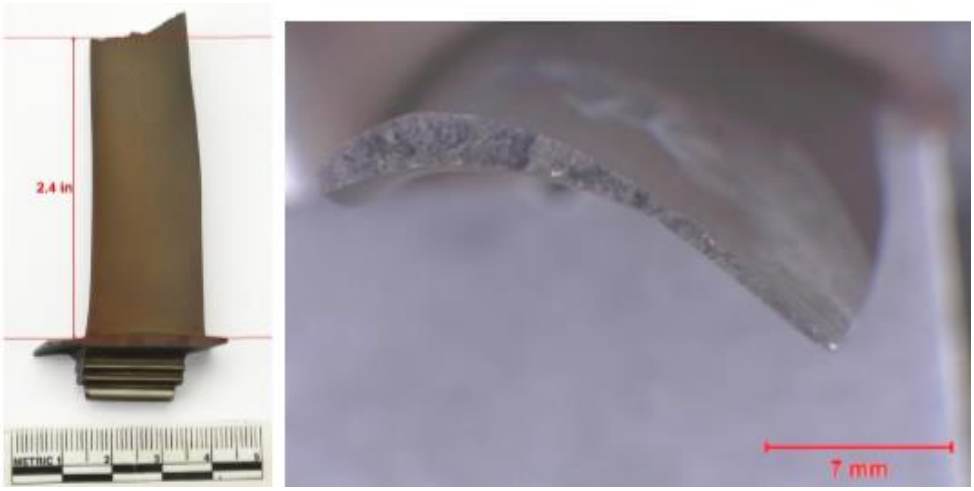

Fig 26

- Blade No. 42 was sectioned longitudinally for over temperature microstructural evaluation along the trailing edge (inset, **Fig 27**). The cross-section revealed an essentially unaffected microstructure consisting of quasi-cuboidal gamma prime precipitates in a gamma matrix with carbides. No evidence of any over temperature was observed. The presence of Type I sulphidation (left image, **Fig 27**) which followed an inter - dendritic path due to the presence of an elongated Niobium-rich phase, was observed at approximately the same height as the fracture of Blade No.

13. The Type I sulphidation was confirmed with the presence of Chromium Sulphides (black arrows, right image, **Fig 27**).

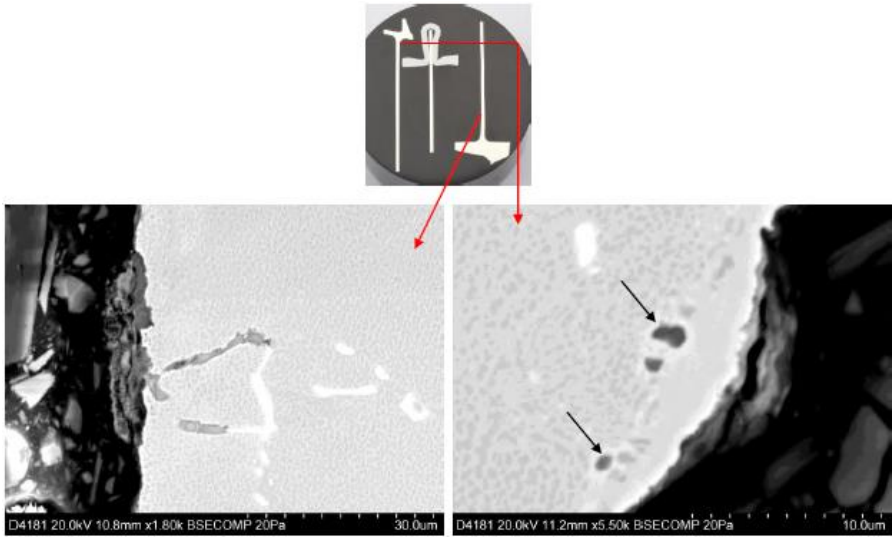

Fig 27

- SEM examination of the fracture surfaces of No 6 and No 7 bearing vent tube of as indicated in Fig 01, revealed a flat surface with evidence of beach marks and river lines indicative of fatigue. SEM magnification of the fracture surface suggests the fatigue origins were located along the tube outer diameter and propagated likely by high cycle fatigue towards the inner diameter. The exact fracture origins due to rubbing could not be further characterised. No evidence of material anomalies was observed.

