

FINAL INVESTIGATION REPORT OF SERIOUS INCIDENT TO M/S JET AIRWAYS
ATR 72-212A AIRCRAFT VT-JCS AT BENGALURU ON 13/06/2014

1.	Aircraft Type	ATR 72-212A
2.	Nationality	INDIAN
3.	Registration	VT - JCS
4.	Owner	M/s Injet Leasing Company Ltd
5.	Operator	Jet Airways Ltd
6.	Pilot – in –Command	Holder of ATPL
7.	Co-Pilot	Holder of CPL
8.	Place of incident	Bengaluru
9.	Co-ordinates of incident Site	13° 11' 57" N, 77° 42' 36" E
10.	Last point of Departure	Bengaluru
11.	Intended place of Landing	Cochin
12.	Date & Time of incident	13 th June, 2014, 0448 UTC
13.	Passengers on Board	64
14.	Extent of Injuries	NIL
15.	Crew on Board	04 (02+02)
16.	Extent of Injuries	NIL
17.	Phase of Operation	Pushback
18.	Type of Incident:	Smoke in Cockpit and Cabin

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SYNOPSIS:

On 13.06.2014, M/s Jet Airways Ltd. ATR 72 -212A aircraft VT-JCS while operating flight 9W-2731 (Bengaluru to Cochin) was involved in a serious incident during pushback at Bengaluru.

The aircraft was schedule to depart from Bengaluru at around 0445 UTC. Aircraft was cleared for pushback, facing east on L3. Till pushback all the operations were normal. Immediately after push back Nacelle (NAC) OVERHEAT warning came on. Engine No. 02 was shut down by the cockpit crew and the same was intimated to ground crew. After shutting down engine no. 2, NAC OVERHEAT warning got disappeared. Thereafter engine no. 1 was started normally. Once again engine no. 02 was started with prop brake released. Once again NAC OVERHEAT warning illuminated but it went off after 25 seconds. After that MODE SEL AUTO FAULT came on. Ground crew was intimated and consulted about the fault indication. In the meantime a burning smell was noticed followed by heavy smoke in the cockpit. Cabin crew also intimated to the cockpit crew about the smoke in cabin. The cockpit crew then informed ATC and ground crew of Jet Airways about the smoke in cockpit and cabin. The passengers were then deplaned on L3 normally without hand baggage. Both the engines were shut down by the cockpit crew. Cockpit Crew then asked ATC to activate the fire services. The aircraft was then towed back to bay 36.

Ministry of Civil Aviation constituted a Committee of Inquiry to investigate the cause of the incident under Rule 11 of Aircraft (Investigation of Accidents and Incidents) Rules 2012 vide order no. 15018/01/2014- DG.

1. FACTUAL INFORMATION.

1.1 History of the flight

Jet Airways Ltd. ATR 72-212A aircraft VT-JCS while operating flight 9W-2731 (Bengaluru to Cochin) was involved in a serious incident at Bengaluru on 13.06.2014. The aircraft was under the command of Captain holding ATPL with co-pilot holding CPL.

Prior to the incident flight the aircraft VT-JCS had operated two sectors 9W 2573 (Pune - Hyderabad) and 9W 2742 (Hyderabad - Bengaluru). There was no abnormality

reported by the operating crew. The weather at Bengaluru at the time of startup was fine with visibility approx 10 km. The aircraft was schedule to depart from Bengaluru at around 0445 UTC. The Aircraft was cleared for pushback by ATC, facing east on taxiway L3. Till pushback all the operations were normal. Immediately after push back NAC OVERHEAT warning came on and as the warning was persisting, Engine No. 02 was shut down by the crew and same was intimated to ground crew. After shutting down the engine no. 2, NAC OVERHEAT warning got disappeared as per the pilot it lasted for about 30 seconds. The pilot then informed ground about the same and asked for Engine # 1 start and the same was acknowledged by ground. Engine # 1 was started normally. Thereafter pilot asked ground for Engine # 2 start and the same was acknowledged. Engine # 2 was started with prop brake released. Once again NAC OVERHEAT warning illuminated and it went off after approximately 25 seconds. Thereafter MODE SEL AUTO FAULT was indicated on the Anti/De-icing panel. The cockpit crew then intimated ground crew and consulted about the fault indication. In the meantime a burning smell was felt by the crew in the cockpit followed by heavy smoke in the cockpit. The ground crew then asked pilot about the ITT and pilot told ground that ITT went up and then it got settled. Thereafter Cabin crew also intimated cockpit crew about the smoke in the cabin. Ground then asked pilot if they are going to come back to bay. The cockpit crew then decided to disembark the passengers at same position (L3) and return back to bay. ATC was also intimated about the smoke in cockpit & cabin and also that passengers will be deplaned on taxiway L3 only. ATC was asked to activate the fire services. The pilot then shut down both the engines. Passengers were disembarked on L3 normally and after disembarking the passengers the aircraft was towed back to bay 36. There were total 68 persons on board the aircraft. There were no injuries to any of the occupant. There was no fire.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR/NONE	04	64	

