FINAL INVESTIGATION REPORT

ON

SERIOUS INCIDENT TO M/S AIR INDIA LTD.

AIRBUS A320 AIRCRAFT VT-EXM

AT CHENNAI ON 13TH NOVEMBER 2020.

K. Ramachandran
Investigator -In- charge

Amit Kumar
Investigator

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 2017, the sole objective of the investigation of an accident/serious incident shall be the prevention of accidents and incidents and not to apportion blame or liability. The investigation conducted in accordance with the provisions of the above said rules shall be separate from any judicial or administrative proceedings to 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
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
CAR	Civil Aviation Requirements
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DFDR	Digital Flight data Recorder
DGCA	Directorate General of Civil Aviation
F/O	First Officer
FCOM	Flight Crew Operating Manual
FCTM	Flight Crew Training Manual
FRTOL	Flight Radio Telephone Operators License
hrs	Hours
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
LLZ	Localizer
MEL	Minimum Equipment List
MLG	Main Landing Gear
NDB	Non-Directional Beacon
NLG	Nose Landing Gear
NM	Nautical Miles
PA	Passenger Address
PF	Pilot Flying
PIC	Pilot in Command
PM	Pilot Monitoring
QRH	Quick Reference Handbook
RA	Radio Altitude
RESA	Runway End Safety Area
SB	Service Bulletin
SEP	Safety and Emergency Procedures Manual
VFR	Visual Flight Rules
VMC	Visual Meteorological Conditions
VOR	VHF Omnidirectional Range
UTC	Coordinated Universal Time

FINAL INVESTIGATION REPORT ON SERIOUS INCIDENT TO M/S AIR INDIA LIMITED AIRBUS A320 AIRCRAFT VT-EXM AT CHENNAI ON 13th NOVEMBER 2020.			
1.	Aircraft	Type	Airbus A320
		Nationality	Indian
		Registration	VT-EXM
2.	Owner & Operator		M/s Air India Ltd.
3.	Pilot		ATPL Holder
	Extent of Injuries		Nil
4.	Co- Pilot		CPL Holder
	Extent of Injuries		Nil
5.	No. of Passengers on board		161
6.	Date & Time of Serious Incident		13th November 2020 at 1550 UTC
7.	Place of Serious Incident		Chennai Airport
8.	Co-ordinates of Serious Incident Site		Lat: 19°41'27.33" N Long: 74°22'18.35" E.
9.	Last point of Departure		Chennai Airport
10.	Intended landing place		Delhi Airport
11.	Type of Operation		Scheduled Operation
12.	Phase of operation		Take-off Roll
13.	Type of Serious Incident		Aborted Take-off from Unassigned Runway

(All the timings in this report are in UTC unless otherwise specified)

SYNOPSIS

On 13th November 2020, M/s Air India Ltd. Airbus A320 aircraft VT-EXM while operating a scheduled flight from Chennai to Delhi was involved in a Serious Incident of aborted take-off from unassigned runway at Chennai airport.

The aircraft was under the command of an ATPL holder who was Pilot Flying (PF) with a CPL holder as co-pilot who was Pilot Monitoring (PM). There were 161 passengers on board the aircraft and 04 cabin crew members.

The aircraft was advised by ATC (Ground) to expect runway 25 for departure before it was given pushback & start-up clearance. The same was also acknowledged by the crew. The aircraft was then given taxi clearance to holding point runway 25 via taxiway 'E', 'B' and 'C'. The crew, however, requested for 'A' intersection departure. Accordingly, ATC (Ground) revised taxi clearance as taxi via 'B' and 'A' holding point runway 30 on 'A'. The ATC (Ground) then handed over the aircraft to ATC (Tower). The ATC (Tower) then gave take-off clearance from runway 25. The aircraft, however, lined up on runway 30 (unassigned runway) and started rolling for take-off. On observing this, ATC (Tower) immediately asked aircraft to cancel take-off, hold position and instructed to stop immediately. As instructed by ATC (Tower), the crew rejected take-off. The take-off was rejected at a speed of 67 knots. The crew then requested ATC that they would like to return to the bay. Accordingly, ATC (Tower) gave taxi clearance to vacate via 'Q1', 'Q' holding point runway 07 and the same was readback by crew. After vacating the runway via "Q1", the pilot took a wrong turn and entered taxiway "N" (not a full taxiway) instead of continuing straight for "Q". The ATC then instructed the aircraft to hold position and appraised them of the situation.

Director General, AAIB appointed Sh. K Ramachandran, Assistant Director, AAIB as Investigator – In – Charge & Sh. Amit Kumar, Safety Investigation Officer, AAIB as Investigator to investigate into the probable cause(s) of the serious incident, vide Order No. INV.12011/12/2020-AAIB dated 19th November 2020 under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017.

BEA, France appointed Accredited Representative to participate in the investigation in accordance with ICAO Annex 13 requirements.

1 FACTUAL INFORMATION

1.1 HISTORY OF THE FLIGHT

On the day of incident prior to the incident flight, the aircraft had operated sector Delhi – Chennai. There was no abnormality reported on the aircraft. Thereafter, the aircraft was scheduled to operate return flight sector Chennai – Delhi with the same pair of cockpit crew. The Pilot – In – Command was Pilot Flying (PF) and Co-Pilot was Pilot Monitoring (PM) for the flight. The crew were paired together for the first time to operate the sector (Delhi-Chennai-Delhi).

The aircraft contacted ATC (ground) at 153650 UTC and requested for pushback and start. However, ATC asked aircraft to Standby and informed delay of 05 minutes. ATC (Ground) also informed crew to expect runway 25 for departure which was read back correctly by the crew. At 153827 UTC, the ATC gave pushback and startup clearance and once again informed that the clearance is for runway 25. The same was again readback correctly by crew. At 154400 UTC, ATC (Ground) gave taxi clearance to aircraft as "Taxi to holding point runway two five via 'E', 'B', 'C' " and the same was read back correctly by the crew. However, in order to have better take-off performance, crew decided intersection 'A' for departure and requested ATC "Requesting two five 'A' intersection". Accordingly, ATC gave clearance as "Roger continue taxi via 'B' 'A' holding point runway three zero". The crew then asked ATC to repeat the taxi clearance and ATC again repeated the taxi clearance as "Continue taxi via 'B' 'A' holding point runway three zero on 'A'. The crew acknowledged by giving call out "'A' AIC 554". The ATC then asked the aircraft to hold at Holding point runway three zero on taxiway 'A' and contact tower (118.1 Mhz). The crew read back the instructions correctly. At 154733 UTC, the crew contacted ATC (Tower). The tower also gave instruction to aircraft to "Hold at holding point 'A' runway three zero" which was again read back correctly by crew. However, the crew were confused about the clearance given for departure runway and again confirmed with tower also "And confirm runway two five for our departure" which was confirmed by tower by calling out "Affirm sir runway two five sir". At 154821 UTC, tower gave clearance "Line up runway two five via intersection" which was read back correctly by the crew. At 154932 UTC, the tower gave clearance for take-off as "Cleared for take-off runway two five winds calm" which was read back correctly by crew. As per the statement of crew during this time the aircraft crossed the intersection 'A' and was turning for line

up on runway (runway 30) for departure. The crew further stated that, as they turned the aircraft, they saw the runway (runway 30) in front and lined up on the same for departure without identifying the runway and analysing the visual cues. The crew were given continuous clearance by ATC for line up and take-off. The crew also stated that there was an aircraft on finals for landing which was at the back of their mind to clear the runway as soon as possible. The crew also stated that as it was festive season during that time, they were in a hurry to complete the flight and go back home for festival.

Thereafter, the crew, initiated take-off roll and the aircraft started rolling on runway 30. At 154953 UTC, the ATC (Tower) on observing that the aircraft is rolling on runway 30 instead of runway 25, immediately instructed aircraft "AIC 554 cancel take-off hold position stop immediately". Thereafter, the tower again instructed "AIC 554 I say again stop immediately I say again stop immediately". The crew responded to the instruction given by the tower and rejected take-off. The take-off was rejected at a speed of around 67 knots which increased to a maximum value of 74 kts before it started decelerating.

At 155011 UTC, the tower asked aircraft to vacate runway 30 via taxiway 'Q1' and informed "AIC 554 you were given clearance for runway two five sir not runway three zero" which was acknowledged by crew as "Apologies AIC 554 would like to return back to bay. At 155047 UTC, the tower accordingly gave taxi clearance as "Roger vacate via 'Q1' continue via 'Q1' 'Q' holding point runway zero seven". The same was read back correctly by crew. At 155140 UTC the crew again confirmed with tower about taxi clearance by calling out "Taxi instructions AIC 554". The tower again gave the taxi clearance as "AIC 554 continue via 'Q' holding point runway zero seven" which was again read back correctly by crew. The crew vacated the runway via 'Q1', however, instead of continuing on taxiway 'Q1' 'Q' turned the aircraft to taxiway 'N'. At 155157 UTC, on observing the aircraft turning to wrong taxiway (taxiway 'N') the tower again instructed the aircraft to hold position. The tower then asked the aircraft to contact 'Ground' (on 121.9 Mhz). At 155224 UTC, the aircraft contacted 'Ground' and asked clearance for further taxi. At 155229 UTC, 'Ground' informed aircraft that they have entered a wrong taxiway and there is no taxiway ahead. Ground asked aircraft to hold position as they are coordinating with apron for which the crew affirmed by calling out "Position" at 155252 UTC. At 155316 UTC, the 'Ground' asked the aircraft to "Switch off both engines" and sice there was no response from the crew, at 155409 UTC, 'Ground' again confirmed by calling out "AIC 554 confirm engines switched off", however, there was no response from

the aircraft. Thereafter 'Ground' repeatedly called the aircraft, however, there was no response from the aircraft. At 155433 UTC, the 'Ground' contacted security jeep and asked them to report position of the aircraft. The aircraft contacted 'Ground' at 155746 UTC only and asked for status of the tow bar. The 'Ground' also asked the crew if they are not maintaining listening watch. The crew replied to 'Ground' which was not recorded properly. It took considerable time to tow the aircraft back to bay. There was no fire and there was no injury to any of the occupant on board the aircraft. There was no damage to the aircraft.

1.2 INJURIES TO PERSONS

Injuries	Crew	Passengers	Others
Fatal	NIL	NIL	NIL
Serious	NIL	NIL	NIL
~~**Minor**~~**/ None**	02+04	161	

1.3 DAMAGE TO AIRCRAFT

There was no damage to the aircraft.

