



सत्यमेव जयते

**Government of India
Directorate General of Civil Aviation**

**INVESTIGATION REPORT ON AIR TURN BACK INCIDENT OF
M/S AIR INDIA A-319 AIRCRAFT VT-SCJ OPERATING FLIGHT
A1-776 ON 14.07.2023 AT MUMBAI**

Foreword

In accordance with the Aircraft (Investigation of Accidents & Incidents) Rules 2017, the sole objective of this investigation is to prevent aviation incidents/ accidents in the future. It is not the purpose of the investigation to apportion blame or liability.

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

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INVESTIGATION REPORT ON AIR TURN BACK INCIDENT OF M/S AIR INDIA
A-319 AIRCRAFT VT-SCJ OPERATING FLIGHT A1-776 ON 14.07.2023
AT MUMBAI

1. Aircraft
 - Type : Airbus A319-112
 - Nationality : Indian
 - Registration : VT-SCJ
2. Owner : M/s Air India Limited
3. Operator : M/s Air India Limited
4. Pilot-In-Command : ATPL Holder
 - Extent of Injuries : Nil
5. Co-Pilot : CPL Holder
 - Extent of Injuries : Nil
6. Place of Incident : Mumbai (VABB)
7. Geographical location of site : 19.0902⁰ N & 72.8628⁰ E
8. Date and Time of incident : 14-07-2023 & 1514 UTC
9. Last point of departure : Mumbai (VABB)
10. Point of intended landing : Kolkata (VECC)
11. Type of Operation : Scheduled Operation
12. Persons on Board : 121 (06 crew members and 115 passengers including 03 infants)
 - Extent of injuries : Nil
13. Phase of Operation : Take-off Roll
14. Type of incident : Air Turn Back

(All the timing in the report is in UTC, otherwise mentioned)

SYNOPSIS

On 14/07/2023, M/s Air India A-319-112 aircraft VT-SCJ was involved in an Air turn back incident while operating flight AI-776 sector Mumbai-Kolkata.

During rotation, while getting airborne, the flight crew and passengers heard loud bang noise twice. After takeoff, a severe burning smell was reported inside the cockpit and cabin. The passengers from rows 5 to 12 observed flames/ fire from engine no. 1. The indications in the cockpit were normal and all engine parameters were found to be within limits. As a precaution, the crew decided to return to Mumbai and carried out an overweight landing.

DGCA-India, vide Order No. DGCA-15018(01)/19/2023-DAS dated 08/08/2023 instituted investigation of the incident under Rule 13 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017 by appointing an Investigator-In-Charge.

The failure of Engine No. 1 was attributed to engine stall during the take-off roll, just prior to lift-off. While the shop investigation could not definitively establish the root cause, DFDR data and the damage observed on the HPC blades were consistent with stall condition.

1. FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHT:

On 14/07/2023; M/s Air India A319-112 aircraft VT-SCJ was scheduled to operate flight AI-776 from Mumbai to Kolkata with 06 crew members and 115 passengers including 03 infants on board. The aircraft was under the command of an ATPL holder with co-pilot also an ATPL holder. PIC was PF and FO was PM.

The previous sector of aircraft VT-SCJ was flight AI-775 from Kolkata to Mumbai and was operated by same set of crew. In sector AI-775, the aircraft experienced bird hit during approach. As per PDR, "2 Birds Hit, one bird hit suspected on one of the engine. Parameters normal". Post landing at Mumbai, AME carried out the Phase-1 Bird Strike and FOD inspection as per AMM. Bird strike evidence was observed on Engine No. 1

with bird feathers on periphery of the fan and blood stains on OGV. There was no damage to the Engine. Also no core ingestion was observed during the inspection. Further, a DMR was raised for carrying out Borescope Inspection within 25 flight hours/ 10 flight cycles as a precaution. Aircraft was released for service as per AMM. As per the PDR, no MEL was pending.

The aircraft took off from Mumbai at 1514 UTC. As per the crew, during rotation, while getting airborne, the flight crew and the passengers heard loud bang twice. After takeoff, a severe burning smell was reported inside the cockpit and the cabin. Passengers from row 5 to 12 informed crew that they observed flames/fire from the Engine No. 1. The indications in the cockpit were normal and all parameters were found to be within limits. As a precautionary measure, the crew decided to return to Mumbai and carried out overweight landing. No priority or assistance was requested by the crew as indications in the cockpit were normal and all parameters were within limits. Aircraft landed safely. Load report was not generated. The post-flight report (PFR) of the incident sector has not recorded any warning/failure messages. No injury was reported to any of the crew and passenger.

