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INVESTIGATION REPORT ON INCIDENT TO M/s SPICEJET LTD. BOEING 737-800 AIRCRAFT, VT-SZM ON 23.07.2021 AT YEREVAN - ZVARTNOTS INTERNATIONAL AIRPORT, ARMENIA

GOVERNMENT OF INDIA

DIRECTORATE GENERAL OF CIVIL AVIATION

FOREWORD

In accordance with Annex 13 to the International Civil Aviation Organisation Convention and the Aircraft (Investigation of Accidents & Incidents) Rules 2017, the sole objective of this investigation is to prevent aviation incidents and 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.

List of abbreviations used in the report

1.	ACM	Additional Crew Member
2.	AE-GO	All Engine Go Takeoff distance
3.	AFM	Airplane Flight Manual
4.	AGL	Above Ground Level
5.	ASDA	Accelerated Stop Distance Available
6.	ATIS	Automatic Terminal Information Service
7.	AME	Aircraft Maintenance Engineer
8.	ARMATS	Armenian Air Traffic Services
9.	ARC	Airworthiness Review Certificate
10.	ATC	Air Traffic Control
11.	ATPL	Airline Transport Pilot License
12.	BCOP	Boeing Climbout Program
13.	CAS	Computed Air Speed
14.	CSN	Cycles Since New
15.	CVR	Cockpit Voice Recorder
16.	DGCA	Directorate General of Civil Aviation
17.	EFB	Electronic Flight Bag
18.	FCOM	Flight Crew Operations Manual
19.	FCTM	Flight Crew Training Manual
20.	FDTL	Flight Duty Time Limitation
21.	EO-GO	Engine Out-Go Takeoff distance
22.	FC	Flight Cycles
23.	FDR	Flight Data Recorder

24.	FH	Flight Hours
25.	FMC	Flight Management Computer
26.	FRTOL	Flight Radio Telephone Operator's Licence
27.	GDCA-Armenia	General Department of Civil Aviation-Armenia
28.	IFR	Instrument Flight Rules
29.	LDA	Landing Distance Available
30.	LH	Left Hand
31.	MLG	Main Landing Gear
32.	OPT	On-board Performance Tool
33.	PIC	Pilot In-Command
34.	PF	Pilot Flying
35.	PM	Pilot Monitoring
36.	RH	Right Hand
37.	RWY	Runway
38.	SOP	Standard Operating Procedure
39.	STAS	Standard Take-off Analysis Software
40.	TAC	Take-off Analysis Chart
41.	TODA	Take-off Distance Available
42.	TORA	Take-off Run Available
43.	TSN	Time Since New
44.	TWY	Taxiway
45.	UTC	Coordinated Universal Time
46.	VFR	Visual Flight Rules

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Investigation Report on incident to M/s SpiceJet Ltd. Boeing 737-800 aircraft VT-SZM at Yerevan, Armenia on 23.07.2021

1.	Aircraft		
	Type	:	Boeing 737-800
	Nationality	:	INDIAN
	Registration	:	VT-SZM
2.	Owner	:	Air Lease Corporation, USA
	Operator	:	SpiceJet Ltd., INDIA
3.	Pilot-in-Command	:	ATPL Holder
	Extent of injuries	:	Nil
	Co-Pilot/First Officer	:	ATPL Holder
	Extent of injuries	:	Nil
4.	Date of incident	:	23.07.2021
	Time of incident	:	11:50UTC
5.	Place of Incident	:	UDYZ/ EVN-Yerevan, Zvartnots International Airport, Armenia
6.	Co-ordinates of incident site	:	Runway 09- Yerevan, Zvartnots International Airport, Armenia
7.	Last point of Departure	:	UDYZ/EVN (Yerevan, Zvartnots International Airport, Armenia)
8.	Intended place of Landing	:	VIDP/DEL (Indira Gandhi International Airport, Delhi, India)
9.	No. of passengers on board	:	07 (excluding operating crew)
10.	Type of operation	:	Positioning flight
11.	Phase of operation	:	Take-off
12.	Type of Incident	:	Operational

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

Synopsis:-

M/s SpiceJet Ltd. Boeing 737-800 aircraft VT-SZM was scheduled to operate flight SG-9029 on 23.07.2021 from Yerevan (UDYZ), Armenia to Delhi (VIDP) as a positioning flight, after operating SG-9028 a Non-scheduled flight from Delhi to Yerevan. The operating crew planned for departure from runway 09 intersection with TWY 'B' and calculated performance using the on-board OPT (On-board Performance Tool).

The aircraft lined-up on RWY 09 from TWY 'B' runway intersection and started take-off run. Approaching speed of approximately 100kt, the crew observed that the remaining runway length was insufficient for achieving the calculated take-off speed and an early rotation before V_1 was initiated. Aircraft lifted off at approximately 266ft beyond the TORA. The remaining flight till landing at Delhi was uneventful.

DGCA-India, vide Order No DGCA-15018(07)/25/2021-DAS dated 30.07.2021 instituted investigation of the incident under Rule 13 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017 by an Investigator-In-Charge.