1.4 OTHER DAMAGE

Nil

1.5 PERSONNEL INFORMATION

1.5.1 Pilot – In – Command

Type of license	ATPL
Valid upto	07/08/2022
Date of Initial issue	08/02/2017
Class of license	SINGLE/MULTIENGINE, LAND/SEA AEROPLANE
Category of license	AEROPLANE
Date of Birth	21/06/1990
Aircraft Ratings	KING AIR C-90 A, TB-20 A320/319/321
Date of Endorsement as PIC	16/05/18 A320

Date of last Medical Exam	12/10/2020
Medical Exam validity	11/10/2021
FRTO License number	15260
Valid upto	23/06/2025
Instrument Rating	25/02/18 A320 SIM
Date of Last IR check	25/09/2020
Date of last Proficiency Check	01/10/20
Total flying experience	4220 Hours
Experience on Type	4019 hrs 39 min
Experience as PIC on Type	1450 hrs 39 min
Last technical refresher	28/10/2020
Details of any approval held- LTC/instructor/ Examiner held by the pilot.	Not Applicable
Last flown on Type (date)	10/11/20
Total flying experience in last 180 days (prior to incident)	54 hours 23 min
Total flying experience in last 30 days (prior to incident)	38 Hours 49 min
Total flying experience in last 7 days (prior to incident)	13 hrs 40 min
Total flying experience in last 24 hrs (prior to incident)	NIL
Rest before duty	28 Hours
Whether involved in any accident/incident earlier	Yes (In an incident)

The PIC was the pilot flying. He joined the company in the year 2009. He had operated into Chennai earlier and was familiar with the aerodrome. Prior to the incident flight, he had last operated into Chennai on 14th April 2019.

1.15.2 Co-Pilot

Type of license	CPL
Valid upto	14/07/2024
Date of Initial issue	01/07/2014
Class of license	Single/Multi Engine, Land/Sea Aeroplane

Category of license	Aeroplane
Date of Birth	27/07/1988
Aircraft Ratings	C-172 R, PA-34, A319/320/321
Date of Endorsement as PIC	C-172 R (01/07/2014), PA 34 (27/11/2015)
Date of last Medical Exam	03/10/2020
Medical Exam validity	02/10/2021
FRTO License	Valid
Valid upto	14/07/2024
Instrument Rating	Valid
Date of Last IR check	30/11/2019
Date of last Proficiency Check	17/07/2020
Total flying experience	713:03 hrs.
Experience on Type	498 hrs.
Experience as PIC on Type	C-172R (143 Hrs 05 min), PA -34 02 Hrs.
Last technical refresher	28/08/2020
Details of any approval held- LTC/instructor/ examiner held by the pilot.	Not Applicable
Last flown on Type	10/11/2020
Total flying experience in last 180 days	89 hrs. 23 min
Total flying experience in last 30 days	33 hrs. 15 min
Total flying experience in last 7 days (prior to incident)	11 hrs. 36 min
Total flying experience in last 24 hrs (prior to incident)	NIL
Rest before duty	72 hrs.
Whether involved in any accident/incident earlier	No

The co-pilot was the Pilot Monitoring. He joined the company in July 2018 and started flying as co-pilot from February 2019. Both cockpit crew were paired for the first time.

1.6 AIRCRAFT INFORMATION

1.6.1 Airbus A320 Aircraft Description

Airbus A320-251 Neo is a subsonic, medium-range, civil transport aircraft. The aircraft is installed with two high bypass turbofan engines manufactured by CFM International. The aircraft is designed for operation with two pilots. The aircraft is certified in Normal (Passenger) category, for day and night operation under VFR & IFR. The Maximum Take-Off Weight is 79000 Kgs. The aircraft dimensions are given below: -

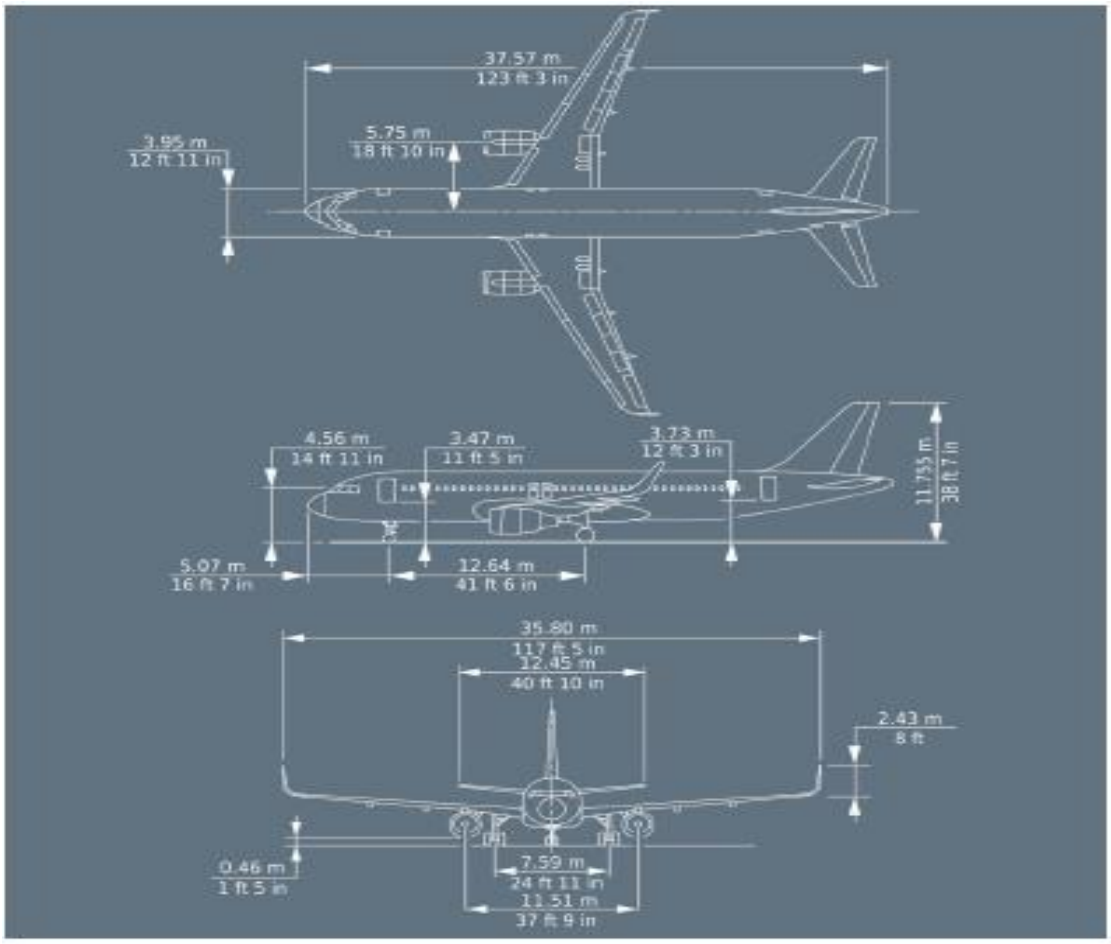


Figure 1. Aircraft Dimensions

1.6.2 Take-off Surveillance and Monitoring Functions

In order to improve take-off safety, Airbus has developed Take-off Surveillance (TOS1 & TOS2) and Take-off Monitoring (TOM) functions which are available on various aircraft (Airbus) types.

The Take-off Surveillance functions (TOS2) was introduced on A350 aircraft in 2018 and is now available on A320 family and A330 aircraft as an option.

TOS2 checks that the aircraft is positioned on the intended runway and that the expected take-off performance – based on data entered in the FMS by the crew is compatible with the runway distance available.

When the crew applies take-off thrust, TOS2 checks if the aircraft is positioned within an area that contains the take-off runway entered in the FMS. If the flight crew applies take-off thrust when the aircraft is still on a taxiway and outside the runway area, this will trigger the red ECAM warning NAV ON TAXIWAY.

The alert can also be an amber caution depending on the FWS standard. If the flight crew applies take-off thrust while the aircraft is positioned on a different runway from the one entered into the FMS, this will trigger the ECAM caution NAV NOT ON FMS RUNWAY. TOS2 function is available as an option on Airbus A320 family aircraft.

Figure 2: TOS2 - ECAM Caution of NAV NOT ON FMS RUNWAY.

1.6.3 Aircraft VT-EXM General Information

Aircraft Model	A320-251 Neo
Aircraft S/N	8056
Year of Manufacture	2018
Name of Owner	M/s Alafco Irish Aircraft Leasing Eight Limited.
C of R	Issued on 15th Feb 2018 & valid
C of A	Issued on 16th Feb 2018.
Category	NORMAL (A)
C of A Validity	Till the time ARC is valid.
ARC issued on	16.01.2020
ARC valid up to	15.01.2021

Aircraft Empty Weight	43206.32 KG.
Maximum Take-off weight	79000 KG.
Date of Aircraft weighment	16.01.2018
Empty Weight	43206.32 KG.
Max Usable Fuel	18623 KG.
Max Payload with full fuel	15493.70 KG.
Empty Weight C.G.	18.86 m aft of datum.
Next Weighing due	16.01.2023.
Total Aircraft Hours	9118:28:00 hrs.
Last major inspection	1A check, 31.08.2020.
List of Repairs carried out after last major inspection till date of incidence	NIL
Engine Type	LEAP 1A-26
Date of Manufacture (LH)	27.12.2017
Engine (LH) Sl. No.	Engine 1 S/N 598450
Last major inspection (LH)	'A' check, 31.08.2020.
List of Repairs carried out after last major inspection till date of incidence.	NIL
Total Engine Hours/Cycles (LH)	9127:32 Hours / 4656 Cycles
Date of Manufacture (RH)	02.08.2017
Engine (RH) Sl. No.	598326
Last major inspection (RH)	1A check, 31.08.2020.
List of Repairs carried out after last major inspection till date of incidence	NIL
Total Engine Hours/Cycles RH	8379:32 Hours / 4360 Cycles
Aero mobile License	A-014/RLO (NR)
Issued on/ Valid till	08.03.2018/28.12.23
AD, SB, Modification	All Complied.

All concerned Airworthiness Directives, mandatory Service Bulletins, and DGCA Mandatory Modifications on this aircraft and its engines were complied with as on date of event.

Scrutiny of the Technical Log Book revealed that there was no snag pending on the aircraft prior to the incident flight.