Borescope inspection of the engine was performed by the AME after landing at Mumbai and it was found that Engine no. 1 had suffered damages in High Pressure Compressor beyond the AMM limits. Hence Engine no. 1 was removed on 19-07-2023 and the damaged engine was sent to Jet Engine Overhaul Complex (JEOC), Air India Engineering Services Ltd. (AIESL), Delhi for the root cause analysis of the failure.

1.2 INJURIES TO PERSON:

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR/ NONE	06	115 (03 Infant)	

1.3 DAMAGE TO AIRCRAFT:

During Borescope Inspection following damages were observed:

- LPC Module:
 - Booster Stages 2 to 5: No damage observed, minor corrosion with external deposits.
- HPC Module
 - Stage 1: Several blades with tears, missing material, tip curls, and bends beyond AMM limits.
 - Stage 2: Most blades with tears, missing material, tip curls, bends, and dents beyond AMM limits.
 - Stage 3: Most blades with tears, missing material, tip curls, material separation, and impact damage beyond AMM limits.
 - Stage 4: 5 to 7 blades with tears, missing material, and tip curls beyond AMM limits.
 - Stage 5: 8 to 10 blades with missing material, tears at tips, dents, bends, and tip curls beyond AMM limits.
 - Stage 6: 4 to 6 blades with corrosion, dents, bends, and missing material within AMM limits.
 - Stage 7: 3 to 4 blades with missing material on tip areas, one blade previously blended within AMM limits.
 - Stage 8: 10 to 12 blades with dents, tears, tip curls, impacts, and rubbing beyond AMM limits.
 - Stage 9: 10 to 12 blades with tears, missing material, and impacts beyond AMM limits
- HPT Module
 - Blades from Rear: No damage observed, notches visible on four blades.
- LPT Module
 - Stage 4 Blades: Minor erosion on leading edges within AMM limits.
- Other Observations
 - OGV Bolts: Four bolts not in safety.
 - OGV Metal Strip: Two strips found liberated.
 - Rear Spinner Cone Coating: Minor scratches within limits.

- AFT Engine Mount LH Side Link: Nicks observed.
- Engine no. 1 Inlet and Exhaust inspection carried out and found satisfactory.

1.4 OTHER DAMAGE: Nil

1.5 PERSONNEL INFORMATION:

1.5.1 Pilot-in-Command

AGE & Gender	39 & Male
License	ATPL
Date of Issue	25.06.2012
Valid up to	24.06.2026
Category	Aeroplane
Aircrafts endorsed as PIC	A320, C152, BE-76
Aircrafts endorsed as FO	B777/B787
Date of Endorsement as PIC on A320	06.02.2019
Date of Class I Med. Exam	15.06.2023
Class I Medical Valid up to	28.06.2024
Date of issue of FRTTO License	17.10.2007
FRTTO license valid up to	17.10.2037
Total flying experience	6788:22 Hours
Total flying experience on type	3310:82 Hours
Total flying experience during last 1 year	463:49 Hours
Total flying experience during last 6 months	215:04 Hours
Total flying experience during last 30 days	83:05 Hours
Total flying experience during last 7 days	18:37 Hours
Total flying experience during last 24 hours (excluding day of incident)	04:26 Hours
Total flying on the day of incident (excluding incident flight)	02:54 Hours
Rest before duty	16:25 Hours

1.5.2 Co-Pilot

AGE & Gender	32 & Male
License	ATPL
Date of Issue	04.10.2019
Valid up to	03.10.2024
Category	Aeroplane
Aircrafts endorsed as PIC	A320, C152, C172
Aircrafts endorsed as FO	ATR42/72
Date of Endorsement as PIC on A320	12-03-2018
Date of Class I Med. Exam	02.03.2023
Class I Medical Valid up to	03.03.2024
Date of issue FRT0 License	26.04.2019
FRT0 license valid up to	25.04.2024
Total flying experience	583:29 Hours
Total flying experience on type	582:49 Hours
Total flying experience during last 1 year	382:38 Hours
Total flying experience during last 6 months	382:38 Hours
Total flying experience during last 30 days	72:09 Hours
Total flying experience during last 7 days	17:01 Hours
Total flying experience during last 24 hours (excluding the day of incident)	0 Hours
Total flying on the day of incident (excluding incident flight)	03:58 Hours
Rest before duty	85:19 Hours

Pre-flight breath analyser examination of both the crew was carried out at Mumbai and they were not found under the influence of alcohol. As per the operator, the crew were not involved in any serious incident/accident.