The aircraft did not achieve the required performance as the take-off was initiated from a runway intersection with performance calculated for a much longer runway length than the actual runway length available.
Following were the contributory factors:

- Error in configuration of the OPT tool, i.e., the location of TWY'B' - RWY 09 intersection was erroneously configured in the OPT data which resulted in TWY'B' being indicated as a viable option for departure to the operating crew.
- Lack of awareness of the aerodrome layout due to inadequate review of the aerodrome chart by the flight crew.

1. Factual Information

1.1 History of flight:

M/s SpiceJet Boeing 737-800 aircraft VT-SZM was scheduled to operate a non-scheduled/ positioning flight SG-9029 from Yerevan (UDYZ) to Delhi on 23.07.2021. The subject flight sector was the return sector operated as a positioning flight after operating a non-scheduled flight SG-9028 from Delhi (VIDP) to Yerevan (UDYZ), Armenia.

An additional set of crew travelled as ACM on-board while operating the outbound sector (VIDP-UDYZ) and they operated the return sector (UDYZ-VIDP). SG-9029 was the first flight sector operated by the crew on 23.07.2021. Both the PIC and First officer were informed in advance on 21.07.2021 for the planned schedule. Crew reportedly performed the review of the Yerevan airfield during their travel as ACM from Delhi to Yerevan.

The operating crew reviewed the flight folder for the flight when aircraft was parked at Yerevan(UDYZ) and initially decided that the PIC would be Pilot Flying (PF) for sector and First Officer would be the Pilot Monitoring (PM) as runway surface condition in ATIS was 'WET'.

The First Officer completed the aircraft external inspection and the PIC started with the pre-flight cockpit preparation. Crew obtained update from ATC that the present runway condition was 'DRY' and hence it was decided that First Officer would perform the take-off from Yerevan. Both the PIC and First officer were qualified for Supervised Take-off and Landing.
The subject flight was the first flight operated by First Officer from Yerevan (UDYZ), and the second flight operated by PIC from Yerevan.

The runway in use, at the time of departure was RWY27; crew planned for a TWY 'B' RWY 09 intersection departure as TWY 'B' intersection was closer and aircraft performance was satisfactory as checked from OPT for take-off weight of 56200kg. The operating crew confirmed with ATC unit that TWY 'B' RWY 09 intersection was available for take-off. The PIC and First Officer reported that, they performed the take-off performance calculations independently through OPT function in their company issued EFB and crosschecked the data, for Take-off weight of 56200kg, 'OPTIMUM' engine rating, 'DRY' runway, 'OPTIMUM' Flap setting, Wind 070/2kt, OAT 30ºC and QNH 1003.0 Hpa. The crew cross checked the calculations and the EFB calculated output was for FLAP 1, Engine R-Derate 2 89.1, V_1=143kt, V_R=144kt, V_2=147kt. The speeds were fed in the FMC.

The pre-departure briefing was completed by the crew and line-up was planned for RWY 09 from TWY 'B' intersection. Upon receipt of taxi clearance for taxi to RWY 09 via TWY'B', aircraft started taxi and reaching holding point RWY09 on TWY 'B', the aircraft was cleared to backtrack and line-up on RWY09. However the operating crew requested for intersection TWY'B' RWY09 line-up which was approved by the ATC unit (Yerevan Tower).

The take-off was initiated and passing approximately 100kts, the crew observed that aircraft was rapidly approaching the runway end and aircraft had neither accelerated to the required speeds nor was the remaining runway length sufficient enough for bringing the aircraft to a full stop on the runway. According to the PIC, he took over controls and passing about 123-124kts a slow rotation was initiated before RWY27 marking on runway, the engine thrust settings were not changed. The PIC reported that the slow rotation was performed to avoid a tail strike. After departure the further flight was uneventful, the crew re-checked the EFB/OPT and realised that the EFB data indicated that TWY'B' intersection was located at 2159ft from RWY09 beginning, whereas TWY'B' intersection was located much farther down the runway.

After landing at Delhi, the operating crew made a 'NIL' defect entry in the Flight technical log/Pilot Defect Report, a voluntary report of the occurrence was filed by the crew to the Flight Safety department of M/s SpiceJet Ltd. on 23.07.2021. Nil abnormalities were reported after the post flight inspection conducted upon landing of the aircraft at Delhi.

1.2 Injuries to persons:

Injuries	Crew	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor/None	Nil /02	Nil/06(ACM for positioning after flight)+ 01 AME	

1.3 Damage to aircraft:

No damage was reported after the inspection of the aircraft.

1.4 Other damages:

No damage has been reported by GDCA-Armenia.

1.5 Personnel information:

The details of the licences and ratings, of the Cockpit crew who operated the incident sector are as detailed below:-

Details	PIC	First Officer
Type of license	ATPL	ATPL
Valid upto	11.06.2025	13.10.2024
Date of Initial issue	07.05.2007	14.10.2019
Class of license	Aeroplane	Aeroplane