1.7 METEOROLOGICAL INFORMATION

MET Report – Chennai Airport from 1530 UTC to 1600 UTC

Time in UTC	Wind Dir	Wind Speed (KT)	Vis (m)	Clouds	Temp (°C)	Dew Point	QFE hPa	QNH hPa	TREND
1530	090	05	3000	FEW 2000 FT SCT 10000 FT FEW CB 2500 FT	28	27	1011	1012	NOSIG
1600	070	05	4000	FEW 2000 FT SCT 10000 FT FEW CB 2500 FT	28	27	1012	1011	NOSIG

1.8 AIDS TO NAVIGATION

Navigational Aids available at Chennai Airport is as given below:

Type of aid	ID	Frequency	Hours of operation
LLZ 07	IMAS	110.3 MHz	H24
GP 07	-	335.0 MHz	H24
OM07	---	75.0 MHz	H24
LO	MA	228.0 kHz	H24
LM	AS	211.0 kHz	H24
DVOR/DME	MMV	1159/1096MHz	H24
DME(ILS)	IMAS	1001/1064MHz	H24
DVOR	MMV	112.5 MHz	H24

All navigational aids available were serviceable at the time of incident.

1.9 COMMUNICATIONS

At the time of incident, the aircraft was in contact with Chennai ATC (Tower) on frequency 121.9 MHz. There was always two-way communication between the aircraft & ATC.

The relevant part of ATC Tape Transcript for ATC (Ground & Tower) is given below: -

ATC (GROUND) AT 121.9 MHZ			
TIME	**FROM**	**TO**	**TRANSCRIPT**
153650	AIC 554	GND	CHENNAI GROUND AIC 554 TOTAL OF ONE SIXTY-SEVEN THROUGH SECURITY READY FOR PUSH AND START
153659	GND	AIC 554	AIC 554 STANDBY DELAY FIVE MINUTES
153704	AIC 554	GND	COPIED AIC 554
153709	GND	AIC 554	AIC 554 EXPECT RUNWAY TWO FIVE FOR DEPARTURE
153710	AIC 554	GND	UH... ROGER RUNWAY TWO FIVE FOR DEPARTURE AIC 554
153827	GND	AIC 554	AIC 554 CLEAR OF INDIGO AIRBUS THREE TWO ZERO TAXING BEHIND PUSH BACK AND STARTUP APPROVED FACING EAST RUNWAY TWO FIVE
153836	AIC 554	GND	CLEAR OF INDIGO FACING EAST (NOISE) STARTUP APPROVED AIC 554
153847	GND	AIC 554	AIC 554 CLEARANCE REMAINS THE SAME
153852	AIC 554	GND	SAY AGAIN SIR
153852	GND	AIC 554	CLEARANCE REMAINS SAME RUNWAY TWO FIVE
153855	AIC 554	GND	CLEARANCE REMAINS THE SAME RUNWAY TWO FIVE AIC 554
154435	AIC 554	GND	AIC 554 REQUEST TAXI INSTRUCTIONS
154400	GND	AIC 554	AIC 554 TAXI TO HOLDING POINT RUNWAY TWO FIVE VIA 'E' 'B' 'C'
154407	AIC 554	GND	TAXI TO HOLDING POINT RUNWAY TWO FIVE VIA 'E' 'B' 'C' AND SIR REQUESTING TWO FIVE 'A', INTERSECTION AIC 55(GARBLED)
154415	GND	AIC 554	ROGER CONTINUE TAXI VIA 'B' 'A' HOLDING POINT RUNWAY THREE ZERO
154421	AIC 554	GND	SAY AGAIN SIR
154423	GND	AIC 554	CONTINUE TAXI VIA 'B' 'A' HOLDING POINT RUNWAY THREE ZERO ON ‘A'
154430	AIC 554	GND	‘A’ AIC 554
154712	GND	AIC 554	AIC 554 HOLD AT HOLDING POINT RUNWAY THREE ZERO ON TAXIWAY 'A' CONTACT TOWER ONE ONE EIGHT ONE HAPPY DIWALI
154720	AIC 554	GND	SIR HOLD AT HOLDING POINT(NOISE) RUNWAY THREE ZERO ON 'A' ONE ONE EIGHT DECIMAL... ONE ONE EIGHT ONE AIC 554

AFTER ACFT VACATED RWY 30 VIA Q1, IT CAME BACK TO GROUND FREUENCY			
155224	AIC 554	GND	GROUND AIC 554
155225	GND	AIC 554	AIC 554 GROUND
155228	AIC 554	GND	REQUESTING FURTHER TAXI
155229	GND	AIC 554	AIC 554 YOU WERE GIVEN TAXI VIA 'Q1' 'Q'. YOU HAVE TAKEN 'A' WRONG TURN ON TAXIWAY 'N', (UNREADABLE) 'Q1'
155241	AIC 554	GND	REQUEST TAXI SIR
155243	GND	AIC 554	AIC 554 THERE IS NO FURTHER TAXIWAY HOLD POSITION WE ARE COORDINATING WITH APRON
155252	AIC 554	GND	POSITION
155316	GND	AIC 554	AIC 554 SWITCH OFF BOTH ENGINES
155320	AIC 554	GND	(UNREADABLE)
155409	GND	AIC 554	AIC 554 CONFIRM ENGINES SWITCHED OFF
155417	GND	AIC 554	AIC 554 GROUND
155424	GND	AIC 554	AIC 554 GROUND
155433	GND	SEC JEEP	SECURITY JEEP GROUND
155454	GND	SEC JEEP	SECURITY JEEP GROUND
155505	GND	AIC 554	AIC 554 GROUND
155517	GND	AIC 554	AIC 554 GROUND HOW DO YOU READ
155535	GND	AIC 554	AIC 554 GROUND
155548	GND	AIC 554	AIC 554 GROUND HOW DO YOU READ
155626	GND	SEC JEEP	SECURITY JEEP GROUND
155633	GND	SEC JEEP	SECURITY JEEP GROUND
155638	GND	SEC JEEP	SECURITY JEEP GROUND
155705	SEC JEEP	GND	HUH. HUH. GROUND SECURITY JEEP
155708	GND	SEC JEEP	SECURITY JEEP GROUND STANDBY
155738	GND	SEC JEEP	SECURITY JEEP GROUND REPORT POSITION OF AIC 554
155746	AIC 554	GND	AIC 554 SIR STATUS OF THE TOW BAR SIR
155750	GND	AIC 554	AIC 554 I HAVE BEEN CALLING YOU FOR THE LAST FIVE MINUTES. ARE YOU NOT MAINTAINING THE LISTENING WATCH
155753	AIC 554	GND	(UNREADABLE) LISTENING WATCH

ATC (TOWER) AT 118.1 MHZ			
TIME	**FROM**	**TO**	**TRANSCRIPT**
154733	AIC 554	TWR	TOWER AIC 554 GOOD EVENING

154735	TWR	AIC 554	AIC 554 CHENNAI TOWER VERY GOOD EVENING SIR HOLD AT HOLDING POINT 'A' RUNWAY THREE ZERO
154741	AIC 554	TWR	HOLD AT HOLDING POINT 'A' RUNWAY THREE ZERO AIC 554
154751	AIC 554	TWR	AND CONFIRM RUNWAY TWO FIVE FOR OUR DEPARTURE AIC 554
154753	TWR	AIC 554	AFFIRM SIR RUNWAY TWO FIVE SIR
154755	AIC 554	AIC 554	ROGER SIR CLEARANCE WASTHRE RUNWAY ZERO THAT'S WHYE STANDBY
154800	TWR	AIC 554	AFFIRM SIR HOLDING POINT RUNWAYTHRE ZERO ON 'A' E
154803	AIC 554	TWR	ROGER
154821	TWR	AIC 554	AIC 554 LINEUP RUNWAY TWO FIVE VIA INTERSECTION
154823	AIC 554	TWR	LINE UP RUNWAY TWO FIVE VIA INTERSECTION AIC 554
154932	TWR	AIC 554	AIC 554 CLEARED FOR TAKEOFF RUNWAY TWO FIVE WINDS CALM
154935	AIC 554	TWR	CLEARED FOR TAKE OFF RUNWAYFIVE TWO WINDS CALM AIC 554 ROLLING
154953	TWR	AIC 554	AIC 554 CANCEL TAKE OFF HOLD POSITION STOP IMMEDIATELY.
155000	TWR	AIC 554	AIC 554 I SAY AGAIN STOPI IMMEDIATELY SAY AGAIN STOP IMMEDIATELY
155011	TWR	AIC 554	AIC 554 VACATE VIA TAXIWAY 'Q1'
155017	AIC 554	TWR	VACATE 'Q' AIC 554
155036	TWR	AIC 554	AIC 554 YOU WERE GIVEN CLEARANCE FOR RUNWAY TWO FIVE SIR NOT RUNWAY THREE ZERO
155042	AIC 554	TWR	APOLOGIES AIC 554 WOULD LIKE TORETU BACK TO BAY RN
155047	TWR	AIC 554	ROGER VACATE VIA `Q1' CONTINUE'Q1' VIA `Q' HOLDING POINT RUNWAY ZERO SEVEN
155049	AIC 554	TWR	VACATE VIA 'Q1' CONTINUE VIA 'Ql"Q' HOLDING POINT RUNWAY ZERO SEVEN AIC 554
155140	AIC 554	TWR	TAXI INSTRUCTIONS AIC 554

155142	TWR	AIC 554	AIC 554 CONTINUE VIA Q HOLDING POINT RUNWAY ZERO SEVEN
155145	AIC 554	TWR	HOLDING POINT RUNWAY ZERO SEVEN AIC 554
155157	TWR	AIC 554	AIC 554 HOLD POSITION SIR
155200	AIC 554	TWR	AIC 554
155215	TWR	AIC 554	AIC 554 CONTACT GROUND ONE TWO ONE NINE
155216	AIC 554	TWR	ONE TWO ONE NINE AIC 554

1.10 AERODROME INFORMATION

1.10.1 GENERAL INFORMATION

Chennai Airport is operated and managed by Airport Authority of India (AAI).

The IATA Location Identifier Code is MAA and ICAO Location Indicator Code is VOMM. Chennai Airport operates as international airport. The Airport Rescue and Fire Fighting Services is Category '9'. Chennai airport is equipped with Advance Surface Movement Guidance and Control System and Markings (A-SMGCS) to monitor and guide the aircraft during taxi. It has two runways, the first runway with orientation 07/25 (North-west – South-east orientation) and the Second runway with orientation 12/30 (North-west – South-east orientation).

Airport Co-ordinates: - Lat: 12° 59' 17" N, long: 80° 10' 35" E

Elevation: 52 feet (15.84 meters).