1.6 AIRCRAFT INFORMATION:

Manufacturer	Airbus
Type	A319-112
S. No.	3305
Year of Manufacturer	2007
Certificate of Airworthiness & Date of Issue	No. 3003 15-11-2007
Airworthiness Review Certificate	13.01.2023 – Issue date 16.01.2024 - Expiry
Category	Normal
Certificate of Registration no.	VT-SCJ
Owner	Air India Limited
Operator	Air India Limited
Certificate of Registration and Validity	No. 3624/4 Validity – N/A
Minimum crew required	02
Maximum all up weight authorised	68000 kg
Last major inspection	4A + B2 Check on 20 th April 2023
Air frame Hrs since new	40838.08
Airframe Hrs since last Major Inspection	627:9
Status of Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications	All applicable AD's, Mandatory SB's and DGCA Mandatory modifications have been complied

Engine Information	No. 1	No. 2
Manufacturer	CFM	CFM
Type	CFM56-5B	CFM56-5B
Serial No.	643455	697812
Time since new	21311:04	36463:35
Cycle since new	13214	22034
Time since last shop visit	3026.57	3035.02
Cycle since last shop visit	2143	1695
Last major inspection carried out	4A + B2 Check on 20 th April 2023	
Average oil consumption	0.09 Qtz/hr	

Weight and Balance Information:

The Details of basic weight schedule were as follows:-

Weight	Actual Weights for AI-776	Maximum Permissible
Take-off Weight	65524 kg	67075 kg
Landing Weight	58949 kg	61000 kg
Zero fuel Weight	53174 kg	57000 kg

CG was within the prescribed limit during landing.

1.7 METEOROLOGICAL INFORMATION:

Weather reports (METARs) on 14/07/2023 indicated that rain prevailed at Mumbai airport during the time of incident. METARs issued are as below:

METAR VABB 140900Z 29008G18KT 0600 R27/0800 +RA SCT010 SCT015 FEW030CB OVC080 26/25 Q1007 TEMPO 0350 +RA=
TAF VABB 140800Z 1409/1418 2000 RA SHRA SCT010 SCT015 FEW030TCU/CB OVC080
TEMPO 1409/1415 25010G20KT 1500 TSRA SHRA SCT010 SCT015 FEW030TCU/CB OVC080
BECMG 1416/1418 24011KT 1500 -RA -SHRA SCT012 SCT018 FEW025TCU OVC080=

1.8 AIDS TO NAVIGATION:

All Navigational Aids available at Mumbai airport were serviceable. The aircraft was equipped with standard navigational equipment and there was no recorded defect with the navigational equipment prior to the flight.

1.9 COMMUNICATIONS:

There was two-way communication between the aircraft and ATC. The aircraft was came in contact with ATC Mumbai on 118.1 MHz frequency for takeoff. As per the communication, ATC cleared the aircraft for takeoff on runway 27 and reported wind calm. The clearance of the aircraft for takeoff was at around 15:14:05 hrs.

1.10 AERODROME INFORMATION:

Chhatrapati Shivaji Maharaj International Airport (IATA: BOM, ICAO: VABB) is an international airport and it is the second busiest airport in India in terms of total and international passenger traffic. The airport is operated by Mumbai International Airport Limited (MIAL) and holds licenses for the operation of both IFR (Instrument Flight Rules) and VFR (Visual Flight Rules) traffic.

The airport features two cross runways constructed with asphalt, specifically RWY 09/27 and RWY 14/32. The runways have been upgraded to Code F, which means they can accommodate larger aircraft like the Airbus A380. Each runway is marked with designations, threshold markers, touchdown zones, centrelines, and is equipped with lighting for threshold, edge, end, touchdown zone, and centreline. ATC services are provided by AAI. The Airport Rescue and Fire Fighting Services are classified as Category 10.

Number	Length	Width	ILS
09–27	3,660 m (12,008 ft)	60 metres (200 ft)	Cat. II (27); Cat. I (09)
14–32	2,990 m (9,810 ft)	45 metres (148 ft)	Cat. I (both directions)

1.11 FLIGHT RECORDERS:

1.11.1 DFDR:

M/s Air India shared the DFDR data to the engine manufacturer CFM. CFM had submitted the following:

- CFM confirmed two short and recoverable stalls identified during take-off from the analysis of the flight data, which were supported by the crew statement of loud bang noise heard during final phase of take-off.
- Despite the absence of variable geometry parameters, two probable stalls were identified by comparing the N1 and EGT values of each engine.
- The stalls occurred at 00:27:14 and 00:27:22 during take-off just before the wheels left the ground without the flight conditions and the throttle changing:
 - N1 of ENG1 dropped suddenly twice (85 to 80% and 85 to 78 %)
 - EGT of ENG1 suddenly increased twice (756 to 775 °C and 774 to 791°C),
- Even though the stall condition could not be confirmed by the recorded data, these N1 and EGT reactions are synonymous with stalls.
- These stalls were very short and recoverable, the N1 took 3s each time to return to its initial values. The stalls did not generate any variation in oil pressure.

- The tip curls on the HPC blades confirms the most probable cause of the event as engine stall.
- There was no in-flight shut down of the engine.