1.17 Organisation and Management information:

M/s Jet Airways (India) Ltd. is a Scheduled Airline having DGCA SOP No. S-6A in Category Passenger and Cargo. The Airline Head Quarter is located at New Delhi. The Air operator permit of the Airline is valid till 12/02/2018. The airline commenced its operations on 5th May 1993.

The Company is headed by CEO assisted by a leadership team of professional of various departments. The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA. The Chief of Safety is a Senior Vice President in the company who reports directly to the Chairman

The airlines operate a fleet of aircraft, which includes 09 Airbus A330-200/300, 10 Boeing 777-300 ER aircraft, 76 Boeing 737-700/800/900/900ER aircraft and 18 ATR 72-500/600 turboprop aircraft.

1.18 Additional Information

1.18.1 Earlier cases of Blade failure in M/s Jet Airways fleet.

As per information available from M/s Jet Airways, two events of blade failure were reported on its ATR fleet prior to the incidence involving VT-JCL 15.06.2016. As per the Lab reports from the manufacturer, total of 02 events of crack/failure in Jet Airways fleet, including AV0112 installed on VT-JCL were affected by presence of Niobium.

In Feb 2014 a Special Instruction SI-14-2014 was issued by the manufacturer to carry out Eddy Current Inspection of second stage Power Turbine (PT2) blades. This SI was effective only for the ESN listed in the SI. AV00112 was not listed in the SI and hence ECI was not carried out on this engine.

The ECI was later included in EMM on 03rd Aug 2015 as EMM 72-03-00. The engine was overhauled in Aug 2014. Therefore ECI was again not carried out as it was not part of EMM then.

Service Bulletin SB 21876 was issued by the manufacture in July 2015 to replace the second stage PT blades with new blades having chromium coating. The new blades had improved resistance to corrosion caused by sulfidation. However the SB 21876 too was not complied on the AV0112 engine because the SB was a Category – 7 compliance bulletin, i.e SB can be done when the supply of superseded parts is fully used.

1.18.2. Sulfidation:

Sulfidation is type of hot corrosion caused by reaction of metals with sulphur present in its working environment at extreme temperatures. It is generally classified into Type 1 and Type 2 sulfidation. Type I sulfidation is caused at temperatures ranging between 825°C to 950°C and characterized by a thick, porous layer of oxides with the underlying alloy matrix depleted in chromium, followed by internal chromium-rich sulphides and is generally prevalent in aero engines. Type II sulfidation typically occurs at temperature ranging from 700°C to 800°C and is characterized by pitting attack with little or no internal attack underneath the pit and is generally prevalent in marine engines.

Sulfidation affects turbine blades in engines due to presence of high temperature and sulphur in the operating environment. The fuel is primary source of sulphur, however sulphur may also be present in salts in coastal or polluted environment and atmospheric dust. ATF supplied in India allows for sulphur content of not more than 0.30 %. Presence of niobium in metal alloys makes alloy more prone to sulfidation.

Sulfidation is an unavoidable phenomenon but is generally contained by desalination/desulfidation wash and regular monitoring to detect and replace affected components.

1.18.3 Emergency Evacuation and Operating Procedure:

Emergency Evacuation Procedure are defined by the airline in Chapter 11 of Part B of its Operation Manual . Extract from the chapter is quoted below.

" 11 EMERGENCY EVACUATION PROCEDURES

11.1 INSTRUCTION FOR PREPRATION OF EMERGENCY EVACUATION

Fire / Smoke Emergency Evacuation… etc are some of the types of cabin emergencies. The detailed procedures are given in QRH / FCOM / SEP Manual.

11.2 EMERGENCY EVACUATION OF AIRCRAFT

In the event of an emergency in an aircraft, when on the ground, Captains are responsible for deciding whether or not to order an emergency evacuation of the aircraft. In making this decision, Captains should bear in mind the following considerations:

a) The immediate action must be to carry out the appropriate emergency drill- which may include evacuating the aircraft. If the warning persists, Captains should bear in mind that the primary objective is to take every precaution to safeguard the well- being of the passengers;

b) It must be stressed that for persists smoke or a fire that cannot be positively confirmed to be completely extinguished, a passenger evacuation must be accomplished;

c) Captains should ensure that, following a landing with a suspected fire or smoke in a cargo hold, the hold door should not be opened till all

passengers have left the aircraft; and

d) Should the Captain decide against emergency evacuation, it would be prudent to have fire vehicles follow the aircraft to the apron as a precautionary measure.