The details of runway distances is as below;

Runway	TORA(M)	TODA (M)	ASDA (M)	LDA (M)	WIDTH (M)	RESA (M)
07	3658	3811	3708	3658	45	240 x 90
25	3658	3863	3718	3658	45	90 x 90
12	2085	2235	2085	1942	45	90 x 90
30	2085	2235	2085	1755	45	90 x 90

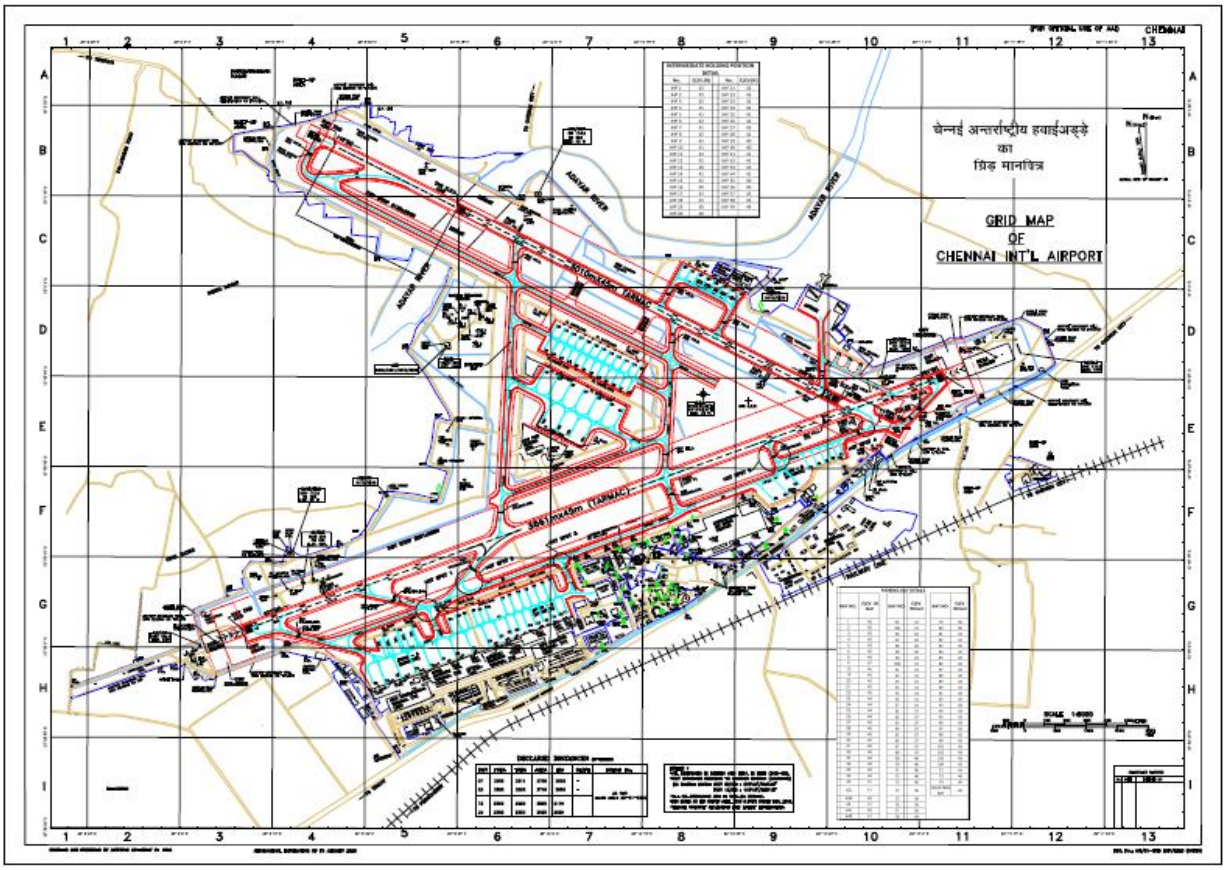


Figure 3: Grid Map of Chennai Airport

1.10.2 Aerodrome Hot Spots

The Aerodrome operator (AAI) of Chennai International Airport had identified various locations in the aerodrome as hotspots. These locations were also published in AIP, Aerodrome layout/map, Aerodrome Manual, etc.

The Hotspot locations identified at Chennai International Airport are as follows: -

HOT SPOT (HS)	LOCATION
HS 1	Intersection of Taxiway 'G' and Taxiway 'B'
HS 2	Intersection of Taxiway 'M' and Taxiway 'B'
HS 3	Intersection of Taxiway 'E' and Taxiway 'B'
HS 4	Intersection of Runway 12/30 and Taxiway 'A'

1.10.3 Runway 25/Runway 30 Intersection

As discussed in the previous para, Chennai International Airport has two runways with orientation 07/25 and 12/30. Runway 07/25 is primary runway and runway 12/30 is

secondary runway. On the day of incident only runway 07/25 was operational i.e., landing/departures were carried out from runway 07/25 only and runway 12/30 was used as a taxiway.

1.10.3.1 Runway/Taxiway edge lights

As per the requirement, the runway edge lights (initial part) are illuminated in white in colour and taxiway edge lights are illuminated in blue colour so that the operating crew can differentiate between taxiway and runway.

Accordingly at the time of incident, runway 12/30 edge lights were illuminated in blue colour and runway 07/25 edge lights (initial part) were illuminated in white colour. In this case crew did not observe the blue egde lights on runway 30.

1.10.3.2 Intersection 'A' on runway 12/30.

Both the runways, runway 07/25 and runway 12/30 intersects at almost start of runway 25 & Runway 30 (Refer Figure 4 below). If the aircraft is cleared for departure from runway 25, generally the departure clearance is given from intersection 'C'. However, if the crew asses that for better take-off performance (as in this case) more runway length is required, then that can be achieved by opting for Intersection 'A' departure. Intersection 'A' is connected to start of Runway 30. Therefore, in order to line up on runway 25 the crew is required to cross the holding point at 'A' turn the aircraft and enter Runway 30 via 'A' intersection then turn again to enter runway 25. There is all probability that a crew might get disoriented and may line up on runway 30 (irrespective of available visual cues). As per the SOP issued by AAI it is mentioned that there have been number of runway incursion occurrences due to this misunderstanding. Keeping this safety hazard in mind the Aerodrome Operator had identified this Intersection 'A' to runway 12/30 as one of the hotspots, Hot Spot 4 (HS 4). The crew did not discuss 'HS4' during briefing.

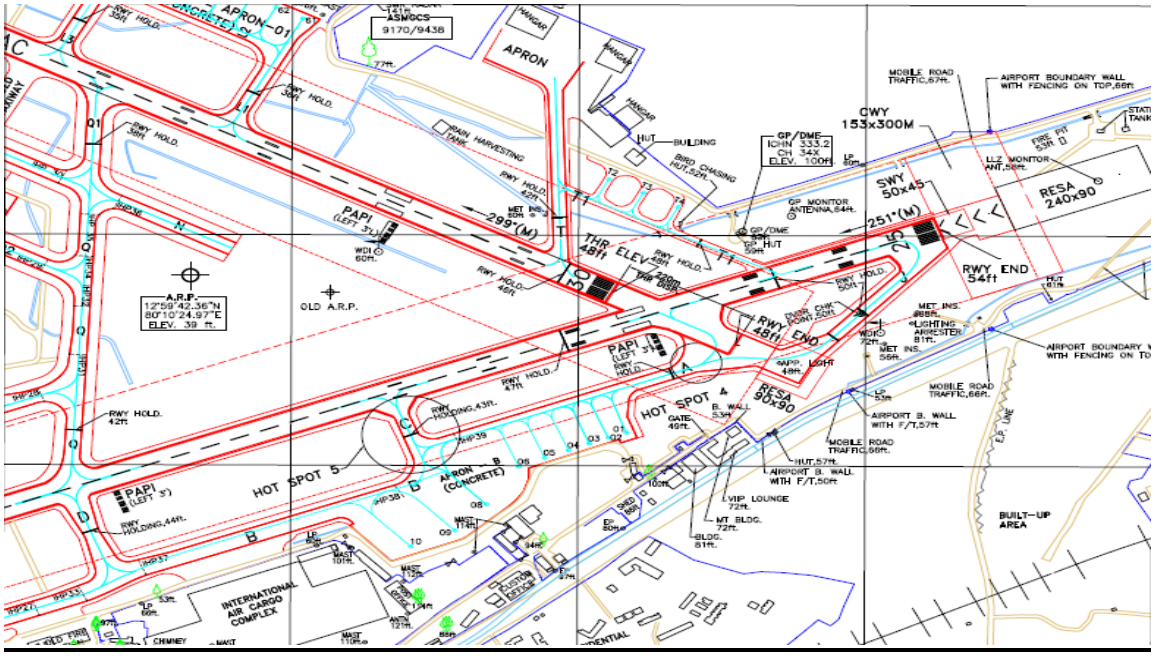


Figure 4: Layout of Runway 25 & Runway 30 intersection.

1.10.4 SOP issued by AAI for Chennai Airport for holding departures on Taxiway 'A'

AAI has issued a SOP dated 25th November 2017 for Holding Departures on Taxiway A for using Runway 25/ Runway 30 at Chennai. It is mentioned in the SOP that "In the recent past there have been instances, where aircraft intending to depart from runway 25 via runway intersection misunderstanding the taxi clearances and entering runway 30 to hold close to runway 25, thereby inadvertently causing runway incursions." The SOP has been formulated to mitigate this hazard.

As per the SOP the objective of it was to provide information to ATCO with respect to taxi instructions to be given to aircraft for holding at Holding point Runway 30 on Taxiway 'A'. Relevant extract from the said SOP is given below: -

Quote

"Procedures

The following procedures shall be applicable for aircraft intending to hold on Taxiway "A" before departing from RWY 30 or from RWY 25 via Runway intersection:

a. SMC controller shall issue Taxi clearance with specific instruction to hold on TWY A.
b. For departures from RWY 25 via Runway intersection the phraseology to be used while issuing Taxi clearances shall be:

"TAXI TO HOLDING POINT RUNWAY TWO FIVE VIA (specific route to be followed e.g., TWY H G B A) HOLD AT HOLDING POINT RUNWAY THREE ZERO ON A."

c. For RWY 30 departure the phraseology to be used while issuing Taxi clearances shall be:

"TAXI TO HOLDING POINT RUNWAY THREE ZERO VIA (specific route to he followed e.g., TWY H G B A) HOLD AT HOLDING POINT RUNWAY THREE ZERO ON A."

Unquote

1.11 FLIGHT RECORDERS

Both Solid State Cockpit Voice Recorder (SSCVR) and Solid-State Flight Data Recorder (SSFDR) were downloaded and readout was carried out.