1.3 Damage to the Aircraft:

External visual inspection of the aircraft was carried out. There was no burning sign or any other abnormality was observed.

LH & RH pack, Air Cycle Machine and condenser removed and checked, no traces of oil contamination were observed. However, when LH ACM & Condenser surrounding ducts and hoses were checked, oil smell was felt.

After the incident, at Bengaluru, boroscopic inspection of both the engines was carried out. LP Impeller of LH engine was found with oil stains. HP impeller vanes of both LH & RH engines were wet with oil stains and oil puddle on the case surface of the vanes. On the recommendation of P&W, RH and LH Engine Air Switching Valve was checked for condition of pin and spring and free movement of piston, which was found satisfactory. Thereafter Compressor wash of both LH and RH engine was carried out. After compressor wash, high power Engine Ground Run (EGR) was carried out at 80% torque for 10 minutes. During EGR, no smell of oil or oil fumes with bleed "ÖFF" and bleed "ON" settings was observed. After EGR, boroscopic inspection for both the engines was carried out. During boroscopic inspection, two HPT blades of LH and RH engine were found with oil stains on leading edge near tip without any burn marks. As per PWC Aircraft Maintenance Manual, Air Switching Valves on both the engines were replaced.

On 19.06.2014, an evaluation flight was carried out and no smoke or oil smell was observed in cockpit and cabin. Thereafter, the aircraft was released and no snag was reported on the functioning of sequencing valve.

Prior to this incident flight the aircraft VT-JCS was involved in a serious incident while operating flight Rajahmundry to Hyderabad during taxing at Hyderabad, wherein during rectification, the inner valves of switching valve were swapped. As reported by the operator, in between, above stated inner valves were replaced during maintenance.

The inner valve along with the inner housing (Qty 03) was sent to P&W for investigation.

1.4 Other Damage:

Nil

1.5 Personnel Information:

1.5.1 Pilot – in – Command:

Age	55years
License	ATPL holder
Date of Issue	17.06.2003
Valid up to	16.06.2015
Class	Single/Multi Engine, Land
Endorsements as PIC	P-68C,ATR-42-320,ATR-42-500, ATR- 72- 500
Date of Med. Exam.	11.06.2014
Med. Exam valid upto	10.12.2014
FRT0 License.	Valid
Total flying experience	6481:40 hours
Experience on Type	3706:55 hours
Last flown on type	12.06.2014
Total flying experience during last 180 days	222:15 hours
Total flying experience during last 90 days	133:28 hours
Total flying experience during last 30 days	61:27 hours
Total flying experience during last 07 Days	06:06 hours
Total flying experience during last 24 Hours	04:25 hours

1.5.2Co-Pilot:

AGE	26 years & 03 months
License	CPL holder

Date of Issue	21.01.2010
Valid up to	20.01.2020
Class	Single/Multi Engine, Land/Sea
Date of Med. Exam.	03.04.2014
Med. Exam valid upto	02.04.2015
FRTTO License	Valid
Total flying experience	289:49 hours
Total flying experience on type	13:40 hours
Total flying experience during last 180 days	13:40 hours
Total flying experience during last 90 days	13:40 hours
Total flying experience during last 30 days	13:40 hours
Total flying experience during last 07 Days	05:40 hours
Total flying experience during last 24 Hours	00:00 hours

1.6 Aircraft Information

The aircraft manufactured by M/s Avionics De Transport (Regional) with MSN 920, was registered with DGCA under category 'A' and the Certificate of Registration No. 4139 was issued on 29th Oct 2010.