Time	Altitude (In feet)	Engine No. 1 N1	Engine No. 1		Engine No. 1 EGT	Engine No. 1 Oil Pressure
			N1 Vibration	N2 Vibration		
00:27:14	188	85.25	1.6	0.4	756	50
00:27:15	188	85.31	1.5	0.4	760	50
00:27:16	188	80	1.5	0.4	775	50
00:27:22	188	85.37	1.5	0.5	774	50
00:27:23	184	78	1.4	0.4	781	50
00:27:24	188	86.06	1.4	0.5	791	51

1.11.2 CVR

Salient observations made from the CVR tape transcript are given below:

- At 15:14:01, Aircraft was cleared for takeoff from Runway 27.
- At 15:15:03, P2 reported smell in cabin, P1 reported noise and no vibration.
- At 15:16:08, Cabin crew reported burning smell in 5th to 12th row and also reported some passengers saw flames on left engine.
- At 15:17:28, P2 requested to maintain an altitude of 5000 and the same was cleared by ATC.
- At 15:18:10, P1 requested for return to Mumbai stating the reason “Just after airborne and during takeoff roll, lot of burning smell and passengers also seen flashes of fire from the left engine but as of now all cockpit indications are normal. As a precautionary measure we are coming back. Still the burning smell is inside the aircraft.”
- At 15:21:37, P2 reported “No priority landing or assistance required for AI-776”
- At 15:21:43, the cabin crew started the overweight landing checklist.
- At 15:23:09, Announcement to Passengers regarding Return back was done.

- At 15:24:34, landing weight of 64.7 was reported for calculating overweight landing.
- At 15:24:59, endurance of 4 hours 30 minutes was reported.
- At 15:25:52, Overweight landing checklist reviewed again.
- At 15:28:08, Cabin clearance was taken from cabin crew.
- At 15:31:33, ATC cleared descent to 3800 feet QNH 1006.
- At 15:33:45, Approach checklist was carried out and company dispatch was informed about return back.
- At 15:35:59, P1 mentioned “most likely because of the bird hit which the Engineering had cleared but we do not know we have to check after landing”. Affirmation on Air turn back decision done among P1, P2 and Cabin crew.
- At 15:37:20, Aircraft was established on ILS.
- At 15:39:42, Clearance to land on runway 27 was provided (Wind 160/4 knots).
- At 15:42:17, Aircraft landed safely on runway 27.

As per CVR analysis, it is clear that the Flight crew had followed checklist as per Standard Operating Procedures.

1.12 WRECKAGE AND IMPACT INFORMATION:

There was no wreckage.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION:

The crew had undergone pre-flight breath analyzer examination at Mumbai as per requirements. The test result was negative.

1.14 FIRE:



During takeoff, the cabin crew informed PIC that the passengers seated at Row 5 to 12 saw fire/flames coming from Engine No. 1. Burning smell was observed in cockpit and in the cabin. Apart from this, there was no pre/post incident fire.





1.15 SURVIVAL ASPECTS:

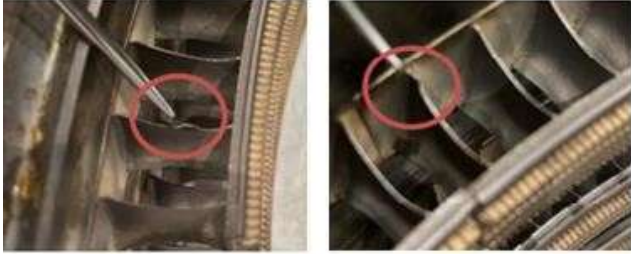
The incident was survivable.

1.16 TESTS AND RESEARCH:

The affected engine was sent to Jet Engine Overhaul Complex (JEOC), M/s Air India Engineering Services Ltd. (AIESL), Delhi for detailed root cause analysis of the engine failure. The following are the damages suffered by the engine:

S. No	Description	Quantity	Observation
LPC MODULE			
1	Booster Stage 2 to Stage 5		No damage was observed. Minor corrosion with external deposits observed.
HPC FRONT STATOR ASSEMBLY			
1	Inlet Guide Vanes	03	<ul style="list-style-type: none">Crack observed on Qty 02 vanes outer trailing edge ; not permissible as per ESMNicks on Qty 01 vane trailing edge outer side beyond ESM limits 
2	Stage 1		Several blades had damage in the form of tear, missing material, tip curl & bend. Damage was beyond acceptable limits of AMM.
3	Stage 1 VSV (Scallop)	01	Nick and Crack on leading edge beyond ESM limit 
4	Stage 2		Most of the blades had damage in the form of tear, missing material, tip curl, bend & dent. Damage was beyond acceptable limits of AMM.