1.11.3 Cockpit Voice Recorder

CVR data was downloaded and analyzed. The salient observation during the CVR replay is given below: -

1. At 15:44:00 UTC, when taxi instruction (via intersection C) was given to the crew by the ATC, then Crew had requested for Alpha intersection. Accordingly, ATC revised the Taxi instruction.
2. At 15:44:15 UTC, when taxi instruction was given to FO (who was communicating with ATC), then FO was discussing with PIC "why the ATC has given hold at intersection Alpha at Runway 30". In reply PIC said they are just giving/calling name Alpha. At this time crew were little confused as they were not aware that Intersection A is adjacent to runway/runway intersection.
3. At 15:47:51 UTC, when PIC confirmed from the ATC about the runway Clearance. ATC in its reply confirmed that the takeoff clearance is for runway 25.
4. The crew carried out before take-off checklists and PIC had confirmed the runway (Intended for departure) when co-pilot gave call out of 'runway'. However, the aircraft was lined up on runway 30 for departure.
5. Once the crew confirmed with ATC about the departure runway then there was no discussion in the cockpit regarding departure runway. Crew read back the instruction given by the ATC correctly including instruction given for take-off clearance.

1.11.4 Digital Flight Data Recorder (DFDR)

The aircraft was fitted with DFDR. The analysis of DFDR data was carried out with the help of Accredited Representative, BEA, France and following are the salient observations: -

Figure 5: Path followed by Aircraft beginning from parking bay.

<u>At 15:39:53 UTC</u>

- Both FDs were engaged (no modes engaged)
- ILS frequencies were set to 109.70MHz, corresponding to runway 25 (runway 30 is not equipped with ILS)
- Push back initiated, aircraft at location 1 on the below map (aircraft trajectory based on CPT FMS position parameters).

<u>Between 15:45:08 and 15:49:02</u>

- Taxiing from the gate to holding point A (1 to 2 on the map)
- Aircraft GW was 69.7T (MTOW = 79.0T)
- CG was 29.3%
- Autobrake was set to MAX mode
- Slats/Flaps CONF 2 was selected

At 15:49:02

- Aircraft turned to line up runway 30
- Ground speed (GS) was 13kts
- A nose wheel steering (NWS) left order started to be applied on Captain side
- Aircraft heading started to decrease from 070°

At 15:49:32

- TOWER issued take off clearance mentioning runway 25 for departure, along with the winds.
- The crew read back the clearance

At 15:49:33 (T=0)

- Start of the take–off roll (position No. 3 on the map).
- GS was 7kts
- HDG was 298°
- Thrust levers (TLs) pushed from IDLE to a thrust lever angle (TLA) of 10°
  - N1As started to increase towards 49%
- Aircraft was left of RWY 25 axis
  - LOC deviation was +86µA decreasing (75 µA = 1 dot)

At 15:49:45 (T+12s)

- Aircraft was crossing the centerline of runway 25
- GS was 16kt, increasing
- TLs pushed towards FLX notch
  - N1As started to increase from 49% to 82%
- A nose-down sidestick order of ~5° was applied on Captain side
- 1 second later, LOC deviation was +2µA decreasing to negative values

At 15:49:49 (T+16s)

- GS was 29kts increasing
- CAS was 31kts increasing
- TLs were at FLX notch
  - A/THR engaged in THRUST mode
- FD SRS vertical mode engaged

- RWY lateral mode did not engage
- LOC deviation was -24µA (right of RWY 25 axis)
- HDG was 299°

At 15:49:56 (T+23s)

- Take-off Rejected (position No. 4 on the map).
- CAS was 67kt increasing
- Both TLs were pulled from FLX to IDLE notch
- Captain sidestick was released to neutral position
- Braking pedal orders (up to ~half) were applied (left 45.0°, right 37.0°)
- Max possible pedal deflection = 78°

Within 1 second

- A/THR disengaged
- N1As started to decrease from 82%
- Deceleration started to increase from -0.25G

From 15:49:57 (T+24s)

- CAS reached a maximum of 74kts and starting to decrease
- Ground spoilers deployed
- Both TLs were pulled from IDLE to MAX REV
- Autobrake activated and deceleration was +0.32G increasing towards its maximum value of +0.56G.

At 15:50:00

- TOWER instructed "AIC554 I say again stop immediately I say again Stop immediately."

At 15:50:02 (T+29s)

- Autobrake MAX disconnected (due to the LH brake pedal exceeding the disconnection threshold)
- LH pedal input was recorded at 60°
- RH pedal input was 23°

At 15:50:05 (T+32s)

- Aircraft at position No. 5 on the map.
- GS was 38kt decreasing
- TLs were pushed from MAX REV to REV IDLE
- Differential braking was continued to be applied

At 15:51:20

- Aircraft turned to Taxiway Q1
- Heading was 183^{o}
- Ground Speed of 9.3 Kts

At 15:52:01

- The aircraft turned to taxiway N at a ground speed of 9.3 knots and subsequently stopped.
- Heading was 121.85^{o}

1.12 WRECKAGE AND IMPACT INFORMATION

Not relevant, as there was no damage to the aircraft.

1.13 MEDICAL AND PATHOLOGICAL INFORMATION

The First Officer had undergone pre-flight medical (Breath Analyzer Test) at Delhi before departure as per requirement of CAR Section 5, Series F, Part III. The test result was negative i.e., Co-pilot was not under the influence of alcohol. Whereas the PIC had given an undertaking regarding B.A test at Delhi, in accordance with the DGCA circular dated 29.03.2020 in this regard.

1.14 FIRE

There was no fire.

1.15 SURVIVAL ASPECTS

The Incident was survivable.

1.16 TESTS AND RESEARCH

Nil

1.17 ORGANISATIONAL AND MANAGEMENT INFORMATION

1.17.1 M/s Air India Ltd.

M/s Air India Ltd. is a Scheduled Airline with an Airbus fleet of 77 aircraft comprising of A319 (21), A320 (36), A321 (20) aircraft and it's Boeing fleet consist of B747 (04), B777 (16) and B787 (27), with a total of 47 Boeing aircraft. M/s Air India operates (Passenger & Cargo) flights on domestic and international routes. The Airline's Head Quarter is located at New Delhi. Maintenance base of Airbus A320 is in Delhi. The Air Operator Permit (AOP S-9) of the Airlines is valid till 30/06/2023. The company is headed by a Chairman & Managing Director (CMD), assisted by Executive Directors of various departments.

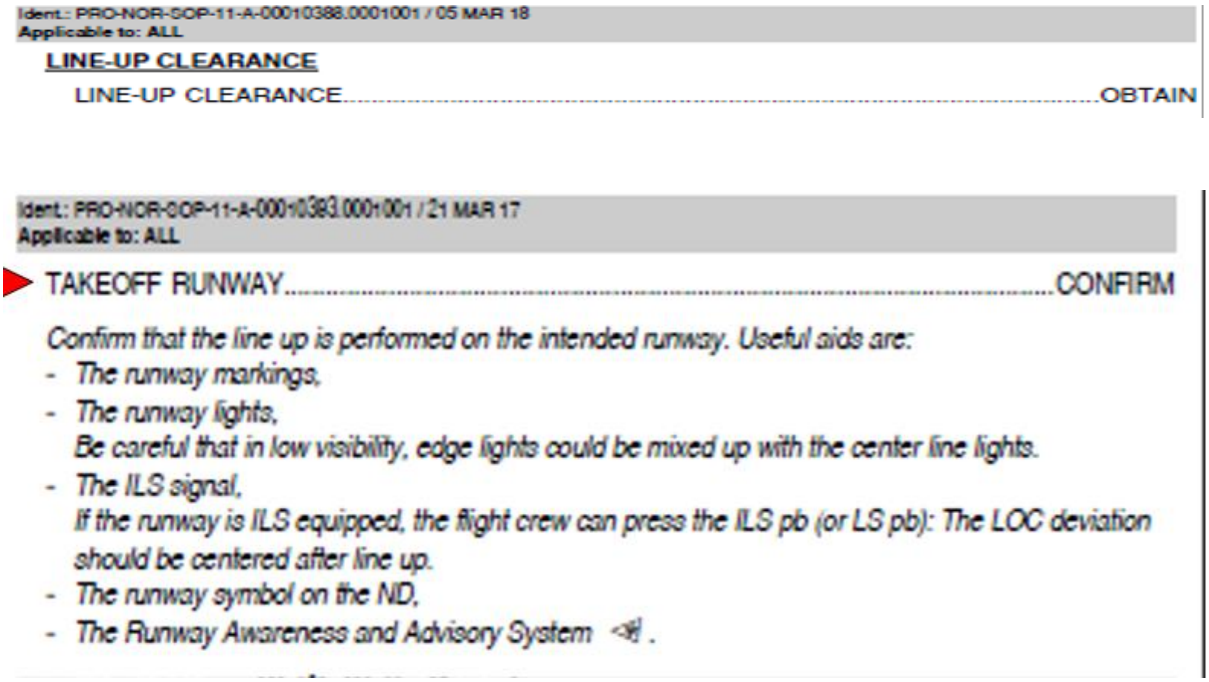
The Flight Safety Department is headed by Executive Director (Flight Safety) or Chief of Flight Safety approved by DGCA. Executive Director (Flight Safety) is directly reporting to CMD.

M/s Air India has two dedicated DGCA approved flight crew training facility for Pilots at Hyderabad and Mumbai for Airbus and Boeing respectively.

1.17.1.1 Flight Crew Operations Manual (FCOM)

FCOM of Airbus A320 family aircraft was scrutinized and extract of some relevant SOPs/Checklists is given below: -

Before take-off checklist


Ident.: PRO-NOR-SOP-11-A-00010388.0001001 / 05 MAR 18
Applicable to: ALL

LINE-UP CLEARANCE

LINE-UP CLEARANCE.....OBTAIN

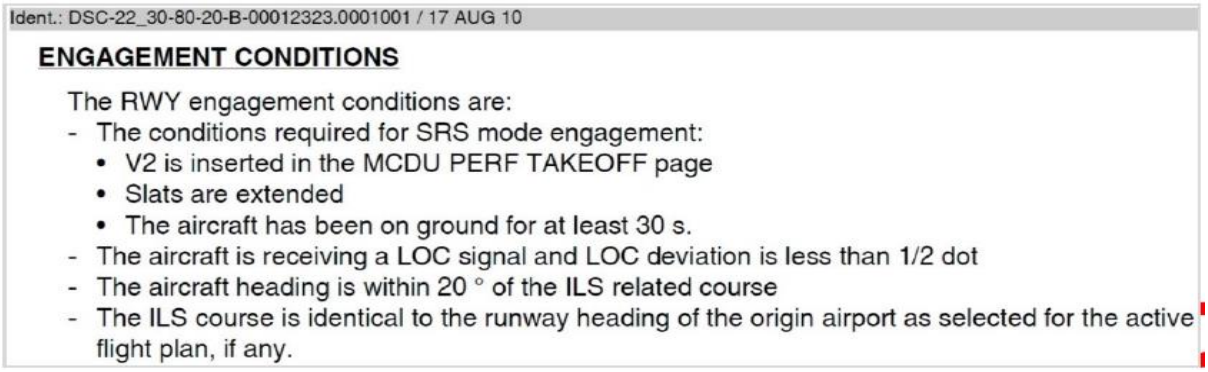
Ident.: PRO-NOR-SOP-11-A-00010383.0001001 / 21 MAR 17
Applicable to: ALL

TAKEOFF RUNWAY.....CONFIRM

Confirm that the line up is performed on the intended runway. Useful aids are:
- *The runway markings,*
- *The runway lights,*
  Be careful that in low visibility, edge lights could be mixed up with the center line lights.
- *The ILS signal,*
  If the runway is ILS equipped, the flight crew can press the ILS pb (or LS pb): The LOC deviation should be centered after line up.
- *The runway symbol on the ND,*
- *The Runway Awareness and Advisory System .*

Figure 6: Before take-off checklist – Take-off Runway

The runway engagement conditions



Ident.: DSC-22_30-80-20-B-00012323.0001001 / 17 AUG 10

ENGAGEMENT CONDITIONS

The RWY engagement conditions are:

- The conditions required for SRS mode engagement:
  - V2 is inserted in the MCDU PERF TAKEOFF page
  - Slats are extended
  - The aircraft has been on ground for at least 30 s.
- The aircraft is receiving a LOC signal and LOC deviation is less than 1/2 dot
- The aircraft heading is within 20 ° of the ILS related course
- The ILS course is identical to the runway heading of the origin airport as selected for the active flight plan, if any.