The aircraft is certified in Normal category, for day and night operation under VFR & IFR. The maximum operating altitude is 25000 feet (7620 m) and maximum take-off weight is 22,800 Kgs. Aircraft length is 27.2 meters, wingspan is 27.0 meters with height 7.6 meters. The aircraft is fitted with two PW127F Engines.

The Certificate of Airworthiness 6248 issued by DGCA on 29th Oct 2010 was valid on the day of incident. The Aircraft was holding a valid Aero Mobile LicenseA-006/050/WRLO-10. The Aircraft had flown 10793.07 airframe hours since new and 10793.07 airframe hours since the issue of last C of A.

Last layover schedule was done on 10.06.2014 at Hyderabad at 10769:06 airframe hours. Certificate of Release to Service was issued on 13.6.2014 at Bengaluru and was valid on the date of incident.

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

Details of LH Engine : (S/N EB0321)

- ✓ Engine Model : PW127F
- ✓ Time Since New : 14,370 Hrs
- ✓ Time Since last HSI : 287 Hrs
- ✓ Last Shop Visit (HSI) : April 2014, P&W, Singapore
- ✓ Cycle Since New : 12,476
- ✓ Cycle since Last HSI : 275

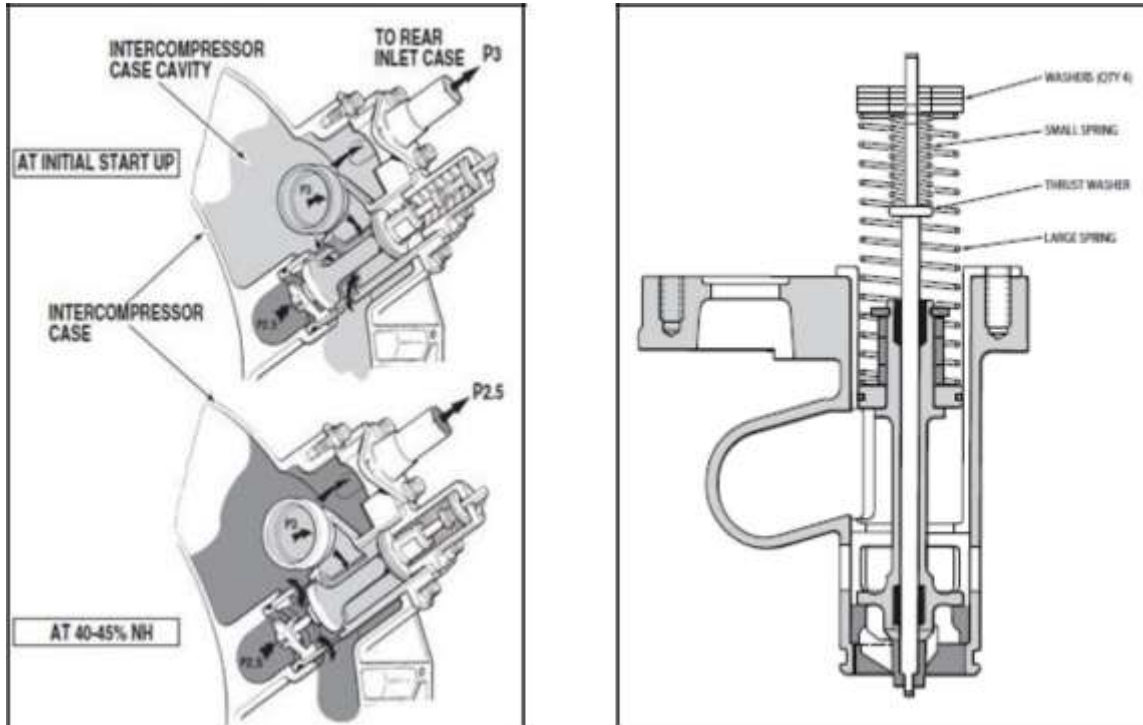
Details of RH Engine : (S/N ED 0089)