5	Stage 2 VSV (Non-Scallop)	42	<p>Dent/ Bent on trailing edge outer side beyond ESM limits</p> 
6	Stage 2 VSV (Scallop)	20	<p>Dent/ Bent on trailing edge outer side beyond ESM limits</p> 
7	Stage 3		<p>Most of the blades had damage in the form of tear, missing material, tip curl, material separation & impact damage. Damage was beyond acceptable limits of AMM.</p>
8	Stage 3 VSV (Non-Scallop)	44	<p>Dent/ Bent on trailing edge outer side beyond ESM limits</p> 
9	Stage 3 VSV (Scallop)	17	<p>Dent/ Bent on trailing edge outer side beyond ESM limits</p> 
10	Stage 4		<p>Quantity 5 to 7 blades had damage in the form of tear, missing material, tip curl. Damage was beyond acceptable limits of AMM.</p>
11	Stage 5		<p>Quantity 8 to 10 blades had damage in the form of tear at tip, missing material, tip curl, dent & bend. Damage was beyond acceptable limits of AMM.</p>
12	Stage 6		<p>Quantity 4 to 6 blades had corrosion, dent, bend, missing material within acceptable limits of AMM.</p>

13	Stage 7		Quantity 3 to 4 blades had damage in the form of missing material on tip area, quantity 01 blade found previously blended within acceptable limits of AMM.
14	Stage 8		Quantity 10 to 12 blades had damage in the form of tear, missing material, impact. Damage was beyond acceptable limits of AMM.
HPC REAR STATOR ASSEMBLY			
1	Stage 8 vane cluster assembly	2	Quantity 02 vanes clusters have nicks and dents beyond ESM limits 
HPT			
1	HPT Blades	04	No damage observed during the Boroscopic inspection of HPT blades from rear. Notches visible on quantity 04 blades.
LPT			
1	Stage 4 LPT blades		Minor Erosion observed on leading edge of the blades, within acceptable limits of AMM.
Other observations			
Quantity 04 OGV metal strip found liberated. Nicks observed on AFT engine mount LH side link.			

Root Cause Analysis:

- Engine Inspection revealed no damage in the Low Pressure Compressor (LPC) modules from booster stage 2 to 5.
- There was no evidence of soft ingestion and missing hardware in the HPC during the inspections, including when the HPC top case was removed. Hence there was no definitive evidence of FOD or DOD.
- During Black Light Inspection; No bird remains, or organic matter was found on HPC blades.
- PFR submitted by Air India showed no Stall message however, the type of damage observed (tip curls on the HPC blades) on HPC blades is similar to that observed on engines which have been inducted in shop earlier due to stall.

1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION:

M/s Air India is the flag carrier airline of India, owned by Tata Group and operates a fleet of Airbus and Boeing aircraft with its headquarter in Gurugram, Haryana, India. Air India operates a combination of both narrow body and wide body aircraft with a fleet composed of Airbus A319, A320, A320neo, A321, A321neo as well as Boeing 777 and Boeing 787. In 2005, Indian Airlines introduced the smaller, A319, which are now used mainly on domestic and regional routes. Air India is the largest international carrier of India. Over 40 international destinations are served by Air India spanning cities in Europe, USA, UK, Africa, the Gulf, Asia and Australia. The airline became the member of Star Alliance on 11 July 2014. The Company is headed by a CEO who is assisted by a team of professionals from various departments. The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA.

1.18 ADDITIONAL INFORMATION:

1. TSM guidance on Engine Stall

As per TSM and FCOM extract appended below, the stall conditions may occur with or without ECAM warnings as abnormal noise from engine if reported by the crew will also ask to perform the inspections as per engine stall conditions.

AIRBUS	TSM - AIC - A318/A319/A320/A321	REV DATE: May 01/2025
	Tail Number - MSN - FSN: VT-SCJ - 03305 - 905	
	73-00-00-810-866-A - Stall of Engine 1 or 2 in Flight	
SCJ Satll		

Ref. AMM 72-31-00-200-011	Compressor Rotor Blade Erosion Molded Impression Check
Ref. AMM 72-31-00-290-002	Inspection of the High Pressure Compressor Rotor Assembly
Ref. AMM 72-52-00-290-001	Borecope Inspection of the HPT Blades (from the Front and the Rear)
Ref. AMM 72-54-00-290-005	Inspection of the Stage 1-3 Blades
Ref. AMM 73-21-60-740-028	Correct Faults of the Engine Scheduled Maintenance Report (SMR)
Ref. AMM 75-31-00-200-002	Manual Operation Check of the Variable Bleed Valve Doors
Ref. AMM 79-00-00-281-002	Check of the Electrical Master Chip Detector (EMCD) for Particles

3. Fault Confirmation

SUBTASK 73-00-00-710-178-A

- A. Not applicable, the confirmation may cause damage to the engine.