Details	PIC	First Officer
Category of license	ATPL	ATPL
Age	55 years	26 years
Aircraft Ratings	C 152A, KING AIR C-90A, TB-20, B737-700/800/900/700F	DA-40,DA-42, B737-700/800/900/MAX/700F
Date of Endorsement as PIC	05.08.2008	N/A
Date of last Medical Exam	17.06.2021	19.06.2021
Medical Exam validity	21.06.2022	26.07.2022
FRTOL Valid upto	05.06.2022	02.02.2025
Date of Last IR check	03.08.2020	09.07.2021
Date of last Proficiency Check	03.02.2021	09.07.2021
Total flying experience	14999:42 Hrs	3202:58 Hrs
Experience on Type	14722:22 Hrs	3002:58 Hrs
Experience as PIC on Type	9953:48 Hrs	N/A
Last technical refresher	19.04.2021 to 24.04.2021	07.09.2020 to 11.09.2021
Total flying experience during last 1 year	470:03 Hrs	401:28 Hrs
Total flying experience in last 6 months (prior to incident)	223:36 Hrs	157:33 Hrs
Total flying experience in last 30 days (prior to incident)	20:40 Hrs	23:15 Hrs
Total flying experience in last 24 hrs (prior to incident)	NIL	NIL

EFB training:-

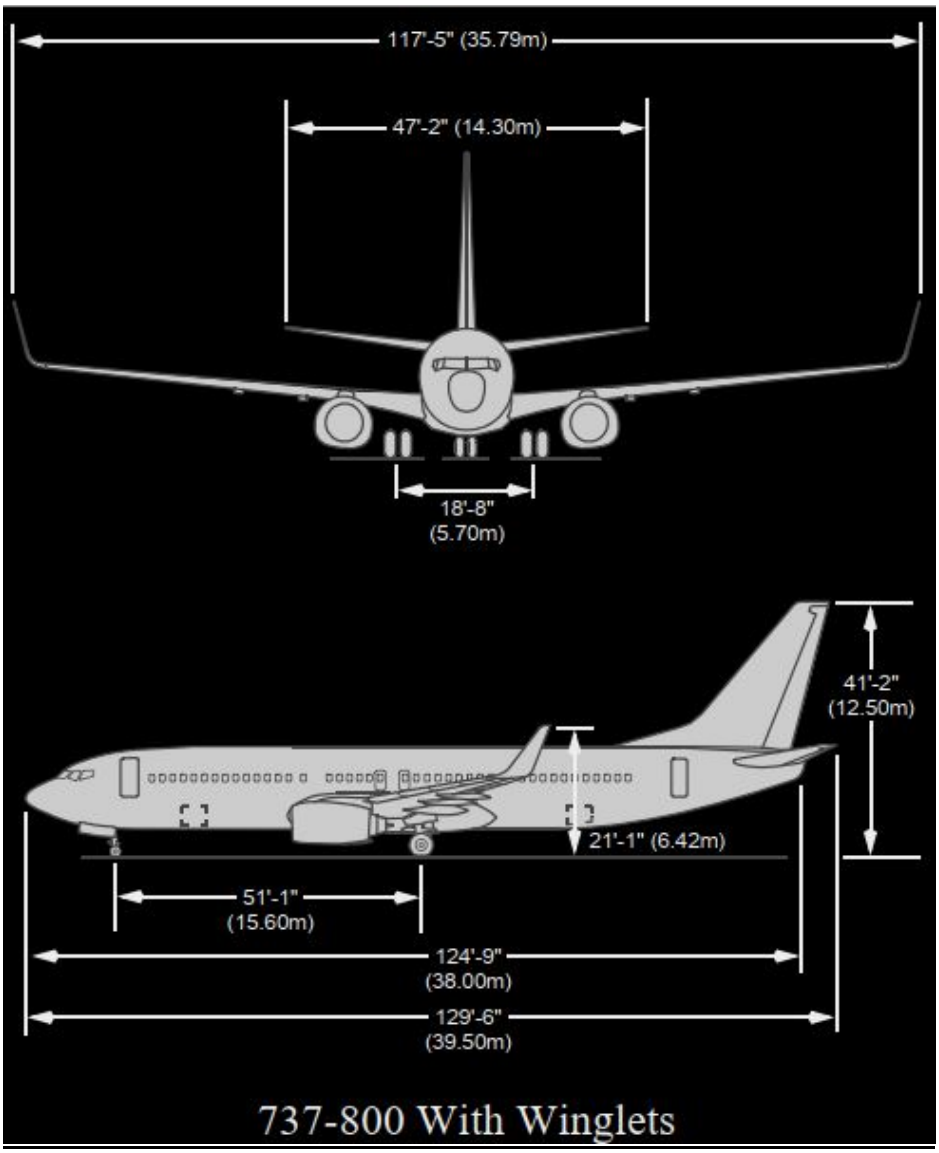
As per SpiceJet company policy detailed in the approved Operations Manual Part-D;

Training on the EFB and take-off performance calculation was provided to both pilots on their initial training course with the operator. After the initial training and qualification, participation in the recurrent training program maintains continuous validity.

1.6 Aircraft information:

The Boeing 737-800 is a narrow body, single aisle, twin engine aircraft manufactured by Boeing Commercial Airplanes and installed with CFM56-7B engines. The aircraft is certified in Normal category, for day and night operation under VFR & IFR. Prior to the departure the aircraft weight and balance was within the operating limitations.