- ✓ Engine Model : PW127F
- ✓ Time Since New : 14,565 Hrs
- ✓ Time Since last Overhaul : 778 Hrs
- ✓ Last Shop Visit (Overhaul) : February 2014, P&W, Singapore
- ✓ Cycle Since New : 12,102
- ✓ Cycle since Last Overhaul : 710

The last major inspection 'A6' Check which was carried out on the Aircraft on 23.05.2014 at 10632 TSN / 8589 CSN. Subsequently all lower inspections including last flight inspection and pre-flight checks, were carried out as and when due before the incident. Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine has been complied with as on date of event. Prior to the incident flight there was no pending/repetitive defect

The engine provides air bleed extraction ports from both compressors i.e. the low pressure (LP/P2.5) and the high pressure (HP/P3), as the two bleed ports are connected to the same duct. A P2.5 check valve is installed in the low pressure port to prevent back flow from the high pressure compressor (P3) to the low pressure compressor (P2.5).

The P2.5/P3 air pressure switching valve ensures an adequate air supply for bearing cavity sealing.



AIR PRESSURE SWITCHING VALVE

The switching valve is located in the intercom pressure case and provides adequate air supply during starting by directing P3 air to areas normally pressurized by P2.5 (during initial start-up, P3 is the only sufficiently pressurized air available). The valve spring holds the valve against the seat, blocking P2.5 air. P3 air enters the intercom pressure case through slots in the valve housing and exits through the adapter to the rear inlet case. P2.5 increases with increasing NH, and at 40% to 45% NH, P2.5 overcomes the spring and pushes the valve and piston up to back P3 air. P2.5 air enters the intercom pressure case and also replaces P3 air in the power turbine shaft seal housing situated in the rear inlet case. As per the maintenance practices the four washers as shown in the figure above are to be installed at all times.

The involved P2.5/P3 Air Switching Valve was also last inspected/ overhauled along with the engine.

Air Pressure Switching Valve	LH (ESN-EB0321)	RH (ESN-ED0089)
Time Since New	14370 Hrs	14565 Hrs
Cycle Since New	12476 Cycle	12102 Cycle
Time Since Visual Inspection	287 Hrs	778 Hrs
Cycle Since Visual Inspection	275 Cycle	710 Cycle

1.7 Meteorological information:

The following is the METAR information for Bengaluru Airport, of the date of incident.

Time (UTC)	Wind Dir	Speed (kts)	Temp	QFE	QNH
0100	270	10	26	0910	1012
0200	270	10	26	0910	1012
0300	270	10	27	0911	1013
0400	270	10	27	0911	1013

1.8 Aids to Navigation

Not Applicable

1.9 Communication:

There was always two way communications between the ATC and the aircraft.

1.10 Aerodrome information:

The Runway orientation at BIAL international airport, Bengaluru is 09/27. The ILS is available for both the approaches for runway 09/27. PAPI is available for both sides of the runway. NDB is also available at BIAL for approach and landing. The ATC is controlled and manned by Airport Authority of India.

Met Office Hour of service is 24 Hrs. TAF, Trend Forecast and Briefing is available. Flight documentation is provided in Chart and Tabular form in English language.

1.11 Flight Recorders:

CVR: CVR serial number 000483556 was removed after the incident and was replayed. The relevant conversation was available.

DFDR: DFDR serial number 000652472 was removed after the incident and readout. NAC overheat warning came twice while the aircraft was pushing back. The warning lasted for 25 seconds for engine No. 2.

1.12 Wreckage and impact information.

Aircraft was cleared for pushback, facing east on L3. Till pushback all the operations were normal. Immediately after push back NAC OVERHEAT warning came on. Engine No. 02 was shut down by the cockpit crew. There was no damage to the aircraft.

1.13 Medical and pathological Information:

The preflight medical was carried out prior to the flight for both the cockpit crew members including breath analyzer test and found satisfactory.

1.14 Fire:

There was no fire.

1.15 Survival aspects:

The incident was survivable.