Figure 7: Runway Engagement Conditions

1.17.1.2 Operations Manual of Air India

The organisation has formulated an "Operations Manual" which was duly approved by DGCA. Scrutiny of the "Operations Manual" revealed that there was no specific procedure formulated for the crew to follow in case of departure from runway/runway intersection. Also, there is no specific procedure mentioned for discussing Hotspots during briefings.

1.17.1.3 Extract from Operations Manual of Air India

ATC CLEARANCES

Air India pilots shall ensure adequate terrain clearance is maintained at all times, irrespective of ATC clearances received. The following air traffic clearances are required and are to be read back.

I. Pre-departure clearance (if available)
II. Push back and start up clearance
III. Taxi clearance
IV. ATC Clearance
V. Departure (Take-off) clearance
VI. Altitude and level change clearance
VII. Enroute clearance
VIII. Descent clearance
IX. Approach and landing clearance

Standard radio phraseology shall be used at all times, including Data Link messages. Free text messages are also permitted e.g Load sheet transmission. In general all clearances must be read back verbatim in full and with the full call sign to avoid any ambiguity.

Acknowledgement of instructions is not be transmitted by the use of a mere call sign. The call sign is only used for identification and not as a means of acknowledgement.

Figure 8: Extract of Operations Manual of Air India – ATC Clearances

Chapter 34 Accident Prevention and Flight Safety Program

34.1.2 IMPLEMENTATION OF RECCOMENDATIONS OF INSPECTOR OF ACCIDENT/ COMMITTEE OF INQUIRY AND COURT OF INQUIRY

The Flight Safety Department shall ensure that the recommendations of Inspector of Accident/Committee of inquiry/Court of Inquiry are implemented. Specific audits shall be conducted to establish that such recommendations are implemented.

34.2 ACCIDENT/INCIDENT REPORTING PROCEDURE

In accordance with CAR Section-5, Series-C, Part-I, Issue-II dtd 20th OCT2015 and Rule 4 of Aircraft (Investigation of Accidents and Incidents) Rules 2012 requires that when an accident or incident occurs to an aircraft covered under sub-rule (2) of rule 1, then the pilot-in-command of the aircraft or, if he is killed or incapacitated, the owner, the operator, the hirer or any other person on whose behalf he was in command of the aircraft, or any other relevant person, as the case may be, shall, as soon as is reasonably practicable but in any case not more than 24 hours after he becomes aware of the accident or the incident to the following:

a) Aircraft Accident Investigation Bureau
b) Director General of Civil Aviation by the quickest means of communication available;
and
c) In the case of an accident occurring in India, give information to District Magistrate and the Officer Incharge of the nearest police station.

Figure 9: Extract of Operations Manual of Air India – Accident Prevention & Flight Safety Program

1.17.1.4 Extract from Flight Safety Manual of Air India.

The Flight Safety Manual, Issue IV, Revision 02 of Air India was approved by DGCA on 01.08.2019. Following are the salient extract from the approved Flight Safety Manual.

1.18 New Investigation Techniques

NOTE: - Notifiable fatal accidents are investigated by Court of enquiry/ Committee of Inquiry. Notifiable non-fatal accidents are investigated by Inspector of Accidents and Air India Ltd. Board of Inquiry, separately.

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5. In particular, and without prejudice to the generality of the foregoing power, such procedures may provide for all or any of the following matters, namely:-
   a. the persons required to notify the accidents and incidents;
   b. the notifications of accidents and serious incidents to International Civil Aviation Organization and the States for participation in the investigation;
   c. the investigation of aircraft accident and incidents;
   d. the format of preliminary and reports of Committee of Inquiry and Formal Investigation conducted under these rules;
   e. the consolidation and follow-up of safety recommendations made by the Committee of Inquiry and Formal Investigation with the agencies required to implement the recommendations and require action taken reports from these agencies; and
   f. Any other matter subsidiary or incidental to aircraft accident and incident investigation.

4. B.2 ROLE / DUTY OF OPERATOR IN ASSISTING THE INVESTIGATION BY AN INQUIRY OFFICER / INSPECTOR OF ACCIDENTS / COMMITTEE OF INQUIRY / COURT OF INQUIRY

The Director-General may specifies the manner in which the aircraft accidents and incidents are to be notified, guidelines and modalities to be adopted for classification, investigation thereto and the responsibilities of various organizations like the Airlines and other Departments/ agencies at the airport etc. in providing assistance with regard to investigation. Flight Safety is responsible for providing all necessary support to DGCA and other regulatory authorities concerned, in accident investigation.
Note :- The following information are the extract from the Aircraft Rule 2017 and relevant section extracted for the airline are reproduced below.

4.B.2.1 RESPONSIBILITIES OF OPERATOR IN ACCIDENT/INCIDENT INVESTIGATION:-

As per Aircraft Rule 2017 following is the responsibility of the operator during Accident/Incident Investigation:

1. Whenever an accident occurs, the Owner, Operator, Pilot-in-Command, Co-pilot of the aircraft shall take all reasonable measures to protect the evidence and to maintain safe custody of the aircraft and its contents for such a period as may be necessary for the purposes of an investigation subject to the Indian Aircraft Rules 2017. Safe custody shall include protection against further damage, access by unauthorized persons, pilfering and deterioration.

2. All the documents relating to the aircraft shall be segregated and sealed by the Operator and shall be handed over to DGCA Officers who shall determine the adequacy of action as deemed appropriate and may seal any other documents etc. pertinent to the investigation of the accident as any of the material could be of use to the investigating authority. The following are the broad outlines of the records which should be segregated and sealed as soon as possible after the accident occurs:

   a) By Airline:
      i. Flight folder consists of Operational Flight Plan, ATC Flight Plan, MET folder, NOTAMS, Company Advisory, Takeoff and landing data card.
      ii. Training files of the Pilots and Cabin Crew including recurrency training record.
      iii. Past incidents of the Crew and Counseling/ training based on FOQA monitoring.
      iv. Any Breath analyser Positive record(i.e Pre / Post Flight Breath Analyser Test records of cabin crew, Cockpit Crew and Maintenance Personnel as applicable.)The requirements of Medical Examination of personnel after accident shall be complied with in accordance with CAR Dection 5, Series F part II & III.
      v. Copy of current SOP, FCOM, Operation Manual etc
      vi. Load & Trim Sheet.
      vii. Passenger Manifest & GD
      viii. AME Training Record & recurrency status.

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Figure 10: Extract from Flight Safety Manual

While going through the flight safety manual of Air India it was observed that in many place references of words such as Inspector of Accident, Committee of Inquiry, etc. are mentioned which corresponds to omitted rules previously existing under Aircraft Rules, 1937.

Further, it is mentioned that in case of accident investigation the operator shall segregate and seal the aircraft documents and hand over to DGCA officers which again is not in line with existing regulations in this regard.

1.18 ADDITIONAL INFORMATION

Nil

1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES

Nil

2 ANALYSIS

2.1 General

The aircraft was manufactured in the year 2018. The aircraft was having a valid Certificate of Registration (C of R) at the time of incident. It was holding a valid Indian Certificate of Airworthiness (C of A) under category Normal, Sub-Division Passenger and valid for lifetime. Airworthiness Review Certificate was valid at the time of incident. All concerned Airworthiness Directives, mandatory Service Bulletins, and DGCA Mandatory Modifications on this aircraft and its engines were complied with as on date of event.

The weather at the time of incident was fine with visibility above minima and winds calm.

2.2 Organisation Aspect

2.2.1 Operations Manual of the Organisation

2.2.1.1 The organisation has formulated an "Operations Manual" based on the existing regulations which was duly approved by DGCA. Scrutiny of the "Operations Manual" revealed that there was no specific procedure formulated for the crew to follow in case of departure from runway/runway intersection. In the present case, the crew opted for intersection 'A' which was a runway intersection departure which led to various unsafe situation. This is a serious safety hazard which could have led to an accident had ATC not intervened in time. As the organisation (also other organizations) is operating regular flights to the airfields like Chennai, where in all probability situations will occur where there is requirement of runway intersection departures. Hence, a specific procedure formulated in this regard will help the crew to take necessary actions as per

the procedure, which will improve their situational awareness and will ensure overall safety of the aircraft.

2.2.1.2 The scrutiny of the "Operations Manual" also revealed that there is no specific procedure mentioned for discussing Hotspots during briefings. The crew in this case did not discussed hotspots during the taxi briefing which if they had carried out could have averted the situation. A specified procedure in this regard will also ensure crew to be more assertive during situation like these.

2.2.2 References of older regulations in Various Documents of the Organisation

Scrutiny of Operations Manual & Flight Safety Manual of the Organisation approved by DGCA revealed that in many places in both documents references of words such as Inspector of Accident, Committee of Inquiry, etc. are mentioned which corresponds to previously existing Rules of Aircraft Rules, 1937 and not in line with the prevailing regulation at the time of approval of these manuals.

Further, in Flight Safety Manual it is mentioned that in case of accident investigation the operator shall segregate and seal the aircraft documents and hand over to DGCA officers which again is not in line with the existing regulations at the time of approval of this manual.

The above observations had no bearing on the incident, however, there is a requirement to address these issues so that the operators are aware of the current regulations in place. This will help them to understand what actions are required to be carried out by them in case of accidents/serious incidents/incidents without any ambiguity.