4. Fault Isolation

SUBTASK 73-00-00-810-115-B

- A. Do the following Troubleshooting:

SB CFM 72-0391

- (1) If engine is affected by SB CFM 72-0391, do a borescope inspection of the stage 5 booster blades (borescope port S05) [Ref. AMM 72-21-00-290-003 at first maintenance opportunity within 25 hours or 10 cycles \(whichever comes first\), then proceed with the following procedure.](#)
END OF SB CFM 72-0391
- (2) Following troubleshooting procedure should be carried out for cases as defined in the title and for cases if crew reported audible engine stall while no ECAM warning ENG 1(2) STALL was set. This procedure covers stall conditions that occurred at N2 speed at or above idle. For engine stall during start, [Ref. TSM TASK 80-00-00-810-833.](#)



A318/A319/A320/A321
 FLIGHT CREW
 OPERATING MANUAL

PROCEDURES
ABNORMAL AND EMERGENCY PROCEDURES

ENG

ENG 1(2) STALL (Cont'd)

Ident.: PRO-ABN-ENG-Z-00017749.0004001 / 28 MAY 20

L2 A stall may be indicated by varying degrees of abnormal engine noises, accompanied by flame from the engine exhaust (and possibly from the engine inlet in severe case), fluctuating performance parameters, sluggish or no thrust lever response, high EGT and/or a rapid EGT rise when thrust lever is advanced. Engine stalls must be reported for maintenance action.

L1 ■ **On ground:**

THR LEVER (AFFECTED ENGINE)..... IDLE
 ENG MASTER (AFFECTED ENGINE)..... OFF

■ **In flight:**

THR LEVER (AFFECTED ENGINE)..... IDLE
 ENG PARAMETERS (AFFECTED ENGINE)..... CHECK

■ **If abnormal ENG parameters:**

ENG MASTER (AFFECTED ENGINE)..... OFF

L12

ASSOCIATED PROCEDURES

ENG 1(2) SHUT DOWN

Apply the **ENG SHUT DOWN** procedure (Refer to PRO-ABN-ENG ENG 1(2) SHUT DOWN).