1.6.1 Aircraft:	
Manufacturer	BOEING
Type	BOEING 737-800
Owner	AIRLEASE CORP
Operator	SPICEJET LIMITED
Manufacturer Serial no.	37772
Year of Manufacturing	2012
State of Manufacturing	SEATTLE, USA
Certificate of Airworthiness(with issue date and validity)	Issue date: 29.07.2016
Airworthiness Review Certificate(with issue date and validity)	SJ/ARC/2019/06 Issue Date: 20.07.2021 Validity: 28.07.2022
Category	A
Certificate of Registration and validity	4683 Validity: 19.11.2022
Minimum Crew Required	Two
Maximum All Up weight	77,999 KG
Last Major inspection	8 yearly check
	30.11.2020/ 25997 FH/ 13493 FC
Airframe Hrs since new	27858:05



Principal Dimensions of B737-800

1.6.2 Engine:	LH	RH
a) Manufacturer	CFM INTERNATIONAL	CFM INTERNATIONAL
b) Type	CFM56-7B26E	CFM56-7B26E
c) Engine Serial Number	854671	854665
d) Type of fuel used	Jet A-1	Jet A-1
e) Time Since new(TSN)	2647:33 hrs	2664:56 hrs
f) Cycles since new(CSN)	1411	1369
g) Engine Thrust	26000 lbf	26000 lbf

1.6.3 FCOM Reference: FMC

Thrust Management
Reduced Thrust Take-off
Reduced thrust take-off's lower EGT and extend engine life. They are used whenever performance limits and noise abatement procedures permit.

Take-off Derate
Fixed derates can be selected on the N1 LIMIT page. Performance data for these derates is provided in the Airplane Flight Manual (AFM).
With derated take-off selected, the thrust setting parameter is considered a limitation for take-off; therefore, thrust levers should not be advanced further except in an emergency. A further thrust increase following an engine failure could result in a loss of directional control while on the ground. Use the take-off speeds supplied by the FMC or specified in Chapter PI, Performance-Inflight, for the selected derate condition.
Derated take-off rating can be further reduced by assumed temperature.

Assumed Temperature Thrust Reduction Take-off
A take-off thrust less than the full rated thrust may be achieved by using an assumed temperature that is higher than the actual temperature. The desired thrust level is obtained through entry of a SEL TEMP value on the N1 LIMIT page or TAKE-OFF REF page 2. Use approved sources for selecting the assumed temperature.
The maximum thrust reduction authorized is 25 percent below any certified rating. Do not use assumed temperature reduced thrust if conditions exist that affect braking, such as slush, snow, or ice on the runway, or if potential windshear conditions exist.
If the assumed temperature method is applied to a fixed derate, application of additional power should not exceed the fixed derate N1 limit as loss of directional control could occur while on the ground.
When the assumed temperature method is used with full rate, the reduced thrust setting is not considered a limitation. If conditions are encountered where additional thrust is desired, the crew can manually apply full thrust.

1.6.3 FCTM Reference:

Reduced and Derated Take-off Thrust
Reduced and Derated Take-off Thrust Take-off - Normally, take-off's are conducted with less than full rated take-off thrust whenever performance capabilities permit. Lower take-off thrust reduces EGT, improves engine reliability, and extends engine life.

Take-off thrust reduction can be achieved using reduced take-off thrust (Assumed Temperature Method or ATM), derated take-off thrust (fixed derate), or a combination of these two methods. Regardless of the method, take-off speeds based on the selected rating (full rated or fixed derate) and the selected assumed temperature should be used. These take-off speeds may be obtained from the take-off analysis (runway/airport analysis) or another approved source. Take-off with less than

full rated take-off thrust using any of these methods complies with all regulatory take-off performance requirements.
Note: Take-off with full rated take-off thrust is recommended if windshear conditions are suspected, unless the use of a fixed derate is required to meet a dispatch performance requirement.

Reduced Take-off Thrust (ATM)
Reduced Take-off Thrust (ATM) is a take-off thrust level less than the full rated take-off thrust. Reduced take-off thrust is achieved by selecting an assumed temperature higher than the actual ambient temperature.

When using ATM, the take-off thrust setting is not considered a take-off operating limit since minimum control speeds (VMCG and VMCA) are based on the full rated take-off thrust. At any time during take-off, thrust levers may be advanced to the full rated take-off thrust.
Note: Reduced take-off thrust (ATM) may be used for take-off on a wet runway if approved take-off performance data for a wet runway is used. However, reduced take-off thrust (ATM) is not permitted for take-off on a runway contaminated with standing water, slush, snow, or ice.

Derated Take-off Thrust (Fixed Derate)
Derated take-off thrust (fixed derate) is a certified take-off thrust rating lower than full rated take-off thrust. In order to use derated take-off thrust, take-off performance data for the specific fixed derate level is required. Derated take-off thrust is obtained by selection of a fixed take-off derate in the FMC.

When using derated take-off thrust, the take-off thrust setting is considered a take-off operating limit since minimum control speeds (VMCG and VMCA) and stabilizer trim setting are based on the derated take-off thrust. Thrust levers should not be advanced unless conditions are encountered during the take-off where additional thrust is needed on both engines, such as a windshear condition.
Note: If an engine failure occurs during take-off, any thrust increase could result in loss of directional control.
Note: Derated take-off thrust (fixed derate) may be used for take-off on a wet runway and on a runway contaminated with standing water, slush, snow, or ice.