2.3 Operational Aspect and Human Factor Analysis

2.3.1 Crew Qualification

Both pilots were qualified to operate the flight. PIC had a total flying experience of about 4000 Hrs on type and Co-pilot had a total experience of close to 500 hrs on type. Their medical and all trainings were current as on date of occurrence.

The crew were paired for the first time to operate the flight. The PIC had operated to Chennai before and the last time he operated was on 14th April 2019, so he was well familiarized with the airport.

2.3.2 Non-adherence to Standard Operating Procedures

ATC (Ground) informed the crew to expect runway 25 for departure which was read back correctly by the crew. Thereafter, ATC (Ground) gave pushback and startup clearance. ATC (Ground) once again informed that the clearance is for runway 25. The same was again readback correctly by crew. ATC (Ground) gave taxi clearance to aircraft as "Taxi to holding point runway two five via 'E', 'B', 'C'" and the same was read back correctly by the crew. However, in order to have better take-off performance, crew decided intersection 'A' for departure and requested ATC for the same. Accordingly, ATC gave clearance as "Roger continue taxi via 'B' 'A' holding point runway three zero" as per the SOP dated 25.11.2017 issued by AAI in this regard. As discussed earlier, holding point on 'A' is for runway three zero which is adjacent to the runway 25/runway 30 intersection. The PIC (PF) was familiar with the aerodrome but did not realize at that time that it is a runway25/runway30 intersection and they also did not discuss the Hot Spots during the taxi briefing as Intersection 'A' has been identified as one of the hot spots (HS4) of the aerodrome. This led to crew being confused on the instruction given by the ATC which was evident from the CVR recordings wherein during this time they were discussing that ATC is confusing as the clearance was given for runway 25 but they are asking to hold at holding point runway 30 on 'A'. In order to confirm the same they again asked ATC (Ground) to repeat the taxi clearance which was repeated as "Continue taxi via 'B' 'A' holding point runway three zero on 'A'. The crew acknowledged by giving call out "'A' AIC 554" which is a non-standard call out. The aircraft was then changed over to ATC (Tower). The crew then came in contact with ATC (Tower). The tower also gave instruction to aircraft to "Hold at holding point 'A' runway three zero" which was again read back correctly by crew. However, the crew in order to confirm again about the clearance given (for departure runway) asked tower also which was confirmed by tower by calling out "Affirm sir runway two five sir". Thereafter, tower gave clearance as "Line up runway two five via intersection" which was read back correctly by the crew and subsequently the tower gave clearance for take-off as "Cleared for take-off runway two five winds calm" which was read back correctly by crew. Thereafter there was no discussion about the departure runway between the crew as by now they were assured that the clearance given for departure runway is Runway 25 (This was also confirmed by the crew during the interaction with the investigation team).

After crossing the intersection 'A' the PIC then turned the aircraft and lined up on runway 30 for departure as just after the turn PIC saw runway (runway 30) in front without ascertaining that it is not the assigned/correct runway i.e., runway 25. During the before take-off checklist also PIC confirmed the assigned runway (runway 25) call out given by Co-pilot without actually ascertaining the same by looking at the available visual cues. This again is non-adherence to the laid down SOPs on the part of PIC. Further, the co-pilot as Pilot Monitoring was busy on head down duties but did not confirm the intended runway by looking at instruments. Crew did not observe the aircraft 'heading' on the FMS when the aircraft was lined up on runway 30 for departure. It was not meeting the requirement of runway engagement conditions as the aircraft heading was 299^{o} whereas runway 25 heading is 251^{o} which is not within 20^{o} of ILS related course. Had the co-pilot observed the aircraft heading, he could have given the call out to PIC to correct the same.

Thereafter, the crew, initiated take-off roll and the aircraft started rolling on runway 30 before Tower asked them to cancel the take-off as Tower observed that the aircraft is rolling on the unassigned runway. The crew followed the instruction given by the Tower and rejected take-off when the aircraft was at a ground speed of about 67 knots.

The tower then informed crew that the aircraft was given clearance for runway 25 not runway 30 and asked aircraft to vacate runway 30 via taxiway 'Q1' which was acknowledged by the crew. Crew informed Tower that they would like to go back to bay. The tower accordingly gave taxi clearance as "Roger vacate via 'Q1' continue via 'Q1' 'Q' holding point runway zero seven". The same was read back correctly by crew. The crew again confirmed with tower about taxi clearance and the tower again gave the taxi clearance as "AIC 554 continue via 'Q' holding point runway zero seven" which was again read back correctly by crew. However, the crew instead of continuing on taxiway 'Q1' and then on 'Q' turned the aircraft to taxiway 'N'. On observing the aircraft turned to wrong taxiway (taxiway 'N') the tower again instructed the aircraft to hold position. This again is non-adherence to the laid down SOPs on the part of crew.

The aircraft was then handed over to 'Ground' and 'Ground' informed crew that they have entered a wrong taxiway and there is no taxiway ahead. Ground asked aircraft to hold position as they are coordinating with apron for which the crew acknowledged by calling out "Position". Thereafter 'Ground' asked the crew to "Switch off both engines" for which there was no response from the crew. 'Ground' again confirmed "AIC 554 confirm engines

switched off', however, there was no response from the crew. Thereafter 'Ground' repeatedly called the aircraft, however, there was no response from the crew until when they asked for status of the tow bar. This shows that crew (may be in the wake of the occurrence) was not maintaining the listening watch properly which again is non-adherence to the laid down SOPs.

2.3.3 Factors which led to Non-Adherence of SOPs.

The Investigating Team during the course of investigation observed that although Non-Adherence of SOPs by the flight crew was the prime factor to the occurrence. However, there were many other factors which led to these non-adherence of SOPs by the flight crew. The Investigation Team interacted with the involved crew to analyse these factors involved in the occurrence. The factors are discussed below: -

2.3.3.1 Fixation/Loss of Situational Awareness

Although many visual cues were available for the pilot to ascertain that it was not the intended runway for example: -

- Runway lights: Runway 30 was not operational at that time as it was the secondary runway and was used only for taxiing purpose hence the edge lights were blue in color (and not 'white' as that in case of runway edge lights). PF did not observe the same.
- Runway signage: The PF also did not observe the runway signage at the beginning of intersection.
- Runway marking: The PF also did not observe the runway '30' marking which was just after the threshold of runway 30.
- Line up (Aircraft Heading): Crew did not observe the aircraft 'Heading' when lining up the aircraft on runway 30 (heading 299^{o}) which was not in line with the intended runway 25 (Heading 251) which was also not in line with the runway engagement conditions.

The PF missed all the above visual cues as he was fixated to the fact that the first runway (runway 30) in sight just after turn was the intended/assigned runway as he was not aware at that time that intersection 'A' is adjacent to runway30/runway25 intersection. Also, when the ATC gave taxi clearance for intersection 'A', although they were communicating in cockpit that ATC is confusing for departure runway (calling out intersection 'A' Runway 30), however, they did not confirm with other resources (like

Jeppesen chart/aerodrome layout) available with them to confirm that it is runway30/runway 25 intersection. This indicates that the crew were fixated due to loss of situational awareness.

2.3.3.2 Hurry to complete the flight

During interaction with the crew, it was observed that there was a hurry to complete the flight. This was not because of any pressure from the company to complete the flight or any delay in flight. As it was festive season during that time, they wanted to complete the flight as soon as possible so that they can go back home and available with their family members for the festival.

2.3.3.3 Another aircraft on finals

During the interaction with the crew, they stated that there was an aircraft on finals for landing which was also at the back of their mind to clear the runway and minimize the runway occupancy time. This may be an additional factor which led crew to miss all the visual cues.

2.3.3.4 Runway/Runway Intersection Departure

The PF was familiar with the aerodrome as he had operated to Chennai number of times earlier, however, on that particular day he forgot that intersection 'A' is adjacent to runway 25/runway 30 intersection. Since he would have rarely departed from runway/runway intersection (which is rare) earlier, so it was at the back of his mind that the first runway visible would be the correct runway (which was not the intended runway and the edge lights were also blue in color as for taxiway).

2.3.3.5 Hotspots not discussed during briefing

The runway intersection 'A' has been identified as one of the hotspots "Hotspot 4" by the Aerodrome Operator and the same is appended in the aerodrome layout. The crew opted Intersection 'A' departure (In place of Intersection 'C' initially given by the ATC) in order to have better take-off performance. However, the crew did not discussed Hotspots (especially Hotspot 4) during the taxi briefing. Had they discussed this during the briefing the PF would have been cautious about the departure via runway25/runway 30 intersection and this unsafe situation could have been averted.

2.3.3.6 Additional Safety Factors/Visual Cues

Although PF missed all the visual cues/factors which were available at that time to ascertain the intended runway, the investigating team, however, was of the opinion that there could have been some additional Safety Factors/Visual Cues (especially at runway/runway intersection points) which could have averted the event, such as: -

- Runway Lead-In lights: There was no runway lead in lights available at Chennai. Had there been lead-in lights especially for Intersection 'A' to intended departure runway could have guided the PF to the assigned runway without any misperception.
- Stop Bar lights for Runway 30: There was no stop bar lights available at runway 30 to alert the pilots that runway 30 is not operational. This also could have alerted the PF to stop immediately or to turn towards the intended runway.
- Caution in the ATIS Announcement: AAI had formulated a SOP for using specific phraseology "HOLD AT HOLDING POINT RUNWAY THREE ZERO ON 'A' " by controllers for giving instruction to the aircraft for departure via runway intersection. However, the investigation team is of the opinion that this may avert runway incursions, however, there may be a scenario (as in the present case) where the aircraft is being given continuous clearances for line up and subsequently for take-off during the taxi itself. This may lead to the crew being confused about the clearance given for departure runway which also happened in this case momentarily. In order to avoid this unsafe situation a CAUTION by the ATC at the time of giving taxi/line up clearance for departure via runway intersection could alert the pilot and avoid any misunderstanding.
- Take-off Surveillance Functions (TOS2): TOS2 function checks that the aircraft is positioned on the intended runway and that the expected take-off performance – based on data entered in the FMS by the crew is compatible with the runway distance available. If the flight crew applies take-off thrust while the aircraft is positioned on a different runway from the one entered into the FMS, this will trigger the ECAM caution NAV NOT ON FMS RUNWAY. However, this function is available as an OPTION on the A320 fleet. Had this function was available on the aircraft, it could have alerted the pilot by giving ECAM caution to avoid such situation.