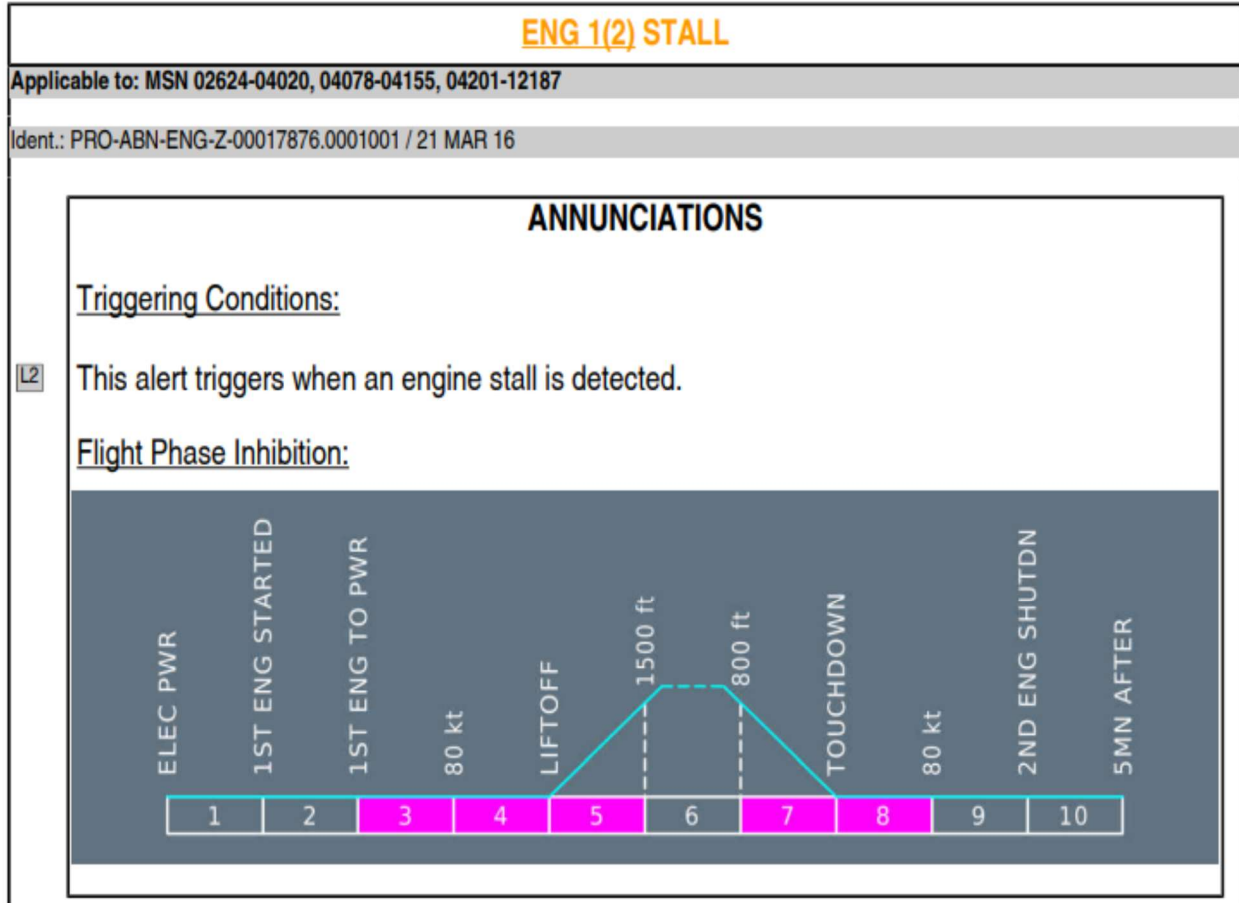
■ **If normal ENG parameters:**

ENG ANTI ICE (AFFECTED ENGINE)..... ON
 WING ANTI ICE..... ON

L2

Operation of ENG and WING ANTI ICE will increase the stall margin but EGT increases

2. Airbus Feedback about Inhibition Logic:



Airbus feedback revealed following about ENG x STALL warning display inhibition logic:

- At FWC side, there is two types of inhibitions:
 - Logic inhibition which avoids computation of a message in the logic definition
 - And monitoring inhibition which is used after computation of message ensures proper message display only when necessary.
- As mentioned in the FCOM, the message "ENGINE x STALL" has a monitoring inhibition in flight phase (FP) 3-4-5-7 and 8.

3. Extract from PIC and FO Statement:

Loud bang noise was heard twice while rotation during takeoff. Non-stop severe burning smell was informed inside the cockpit and the cabin. All engine parameters were normal. Overweight checklist carried out (Landing weight – 64.3 T). As a precautionary, the decision to return back and land at Mumbai was taken keeping the passengers and crew safety in mind as the previous sector AI775 had a bird hit and the bird remains were found on the engine.

4. Extract from AME statement (Post inspection of flight AI-775):

After the flight AI-775, the AME who inspected the aircraft found Bird strike evidence on Engine No. 1. Bird feathers were observed on periphery of the fan. Minor blood stains were observed on OGV. No core ingestion was observed. Bird strike was also confirmed by the Captain. Phase 1 Bird strike inspection and FOD inspection were carried out. DMR was raised to carry out Boroscope Inspection within 25FH/10 CYC as a precaution due to incandescent weather (rain).

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 day of incident, the aircraft had valid ARC and Certificate of Release. No MEL was pending on the aircraft. All applicable AD's, Mandatory SB's and DGCA Mandatory modifications have been complied by the operator. Last major inspection of 4A + B2 Check of the aircraft and the engine was carried out on 20.0.2023.

The CG of the aircraft was within the prescribed limit during landing. The aircraft take-off weight was 65524 kg against Max 67075 kg and landing weight was 58949 kg against 61000 kg. During the incident flight, the crew carried out an overweight landing. However, Load report was not generated.

The shop report of the Engine no. 1 reveals that there was no definitive evidence of FOD or DOD. Also during the Black Light Inspection; No bird remains, or organic matter was found on HPC blades. This rules out the possibility of any bird remains in the Engine due to bird strike in the previous sector leading to this incident.

In view of above, serviceability of the aircraft was not a contributory factor to the incident.

2.2. Operational Aspect:

During rotation of the incident flight, AI776, while getting airborne, the flight crew and the passengers heard loud bang twice. After takeoff, a severe burning smell was reported inside the cockpit and the cabin. Passengers also reported flames/fire from the Engine No. 1. However the indications in the cockpit were normal and all parameters were found to be within limits. Crew decided to return to Mumbai and carried out overweight landing. Aircraft landed safely.

As per the CVR recoding, the flight crew experienced burning smell in cockpit but did not notice any fire. Fire was reported to be observed by the passengers. The decision to return back was taken on time and an overweight landing was carried out by the crew and all the checklist were carried out by the flight crew. The action of the crew was found to be satisfactory.

In view of the above, the operation aspects has no bearing on the incident.

2.3 Engine Shop Investigation

The engine was sent to Jet Engine Overhaul Complex (JEOC), M/s Air India Engineering Services Ltd. (AIESL), Delhi for detailed root cause analysis of the engine failure. Engine Inspection revealed no damage in the Low Pressure Compressor (LPC) modules from booster stage 2 to 5. There was no evidence of soft ingestion and missing hardware in the HPC during the inspections, including when the HPC top case was removed. Hence there was no definitive evidence of FOD or DOD. During Black Light Inspection; No bird remains, or organic matter found on HPC blades. PFR submitted by Air India showed no Stall message however, the type of damage observed on HPC blades is similar to that observed on engines which have been inducted in shop earlier due to stall. The tip curls on the HPC blades confirms the most probable cause of the event as engine stall.