Derated take-off thrust (fixed derate) may permit a higher take-off weight when performance is limited by VMCG, such as on a runway contaminated with standing water, slush, snow, or ice. This is because derated take-off thrust allows a lower VMCG.
Derated take-off thrust (fixed derate) may permit a lower take-off weight when take-off weight is limited by the Minimum Take-off Weight requirement.

Combination ATM and Fixed Derate

Take-off - Combination ATM and Fixed Derate

Note: All limitations and restrictions for reduced take-off thrust (ATM) and derated take-off thrust (fixed derate) must be observed.

Reduced take-off thrust (ATM) and derated take-off thrust (fixed derate) may be combined by first selecting a fixed derate and then an assumed temperature higher than the actual ambient temperature. Thrust levers should not be advanced unless conditions are encountered during the take-off where additional thrust is needed on both engines, such as a windshear condition.

Thrust Control

When conducting a reduced thrust (ATM) take-off, if more thrust is needed (up to full rated thrust) when thrust is in THR HLD mode, thrust levers must be advanced manually. If conditions are encountered during the take-off where additional thrust is needed, such as a windshear condition, the crew should not hesitate to manually advance thrust levers to full rated thrust.

When conducting a derated thrust (fixed derate) take-off or a take-off with a combination ATM and fixed derate, take-off speeds consider VMCG and VMCA only at the fixed derate level of thrust. Thrust levers should not be advanced beyond the fixed derate limit unless conditions are encountered during the take-off where additional thrust is needed on both engines, such as a windshear condition.

Note: If an engine failure occurs during take-off, any thrust increase beyond the fixed derate limit could result in loss of directional control.

When combining a high level of derate with a high assumed temperature, or if a climb thrust rating higher than the automatically selected climb thrust rating is selected, it is possible that the climb thrust may be higher than the take-off thrust. In such case, thrust levers will advance forward upon reaching thrust reduction altitude. If more thrust is needed (up to full rated thrust) when THR HLD mode is displayed, the thrust levers must be manually advanced. When the airplane is below 800 ft RA, full GA N1 can be determined by pushing a TO/GA switch a second time. This will set the reference N1 bugs for full GA thrust.

When the airplane is above 800 ft RA, pushing a TO/GA switch advances the thrust levers to full GA thrust

1.6.4 <u>Pilot Defect Report (PDR):</u>

'Nil' entry was made by the cockpit crew after operating the sector.

1.6.5 Take-off performance – regulatory requirements (AFM Reference):

Take-off Distance Required - The greater of:
1. The distance to take-off and climb to a height of 35 ft (dry runway[1]) with a failure of the critical engine at VEF(Speed at Engine Failure);
Or
2. 115 percent of the distance to take-off and climb to a height of 35 ft with all engines operating.

Take-off Run Required - The greater of:
1. The distance to take-off and climb to a point equidistant between lift off and the 35 foot height point (dry runway [2]) with a failure of the critical engine at VEF;
Or
2. 115 percent of the distance to take-off and climb to a point equidistant between lift off and the 35 foot height point with all engines operating.

Accelerate-Stop Distance Required - The greater of:
1. The sum of the distances required to accelerate with all engines operating and come to a complete stop assuming a critical engine failure at VEF
or
2. The sum of the distances required to accelerate with all engines operating and come to a complete stop with all engines still operating.
Notes:
1. On a wet runway, the height requirement with a failed engine is 15 ft.
2. On a wet runway, the take-off run required is the distance to take-off and climb to 15 ft with a failure of the critical engine at VEF

1.7 Meteorological information:

Wind 070 deg 02kt, Visibility 10km, CB 3930 2000, temperature 30, dew point 12, QNH1003, NOSIG.

1.8 Aids of navigation:

All aids to navigation were serviceable. No un-serviceability was reported.

1.9 Communication:

Two way radio communications was available between aircraft and ATC [ARMATS-Armenian Air Traffic Services].

Yerevan ARMATS(Ground):-

SpiceJet9029 requested Yerevan ground at 11:31:30UTC for RWY09 intersection ‘B’ and same was agreed.

At 11:38:52UTC SpiceJet9029 reported 09 souls on board and requested for departure clearance. Aircraft was cleared to destination via GOSIS4H departure, initial FL190 and same was read back by the crew. Following which push back and start-up was approved, nose to west and QNH1003 and same was read back by the crew of SG9029.
At 11:45:44UTC, SG9029 confirmed whether the Runway condition was Dry, Ground controller confirmed that the runway was Dry and gave taxi clearance to holding point RWY09 via B.
After 11:47:05UTC SG9029 was changed over to TWR frequency 128.0.