1.16 Tests and research:

Nil

1.17 Organizational and management information:

The aircraft was operated by an SOP holder holding a valid SOP with the aircraft endorsed. The maintenance of the aircraft is carried out under CAR 145 approval. Line maintenance is carried out in house and major maintenance is outsourced.

1.18 Additional information:

The involved P 2.5/3 Air Switching Valve was removed on 16.06.2014 and inner valve of the Air Switching Valve sent to P&W (SEA) for further investigation due reported smell and cabin and cockpit. Visual inspection to determine any anomalies was carried out. During inspection of the valves, outer diameter was observed with burr and inner diameter of bushing was observed with wear beyond serviceable limits. It was opined that the burr found on outer diameter could cause some restriction to the valve movement as evidence of wear was observed in the internal diameter of the valve that slide along the guide pin. As a result, the valve may not be able to move smoothly within the inner housing and disturbing the balance of the secondary sealing air to the bearing compartment. Any parts within air switching valves could also affect the operation of the P 2.5/3 air switching valve. '



Burr at outer Diameter on all the three P 2.5/3 Air Switching Valve



Wear in bushing inner diameter in two of the P 2.5/3 Air Switching Valve

1.19 Useful or Effective Investigation Techniques

Nil

2. ANALYSIS

2.1 General:

- Both the operating crew were appropriately licensed and qualified to operate the flight. After observing the smoke in cockpit and cabin, checklists were carried out by both the operating crew.
- The aircraft was having a Valid Certificate of Airworthiness at the time of incident. The Aircraft held valid Certificate of Release to Service which was issued at the airport of departure. The Aircraft was holding a valid Aero Mobile License. Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications has been complied with. Transit inspections are carried out as per approved transit inspection schedules and all the higher inspection schedules include checks/inspection as per the manufacturer's guidelines as specified in Maintenance Program and approved by the Quality Manager.
- The weather at the airport at the time of incident was fine and is not a contributory factor to the incident.

2.2 Pilot Handling of the aircraft:

The aircraft had commenced pushback for the flight. Till pushback all operations were normal. Immediately after push back NAC OVERHEAT warning came on. Engine No. 02 was shut down by the crew and same was intimated to ground crew. The NAC OVERHEAT warning illuminated again after restart of Engine No. 2 but it went off after 25 seconds. After that MODE SEL AUTO FAULT came on.

Ground crew was intimated and engineering was consulted about the fault indication. In the meantime a burning smell was felt followed by heavy smoke in the cockpit. Cabin crew also intimated to the cockpit crew about the smoke in cabin.

The cockpit crew then informed ATC and ground crew about the smoke in cockpit and cabin.

Thereafter passengers were deplaned normally on taxiway "L3" without hand baggage. The aircraft was then towed back to Bay 36.

In view of the above pilot has carried out all the actions as desired.

2.3 Maintenance of the Aircraft:

The last overhaul of the involved engine was carried out in February 2014. Since then, the engine had operated 778 hours and 710 cycles of operation. The core engine is not required to be opened during routine maintenance and is stripped only during HSI and overhaul.

Prior to this incident flight, an incident had occurred on 07.06.2014 and as per the investigation report, the incident had occurred due "Inadequate air supply across the bearing seal, required for prevention of oil seepage in the airflow, due P2.5/P3 air switching valve being sticky and deteriorated #4 bearing housing resulting in seepage of oil into P2.5 air system".

In the present case, detailed rectification actions were taken for troubleshooting in consultation with the manufacturer. In the process, Air Switching Valves were changed. At every step thorough boroscopic inspection was carried out. The snag got rectified and there was no leakage of oil in the core engine.

In view of the above, it is opined that the aircraft and engine were being maintained as per the requirements and maintenance aspect is not contributory to the incident.

2.4 Circumstances leading to the Incident

On the day of incident, till pushback all the operations were normal. During pushback, repeated NAC overheat followed by smoke in the cockpit and cabin was observed. After that MODE SEL AUTO FAULT came on. The flight crew was not able to figure out the source of smoke generation. In the meantime a burning smell was noticed followed by heavy smoke in the cockpit and Cabin. Both the engines

were shut down by the cockpit crew. On ground, the pack operation was found normal but oil smell was observed in cockpit & cabin.