11.3 COCKPIT CREW EVACUATION DUTIES

The Captains shall ensure completion of all emergency checklist as specified in the aircraft FCOM / FCTM and both Captain / First Officer take position in the cabin as per Sep Manual. If it is not possible to reach the passenger cabin the flight Deck, Crew shall evacuate through the Flight Deck emergency windows by means of the escape devices and assist evacuation from the bottom of the escape slide. ”

Emergency Operating procedure in case of fire and smoke is given in the QRH and SEP Manual 4.1 and 4.2

1.19 Useful or effective investigation techniques: NIL

2. ANALYSIS

2.1 Serviceability of the aircraft.

The aircraft had a valid certificate of airworthiness on the date of incident. The last major inspection on the aircraft was carried out in May 2016 and aircraft did not have any pending snag and was neither operating under any MEL.

Both the engines were serviceable and did not have any pending snags. The ECI introduced as per SI-14-2014 was not carried out because the SI was not applicable to Engine Serial Number AV00112. The ECI was later introduced in EMM in Aug 2015; however the engine was overhauled in July 2014 before introduction of ECI in EMM.

SB 21786 for replacement of PT blades with new blades having chromium coating was also not complied on the engine as it was a compliance Category - 7 bulletin.

Not carrying out ECI and SB 21786 was a contributory factor to Serious Incident.

2.2 Flight Operations:

In case of Fire and Smoke emergency procedures are given in the QRH and SEP Manual 4.1 and 4.2.

The aircraft took off with 21205 Kg which is below the permissible Max Landing Weight of 22650 Kg. The aircraft did not carry out overweight landing.

2.2 Weather:

The Met report issued on the date of incident indicated good weather and visibility of more than 10 Km. There was no significant change predicted in the Met reports. The CVR and ATC recordings of the conversation between crew and ATC as well as cockpit conversation indicates that crew did not face any problem in sighting the runway.

2.3 Handling of Evacuation procedures:

Emergency evacuation was carried as per the procedure defined in airline operations manual. As per the para 11.2 (b) of Operations Manual Part B;

"It must be stressed that for persists smoke or a fire that cannot be positively confirmed to be completely extinguished, a passenger evacuation must be accomplished;"

The crew carried out evacuation of passengers immediately after landing as per the defined procedures. Passengers evacuated from both port and starboard side after cabin crew assessed both sides for safety.

2.4 DFDR Readout:

The DFDR data indicates that LH engine was started at 04:12:12 UTC and RH Engine was started at 04:15:37 UTC. Thereon Both NP#1 and NP#2 increased to 71% and reached 100% at 04:29:03 UTC. Aircraft took-off at 04:29:30. Immediately after take-off, master caution warning triggered at 04:30:11 UTC for a second. Crew continued with normal procedures and ignored the caution warning. Autopilot was engaged at 04:30:20 and altitude value was selected to 13960 feet. At 04:31:21 both engines NP was decreased to 82% from 100 %.

At 04:35:24 UTC crew decreased the selected altitude value to 8080 feet from earlier selected 13960 feet. At 04:36:31 UTC there was change in aircraft heading, and aircraft started to turn left to return to Bangalore airport. At 04:47: 05 UTC both engines NP increased and reached 100%. At 04:47:53 UTC localizer was engaged. At 04:48:22 and 04:48:29 master caution warning was again triggered for 02 seconds and 06 seconds respectively. In response to the warning the crew retarded the PL to F1 position at 04:48:33UTC, this is first step in engine shutdown procedure. Aircraft touched down at 04:52:47 UTC.

The DFDR data does not indicate any significant discrepancy in both engines parameters. The RH engine continued to give power till it was shut down by pilot after master caution warning. The DFDR findings are in line with statement of crew.