Yerevan ARMATS(Tower):-

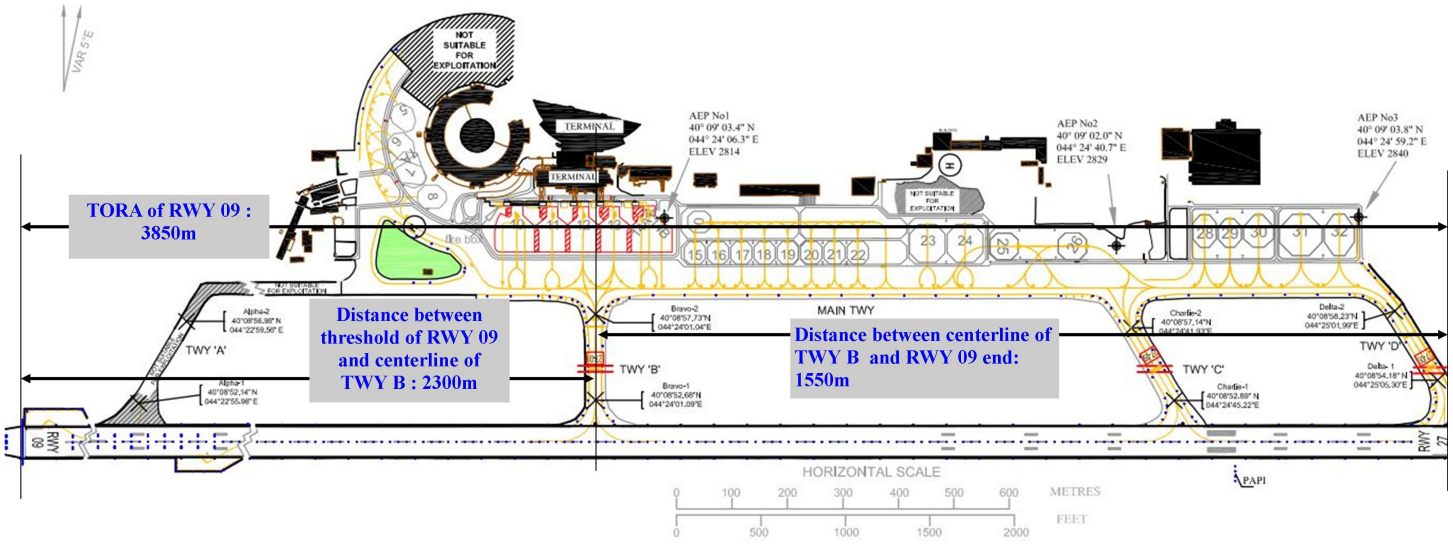
At 11:47:22 UTC SG9029 informed TWR that they were approaching TWY B. TWR controller advised AG9029 to line-up RWY 09 backtrack.
The crew of SG9029 requested for intersection 'B' RWY 09 and TWR controlled confirmed SG9029 request for intersection B line-up RWY09 and same was read back by the crew.
Following the above, TWR controlled cleared SG9029 for take-off, wind reported were calm and advised to contact approach 126.0 when airborne.

Yerevan ARMATS(Approach):-

At 11:51:07UTC, APP contacted AG9029 and advised to turn right heading 140 due restricted area. Later SG9029 was advised to turn left and resume own navigation, direct GOSIS.

1.10 Aerodrome information:

Yerevan Zvartnots airport is located 10km west from Yerevan city, Republic of Armenia. The airport is located at an elevation of about 2838ft. There are four taxiways connecting the aprons to the RWY, TWY 'A', 'B', 'C' and 'D'. TWY A is closed.
The runway 09 is provided with a clearway (400m x 150m).



Grid map of UDYZ (Source: AIP)