2.4 Circumstances leading to the Incident

The aircraft was initially given taxi clearance for departure from Runway 25 via Intersection 'C'. However, the crew in order to have better take-off performance requested Intersection 'A' for departure. The crew did not discuss 'Hotspot 4' during their taxi briefing. Accordingly, taxi clearance was given by the ATC as per the SOP issued by AAI in this regard. This led to crew being confused, as the departure clearance was given for runway 25 but the taxi instructions given by the ATC mentioned "HOLD AT HOLDING POINT RUNWAY THREE ZERO ON 'A' ". However, the confusion was cleared when

the crew confirmed with ATC about the departure runway. The ATC (Ground as well as Tower) had always mentioned 'Runway 25' in all of its call out given to the aircraft in respect of clearance for departure runway. The aircraft was given continuous taxi and the lineup clearance (for runway 25) was also given while the aircraft was taxing. After crossing holding point on 'A' the PF turned the aircraft and lined up on runway 30. Due to loss of situational awareness the PF did not observe any visual cues such as runway 30 edge lights (which were blue), runway signage, etc. available at that time to ascertain the intended runway for departure. The PM who was busy in head down duties also did not confirm the runway with instruments. Moreover, the PF also confirmed the take-off runway (as runway 25) without actually ascertaining the same during the before take-off checklist. The take-off clearance was given by the ATC (for runway 25) when the PF was aligning the aircraft on runway 30. Due to this and various other factors (discussed in para 2.3.3 above) the PF at the back of his mind thought that the first runway visible would be the intended runway for departure. This led PF to start rolling the aircraft on the unassigned runway i.e., runway 30 before ATC instructed it to cancel the take-off.

3. CONCLUSION

3.1 FINDINGS

1. The Certificate of Airworthiness, Certificate of Registration and Airworthiness Review Certificate of the aircraft were valid on the date of incident.
2. Both pilots were qualified to operate the flight.
3. Weather at the time of incident was fine and had no bearing on the incident.
4. Crew (PIC & Co-pilot) were paired for the first time to operate the flight Delhi – Chennai – Delhi. PIC was PF while Co-pilot was PM.
5. The aircraft was initially given taxi clearance for departure Runway 25 via Intersection 'C'.
6. The crew in order to have better take-off performance requested Intersection 'A' for departure.
7. The crew did not discuss Hotspot (Especially Hotspot 4) during their taxi briefing.
8. Taxi clearance was given by the ATC as per the SOP issued by AAI in this regard.
9. Crew were confused momentarily, as the departure clearance was given for runway 25 but the taxi instructions given by the ATC mentioned "HOLD AT HOLDING POINT RUNWAY THREE ZERO ON 'A' ".

10. The confusion was, however, cleared when the crew confirmed with ATC about the departure runway as they read back the instructions given by ATC correctly.
11. The ATC (Ground as well as Tower) had always mentioned 'Runway 25' in all of its call out given to the aircraft in respect of clearance for departure runway.
12. There were occasions where the crew did not read back the instructions given by ATC in full/standard phraseology which is non-adherence to the laid down SOPs.
13. The aircraft was given continuous taxi and the lineup clearance (for runway 25) was also given while the aircraft was taxing.
14. After crossing holding point on 'A' the PF turned the aircraft and lined up for departure on runway 30 instead of runway 25.
15. The PF did not observe any visual cues such as runway 30 edge lights (which were blue), runway signage, etc. available at that time to ascertain the intended runway for departure which is non-adherence to the SOPs.
16. The PM who was busy in head down duties also did not confirm the departure runway with instruments.
17. The PF also confirmed the take-off runway (as runway 25) without actually ascertaining the same during the before take-off checklist.
18. The crew were fixated due to loss of situational awareness due to which they did not observe any of the available visual cues.
19. During interaction with the crew, it was observed that there was a hurry to complete the flight. As it was festive season during that time, they wanted to complete the flight as soon as possible so that they are available with their family members in time for the festival.
20. The crew also stated that there was an aircraft on finals for landing which was also at the back of their mind to clear the runway and minimize the runway occupancy time.
21. The PF was familiar with the aerodrome as he had operated to Chennai number of times earlier, however, on that particular day he forgot that intersection 'A' is adjacent to runway 25/runway 30 intersection. Since he would have rarely departed from runway/runway intersection (which is rare) earlier, so it was at the back of his mind that the first runway visible (which was not the intended runway and the edge lights were also blue in colour as that for taxiway) would be the intended runway.
22. Crew did not observe the aircraft 'Heading' when lining up the aircraft on runway 30 (heading 299^{o}) which was not in line with the intended runway 25 (Heading 251) and also not in line with the runway engagement conditions.

23. The take-off clearance was given by the ATC (for runway 25) when the PF was lining up the aircraft on runway 30 which further confirmed to the PF belief that the runway in front was the intended runway for departure. However, there was no fault on the part of ATC in this regard, it was the timing of the call out which aggravated the situation.
24. PF then started rolling the aircraft on the unassigned runway i.e., runway 30 before ATC instructed it to cancel the take-off.
25. The take-off was rejected at a speed of around 67 knots which increased to a maximum value of 74 kts before it started decelerating.
26. The tower gave taxi clearance to the aircraft to vacate the runway 30 via 'Q1' 'Q' to holding point runway zero. The same was read back correctly by crew.
27. The PF instead of continuing on taxiway 'Q1' and then on 'Q' turned the aircraft to taxiway 'N'. On observing the aircraft turned to wrong taxiway (taxiway 'N') the tower again instructed the aircraft to hold position. This was again non-adherence to the laid down SOPs on the part of the crew.
28. ATC 'Ground' asked the crew to "Switch off both engines" for which there was no response from the crew. 'Ground' again confirmed "AIC 554 confirm engines switched off", however, there was no response from the crew. Thereafter 'Ground' repeatedly called the aircraft, however, there was no response from the crew until when the crew communicated and asked for status of the tow bar. This shows that crew (may be in the wake of the occurrence) was not maintaining the listening watch properly which again is non-adherence to the laid down SOPs.
29. There was considerable delay in the process for towing the aircraft back to bay.
30. At the time of incident, the Aerodrome had the required visual cues in place which the PF did not observe. However, the investigation team is of the opinion that there could have been some additional visual cues (especially at Intersection 'A') such as Runway Lead-In lights, Stop Bar lights for Runway 30, etc. which could have averted the unsafe situation.
31. AAI had formulated a SOP for using specific phraseology "HOLD AT HOLDING POINT RUNWAY THREE ZERO ON 'A' " by controllers for giving instruction to the aircraft for departure via runway intersection as there have been number of runway incursion cases. However, there may be a scenario (as in the present case) where the aircraft is being given continuous clearances for line up and subsequently for take-off during the taxi itself. This may lead to the crew being confused about the clearance given for departure runway which also happened in this case.

32. TOS2 function was not installed on this aircraft as this function is available as an OPTION on the A320 fleet. Had this function be available on the aircraft, it could have alerted the pilot by giving ECAM caution "NAV NOT ON FMS RUNWAY" to help avoid such situation.
33. The organisation (also other organizations) is operating regular flights to the airfields like Chennai, where in all probability situations will occur where there is requirement of departures from runway/runway intersection. However, there was no specific procedure formulated by the operator for the crew to follow in this regard to improve the situational awareness of the crew and to ensure overall safety of the aircraft.
34. The scrutiny of the "Operations Manual" also revealed that there is no specific procedure mentioned for discussing Hotspots during briefing. The crew in this case did not discussed hotspots during the taxi briefing which if they had carried out could have averted the situation. A specified procedure in this regard will also ensure crew to be more assertive during situation like these.
35. Scrutiny of the Operations Manual & Flight Safety Manual of the Organisation approved by DGCA revealed that in many places in both documents, references of words such as Inspector of Accident, Committee of Inquiry, etc. are mentioned. Further, in Flight Safety Manual it is mentioned that in case of accident investigation the operator shall segregate and seal the aircraft documents and hand over to DGCA officers. These are not in line with the existing regulations at the time of approval of these manuals.

3.2 PROBABLE CAUSE OF THE INCIDENT

The incident occurred due to loss of situational awareness of the flight crew, wherein, the PF started rolling the aircraft on the unassigned runway without ascertaining the intended runway with the available visual cues and improper monitoring of the instruments for the intended runway by PM.

3.2.1 Contributory Factors

- Not discussing Hotspots (Hotspot 4) during the taxi briefing.
- Crew not observing the aircraft 'Heading' when lining up the aircraft on runway 30 (heading 299^{o}) which was not in line with the intended runway 25 (Heading 251).
- The crew in a hurry to complete the flight and return home due to festival in mind.

- Crew also showing urgency to clear the runway as at the back of their mind they had that there is another aircraft on finals for landing.
- Take-off from runway 25/runway30 intersection which crew were not aware at that time.
- Take-off clearance was given (for runway 25 not runway 30) when the PF was lining up the aircraft on unassigned runway i.e., Runway 30 which added to the PFs belief that it was the intended runway.

4. SAFETY RECOMMENDATIONS

4.1 It is recommended that, DGCA may advise all operators to formulate a specific procedure for crew to follow during departure from runway/runway intersection.

4.2 It is recommended that, DGCA may advise all operators to formulate procedures wherein the crew gives emphasis on discussing 'hotspots' during the briefings.

4.3 It is recommended that, DGCA may advise all Aerodrome Operators/AAI (especially where departures from runway/runway intersection is carried out) to develop any provision to include CAUTION (in order to alert operating crew) along with the clearances (taxi or line-up or departure) issued by the controllers.

4.4 It is recommended that, DGCA may advise the Aerodrome Operator (Chennai Aerodrome) and all other aerodrome operators where departures from runway/runway intersection is carried out to analyze the feasibility of installing additional visual cues such as Lead-in runway lights, Stop Bar lights at the beginning of unassigned runway, etc., at Runway/Runway intersection points to enhance the safety of flight operations.

4.5 It is recommended that, DGCA may advise all aircraft operators operating A320 family of aircraft to analyze the feasibility of installing Take-off Surveillance and Monitoring Functions (especially TOS2 function) in their A320 family fleet or at least in future if any A320 family aircraft is inducted, it may be ensured that TOS2 function (which is available as an option) is installed in it.

4.6 It is recommended that the aircraft operator may counsel their operating crew to adhere to the laid down SOPs while giving more emphasis on discussing 'Hotspots' during the briefing and more assertive while carrying out the checklists.

4.7 It is recommended that the operator may develop means to improve situational awareness of the operating crew.

4.8 It is recommended that operator may develop means to ensure that all equipment/facilities are in place for recovery of aircraft without delay.

4.9 It is recommended that DGCA may verify the manuals submitted by operators to ensure that these are in line with the existing regulations.

(K Ramachandran)
Investigator – In - Charge

(Amit Kumar)
Investigator

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Place: New Delhi