2.5 Sequence of Events

Approx. Time (UTC)	**Important Events**
04:12:12	Engine Started
04:29:30	Aircraft Takes - off
04:30:11	First Master Caution Warning appears
04:31:28	Aircraft cleared for climb to FL140
04:31:36	Cabin Crew informs PIC of smoke in cabin
04:35:11	ATC requested for holding altitude of 8000 feet
04:35:24	The recorded selected altitude value decreased down to 8,080 ft.
04:37:55	PAN PAN call and ATC requested for vector back to Bangalore
04:38:04	Cleared by ATC to turn Left heading 115 vectoring for ILS approach Rwy 27
04:38:05	The selected heading values reached 116° and stayed fix.
04:40:11	The selected heading values decreased reaching 91° in 3 s and stayed fix at this value.
04:43:00	Aircraft cleared for descent 7200 by ATC
04:43:03	The recorded selected altitude value reached 5,480 ft.
04:43:04	Crew request descent to 5500
04:43:36	ATC instructs JAI2839 to maintain 7200
04:43:45	The longitudinal altitude mode engaged. The selected altitude value was changed, reaching 7160 ft in 4 s
04:44:11	Aircraft cleared for descent to 5500 by ATC
04:44:20	The selected altitude value decreased down to 5,360 ft in 4 s. The longitudinal vertical speed mode engaged, with a selected vertical speed value of -300 ft/min
04:49:16	Cabin Crew informs PIC of RH engine fire
04:49:37	Fire Extinguisher discharged
04:49:41	MAY DAY call given by Co pilot
04:52:47	Aircraft Touches down
04:53:33	PIC gives “Evacuate Evacuate” command

3. CONCLUSIONS

3.1 Findings:

1) Aircraft had a valid certificate of airworthiness and was maintained in accordance with the approved maintenance schedule, however ECI introduced in the SI-02-14 and later incorporated in EMM was not carried out on the Engine and engine was also not equipped with new chromium coated blades introduced in SB 21786
2) The Engine Oil samples taken from the Engine after the incident was tested in DGCA Lab and passed the specification test for appearance, colour, density, viscosity, flash point and pour point.
3) Strip examination of Engine revealed failure of Air/Oil seals of shaft and impeller bearing.
4) Magnetic Chip Detector of Turbomachinery showed some metallic particles.
5) LP impeller was oil wetted.
6) Two 2nd Stage PT blades fractured at approximately 0.4 inches and 2.4 inches above the platform respectively.
7) Blade 13 was fractured due to fatigue. The fatigue crack propagated from leading edge from an area rich in niobium which had signs of sulfidation.
8) Blade 14 fractured due to overload.
9) Damages on other blades was secondary.
10) The fracture of the exterior Nos. 6 and 7 bearings oil vent tube by fatigue was secondary.
11) Failure of Air/Oil seal due vibration resulted in oil leakage into the gas path as evidenced by the oil wetted LP impeller.
12) Oil leakage contaminated the bleed air from RH engine
13) Smoke only affected the cabin.
14) There was no smoke in cockpit.
15) The flight crew was current and qualified to operate the flight.
16) Evacuation was carried out as per procedure laid in Operations Manual Part B Chapter 11.
17) There was no evidence of physiological factors or smoke in cabin affecting performance of flight crew and cabin crew.
18) 03 Passengers received minor injuries while evacuating and were treated accordingly.

3.2 Probable cause of the Incident:

Probable cause of Smoke in cabin was contamination of bleed air by engine oil due to failure of the air/oil seals of turbine shaft bearings and impeller bearings caused by the heavy vibration consequent to failure of PT2 blades.

Not carrying out Eddy Current Inspection as per SI-02-14 or EMM 72-03-00 and SB 21786 was a contributory factor to Serious Incident.

4. Recommendations:

4.1. M/s Jet Airways should ensure routine Eddy Current Inspection on all its ATR fleet as per the EMM 72-03-00.

4.2. Although, SB21876 is a compliance Category 7 mod. M/s Jet Airways may check the feasibility of carrying out SB21876 at a predetermined Engine Hours, based on failure analysis, in consultation with DGCA.

Jasbir Singh Larhga
Assistant Director Air Safety
Chairman, Committee of Inquiry

Dinesh Kumar
Air Safety Officer
Member, Committee of Inquiry