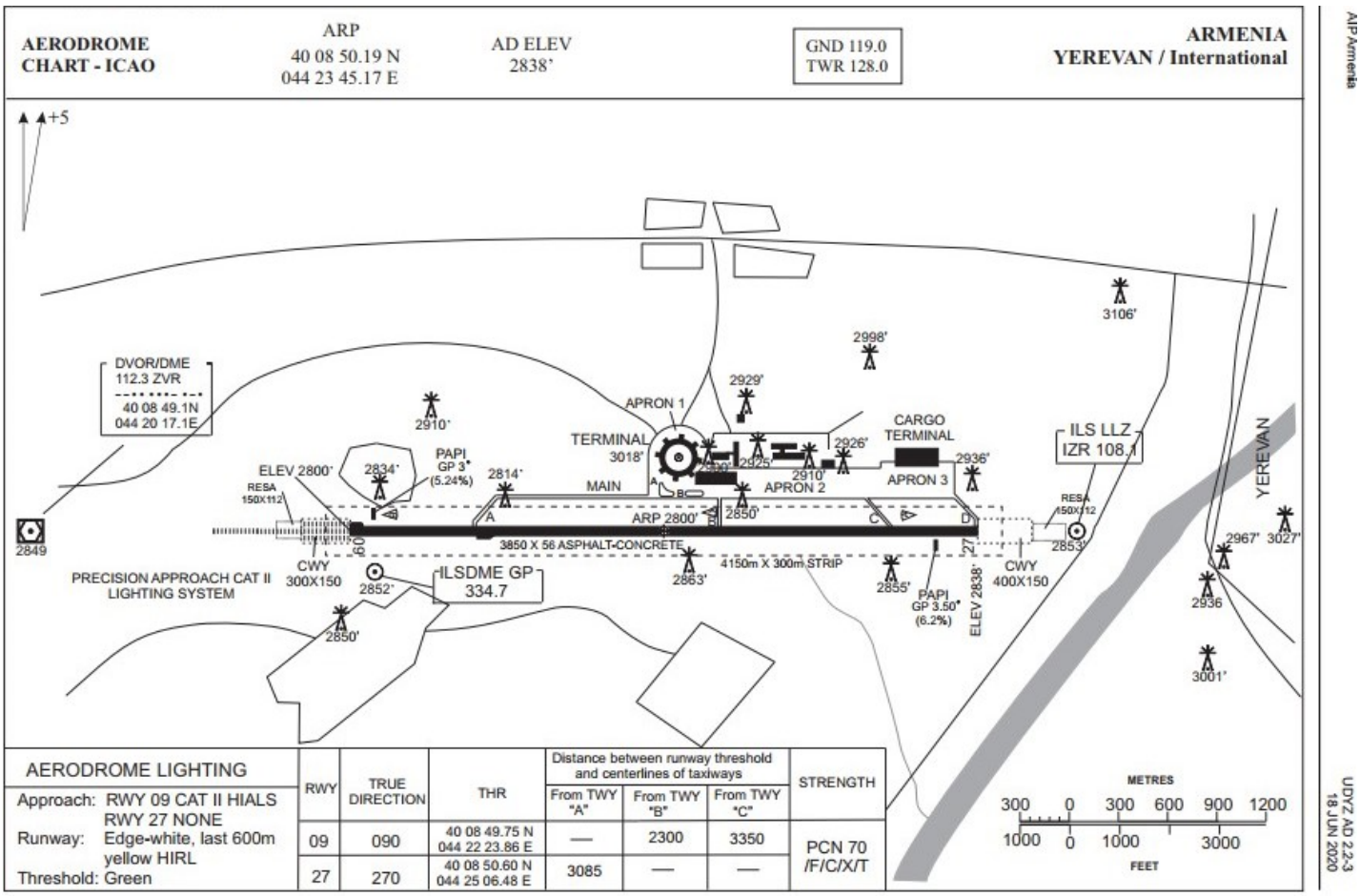
UDYZ Runway physical characteristics

Designations RWYNR	TRUE &MAG BRG	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation andhighest elevation of TDZ of precisionAPP RWY
09	090˚ GEO 085˚ MAG	3850x56	80/R/C/X/T Asphalt/Concrete	400849.75N 0442223.86E	THR 2800ft TDZ 2800ft
27	270˚ GEO 265˚ MAG	3850x56	80/R/C/X/T Asphalt/Concrete	400850.60N 0442506.48E	THR 2838ft TDZ 2838ft

SWY dimensions (M)	CWY dimensions (M)	Strip dimensions (M)	OFZ	Remarks
Nil	400x150	4150x300	According Annex 14	RESA 150m X 112m
Nil	300x150	4150x300		RESA 150m X 112m

UDYZ Declared distances

RWY Designator	TORA (M)	TODA (M)	ASDA (M)	LDA (M)
09	3850	4250	3850	3850
27	3850	4150	3850	3850



AERODROME LIGHTING	RWY	TRUE DIRECTION	THR	Distance between runway threshold and centerlines of taxiways			STRENGTH
				From TWY "A"	From TWY "B"	From TWY "C"	
Approach: RWY 09 CAT II HIALS RWY 27 NONE Runway: Edge-white, last 600m yellow HIRL Threshold: Green	09	090	40 08 49.75 N 044 22 23.86 E	—	2300	3350	PCN 70 /F/C/X/T
	27	270	40 08 50.60 N 044 25 06.48 E	3085	—	—	

Aerodrome Chart of UDYZ (Source: AIP)

The information tabulated in the aerodrome chart clearly indicates the following:
The distance between runway threshold of RWY 09 and centerline of TWY'B' is 2300m (7546ft).
The distance between runway threshold of RWY 09 and centerline of TWY'C' is 3350m (10991ft).

Details of departures from UDYZ- Yerevan from 11:15UTC till 12:30UTC on 23.07.2021.

Sl. No	Flight No.	RWY used	TWY used	Departure time (UTC)
1.	NGT2727	27	C	11:28
2.	SVR2536	27	D	11:31
3.	SEJ9029	09	B	11:50
4.	SDM6922	27	D	12:07
5.	SQP402	27	C	12:30

From the above table it can be seen that between 11:15UTC till 12:30UTC on 23.07.2021, the only aircraft to have departed from RWY 09 TWY'B' intersection was SEJ9029 (VT-SZM).

1.11 Flight recorders:

1.11.1 CVR:

The aircraft was installed with a Solid State Cockpit Voice Recorder capable of recording two (02) hours of cockpit communications.

The flight sector time exceeds 05hours; hence the CVR data was not available for investigation.

1.11.2 DFDR:

The aircraft was installed with a Solid State Flight Data Recorder. The recording of the unit was retrieved and the significant events are detailed below:-

1. Flap configuration 1 was selected at 11:41UTC.
2. The aircraft started taxi at 11:47:00 UTC.
3. Aircraft lined-up on RWY09 by 11:48:55UTC and aircraft was stopped on the runway by applying brakes. By 11:49:08UTC brakes were released and at 11:49:15UTC the throttle levers were advanced. Aircraft started moving at 11:49:22UTC.
4. N1 of both engines reached 88% at 11:49:36UTC and further increased to 89% during the further take-off roll.
5. The set take-off speeds recorded in FDR: V_1, V_R and V_2 values are 143kt, 144kt and 147kt respectively.
6. Passing 123kt CAS at 11:50:03 UTC a slow rotation is observed to be initiated with 0.5º pitch UP inputs, Nose gear was airborne about a second later following which pitch was increased to 8.5°UP by 11:50:09 UTC (MLG airborne) at 141kt CAS.
7. Speed was 144kt during initial climb passing 39ft radio altitude at 11:50:12UTC.
8. Landing gear was selected UP/ Uplocked at 11:50:21UTC.
9. Auto Pilot CMB (B) was selected at 11:50:46UTC passing 850ft radio altitude.
10. The DFDR data playback indicated that the aircraft was below 100ft radio altitude when it crossed the airport boundary.