Boroscopic inspection of both the engines was carried out. LP Impeller of LH engine was found with oil stains. As HP impeller vanes of both LH & RH engines were wet with oil stains and oil puddle on the case surface of the vanes, on the recommendation of P&W, RH and LH Engine Air Switching Valve was checked for condition of pin and spring and free movement of piston, which was found satisfactory. After compressor wash again high power Engine Ground Run (EGR) was carried out and no smell of oil or oil fumes was observed. Boroscopic inspection for both the engines was carried out, and two HPT blades of LH and RH engine were found with oil stains on leading edge near tip without any burn marks, Inner valve of P2.5/3 Air Switching Valves on both the engines were replaced.

On 19.06.2014, an evaluation flight was carried out and no smoke or oil smell was observed in cockpit and cabin. Thereafter, the aircraft was released and the snag has not reoccurred. The removed inner valve of P2.5/3 Air Switching Valves was sent to P&W for investigation. As per the report received from P&W "During inspection of the valves, outer diameter was observed with Burr and inner diameter of bushing was observed with wear beyond serviceable limits.

It is opined that the burr found on outer diameter could cause restriction to the valve movement due wear of the valve diameter that slide along the guide pin. As a result, the valve may not be able to move smoothly within the inner housing and could disturb the balance of the secondary sealing layer to the bearing compartment. Functionally, any parts within the Air Switching Valves could also affect the operation of P2.5/3 Air Switching Valve.

3. CONCLUSIONS:

3.1 Findings:

1. The Certificate of Registration and the Certificate of Airworthiness of the aircraft was valid on the date of incident.
2. The certificate of flight release was valid on the day of incident.
3. Both the pilots were appropriately licensed and qualified to operate the flight.

4. The maintenance of the aircraft was being done as per the approved maintenance programme.
5. All the applicable Airworthiness Directives, Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine were found complied with.
6. The weather has not contributed to the incident in any manner.
7. During pushback, repeated NAC overheat followed by smoke in the cockpit and cabin was observed.
8. The flight crew was not able to figure out the source of smoke generation and in consultation with ground crew the engine was shut down on the taxiway.
9. After the aircraft engines were stopped, the cabin crew de-planed the passengers normally without hand baggage on the taxiway.
10. The pack operation on ground was found normal but oil smell was observed in cockpit & cabin.
11. Boroscopic inspection of both the engines was carried out. LP Impeller of LH engine was found with oil stains. HP impeller vanes of both LH & RH engines were wet with oil stains and oil puddle on the case surface of the vanes.
12. RH and LH Engine Air Switching Valve were checked for condition of pin and spring and free movement of piston.
13. Thereafter Compressor wash of both LH and RH engine was carried out.
14. After compressor wash high power Engine Ground Run (EGR) was carried out. During EGR, no smell of oil or oil fumes with bleed "ÖFF" and bleed "ON" settings was observed.
15. After EGR, boroscopic inspection for both the engines was carried out. During boroscopic inspection, two HPT blades of LH and RH engine were found with oil stains on leading edge near tip without any burn marks.
16. As per Aircraft Maintenance Manual, Inner valve of P2.5/3 Air Switching Valves on both the engines were replaced.
17. An evaluation flight was carried out and no smoke or oil smell was observed in cockpit and cabin.
18. The inner valve of the P2.5/3 air switching valve was sent to P&W for investigation. As per the report received from P&W "During inspection of the

valves, outer diameter was observed with Burr and inner diameter of bushing was observed with wear beyond serviceable limits, which could disturb the balance of the secondary sealing air to the bearing compartment.

19. The above stated imbalance might have contributed to the oil leakage and consequently burning smell/ smoke in cockpit & cabin.

3.2 Probable Cause of the Incident:

During engine start up, the smoke/ oil smell in the cockpit and cabin was probably caused due to oil leak as a result of wear of inner diameter of the inner valve of the Air Switching Valve thereby imbalancing the secondary seal of bearing compartment.

4. Safety Recommendations:

Nil



(Shilpy Satiya)
Member
Committee of Inquiry

(R S Passi)
Chairman
Committee of Inquiry

Place: New Delhi

Date: 15.12.2016