2.4. Feedback received from Airbus & CFM

The Engine 1 Stall was not reflected in the Post Flight Report (PFR) or Electronic Centralized Aircraft Monitor (ECAM) due to Flight Warning Computer (FWC) takeoff phase inhibition.

The technical analysis involved reviewing the DFDR data, in which CFM identified two probable stalls based on N1 and EGT values. The stalls were short and recoverable, with no significant variations in oil pressure or vibration signatures. The engine stall message was inhibited during certain flight phases, which may explain the absence of stall messages in PFR.

2.5 Technical Aspect:

The TSM task for Stall of Engine 1 or 2 in Flight was followed by the Engineer and as per the TSM task, troubleshooting procedure should be carried out for cases as defined in the title and for cases if crew reported audible engine stall while no ECAM warning ENG 1(2) STALL was set. This procedure covers stall conditions that occurred at N2 speed at or above idle. Flight crew had reported that flight encountered two loud bangs, burning smell, and flames from Engine no. 1 which justifies that engine stall conditions were present during the take off and same had been confirmed by CFM as per the DFDR review. The TSM task was followed and damage observed on HPC blades which is prominent to the engine stall conditions.

3. Conclusions:

3.1 Findings:

- On the day of incident, the aircraft had valid ARC, C of R and was released for flight after pre-flight inspection.
- The flight crew was certified and had valid license.
- The flight crew had under the requisite pre-flight medical examination and they were not found under the influence of alcohol.
- The CG of the aircraft was well within the limits.
- The PIC is ATPL holder and had a total flying experience of 6788:22 hrs of which 3310:82 hrs were on type. First Officer is also an ATPL holder and had a total flying experience of 583:29 hrs of which 582:49 hrs were on type.

- Weather at the time of incident was fair with rain.
- After takeoff, the loud bang noise was heard. Burning smell was experienced in the cockpit and in the cabin. Passengers from row 5 to 12 reported observing flames from Engine no. 1.
- All cockpit parameters were normal as observed by the flight crew.
- The crew decided to Air turn back to Mumbai and carried out the landing checklist along with the Overweight landing checklist.
- The aircraft landed back safely at Mumbai airport and load report was not generated.
- After landing at Mumbai airport, boroscopic inspection of the Engine was carried out and was observed that the Engine no. 1 has suffered damages in HPC beyond allowable limits of AMM.
- The Engine #1 was sent to Jet Engine Overhaul Complex (JEOC), M/s Air India Engineering Services Ltd. (AIESL), Delhi for detailed root cause analysis of the engine failure.
- Shop revealed no damage to LPC modules from booster stage 2 to 5.
- There was no definitive evidence of FOD or DOD. However, damage observed was like that seen in engines inducted earlier in JEOC due to stalls.
- The black light inspection was carried out on the HPC blades. No bird remains or organic matter on HPC blades was observed. Hence, the bird ingestion into the core engine during the previous flight was ruled out.
- There was no evidence of soft ingestion and missing hardware in HPC which revealed no definitive evidence of FOD or DOD.
- As per OEM follow up on DFDR review two short and recoverable stalls were identified during take-off and attributing the root cause of engine failure.
- PFR submitted by Air India showed no Stall message however, the type of damage observed (tip curls on the HPC blades) on HPC blades is similar to that observed on engines which have been inducted in shop earlier due to stall.
- The TSM task was followed and damage observed on HPC blades which is prominent to the engine stall conditions.

- The Engine 1 Stall was not reflected in the Post Flight Report (PFR) or Electronic Centralized Aircraft Monitor (ECAM) due to Flight Warning Computer (FWC) takeoff phase inhibition.
- The technical analysis involved reviewing the DFDR data, in which CFM identified two probable stalls based on N1 and EGT values. The stalls were short and recoverable, with no significant variations in oil pressure or vibration signatures. The engine stall message was inhibited during certain flight phases, which may explain the absence of stall messages in PFR.

3.2 Probable Cause of the incident:

The failure of Engine No. 1 was attributed to engine stall during the take-off roll, just prior to lift-off. While the shop investigation could not definitively establish the root cause, DFDR data and the damage observed on the HPC blades were consistent with stall condition.

4. Safety Recommendations:

NIL



(Vasantha Kohila B)
Member
Air Safety officer



(Akhil Shukla)
Investigator In-charge
Assistant Director Air Safety

Date : 16/09/2025

Place : New Delhi