1.12 Wreckage and impact information:

No damage to aircraft and no damage have been reported by GDCA-Armenia.

1.13 Medical and pathological information:

Both the cockpit crew members had undergone the pre-flight breath analyser test at Delhi prior to travelling as ACM from Delhi to Yerevan, the result was negative and they were cleared to operate the flight.

1.14 Fire:

There was no fire or smoke during or following the incident.

1.15 Survival aspects:

The incident was survivable.

1.16 Tests and research:

Take-off Performance analysis:

BCOP (Boeing Climbout Program) is the standardized software used by Boeing and airlines for performance calculation.
The study of the BCOP data was performed for the same conditions as used for the take-off performance calculation by the crew during departure from Yeravan (EVN) [09-B intersection departure(DRY Runway)], which gave the following results:-

1. Distance to V_1 (143kt) : 5817 ft
2. Distance to V_R (147kt) : 6001 ft
3. Distance to 35ft height AGL : 9048 ft

1.17 Organizational& Management Information:-

1.17.1Spice Jet Ltd

M/s Spice Jet Ltd.(Spice Jet) is a scheduled airline registered in India. The airline is holding a valid Air Operator Certificate no. S-16 issued by DGCA valid upto 16.05.2023. It operates a fleet of B737-700/800/900 and Bombardier Q400 serving domestic and international destinations.

The operations to Yerevan (UDYZ/EVN) were non-scheduled/charter flights which were planned from May 2021, but first flight was operated on 02.07.2021. Prior to the subject flight a total of 25 flights were operated by Spice Jet Ltd. departing from UDYZ/EVN, full RWY length was utilised by these 25 departures of SpiceJet flights prior to the incident flight and no reports were raised regarding the error in the definition of TWY 'B' intersection [in EFB (OPT data)].

1.17.1.1 EFB

M/s SpiceJet Ltd. was holding an approval (issued on 26.04.2021) issued by DGCA for use of EFB on-board Boeing-737 aircraft and its Software application (OPT) of Boeing was also approved for Performance Calculation.

The EFB OPT database was updated by SpiceJet on 10.05.2021 for inclusion of UDYZ-Yerevan, Zvartnots International Airport, Armenia

M/s SpiceJet had issued tablet device (iPad) to both the crew members, the functions of the EFB included the following:

- 'OPT' for Performance Calculation
- 'JeppFD-Pro X' for Navigation charts and Airport Moving Map Display
- 'AeroDocs' for Operator's Manuals and Documents

The OPT administration (in SpiceJet) is governed by internal processes which is controlled by Performance Engineering division. The procedure for addition of new airport definition including its runway details is defined in the SpiceJet Performance Engineering and Navigation Manual.
When a requirement to add a new airport to the existing database arises, the performance engineering department is responsible for preparing the airport database in a notepad file for OPT application. The process requires one Performance Engineer to prepare the required notepad file, which needs to be verified by a second Performance Engineer. Once the approval from DGM-Performance Engineering is obtained the database is updated in the OPT (TEST iPad) and is checked by another Performance Engineer.

1.17.1.2 OPT Data configuration for Yerevan, UDYZ

Yerevan (UDYZ) station did not exist in the OPT database as SpiceJet has not operated to the airport prior to April 2021. Due to requirements for charter/ non-scheduled flights the airport data was created in the STAS (Standard Take-off Analysis Software). TWY 'B' was configured to be at a distance of 2159ft from RWY 09 beginning, whereas it was located at a distance of 7546ft from beginning of RWY 09.

The notepad file prepared was not crosschecked by a second Performance Engineer and the Performance Engineer (who prepared the STAS file/notepad file) deployed it on the TEST iPad. During validation of the OPT TEST data by the second Performance Engineer, it was cross checked with the notepad file instead of the AIP data w.r.t runway and taxiways. Same OPT update was then issued to live iPads on 10.05.2021.

OPT data configuration (STAS) file prepared by Performance Engineer:

AIRPORT1
'EVN' 'UDYZ' 'YEREVAN, ARMENIA' 'FFLOLO' 2838
RWYU 180
'09' 0 12631 13943 12631 12631 0.09 0.62 0.09 7 0
22 1312 0
42 2428 0
53 2920 0
122 4823 0
173 7021 0
505 37842 0
1040 41700 0
'REFER STANDARD OPERATING PROCEDURES (SOP)'

#INT 'A' 1727 90 -0.26 -0.26
#INT 'B' 2159 90 -0.26 -0.26
RWYU 180
'27' 0 12631 13615 12631 12631 -0.50 0.00 -0.50 1 0
31 3018 0
'REFER STANDARD OPERATING PROCEDURES (SOP)'

1.17.1.3 SpiceJet SOP for EVN

Both the operating flight crew were STOL cleared. EVN is classified as a Cat B airfield and there is no restriction on use of STOL.

Runway Characteristics

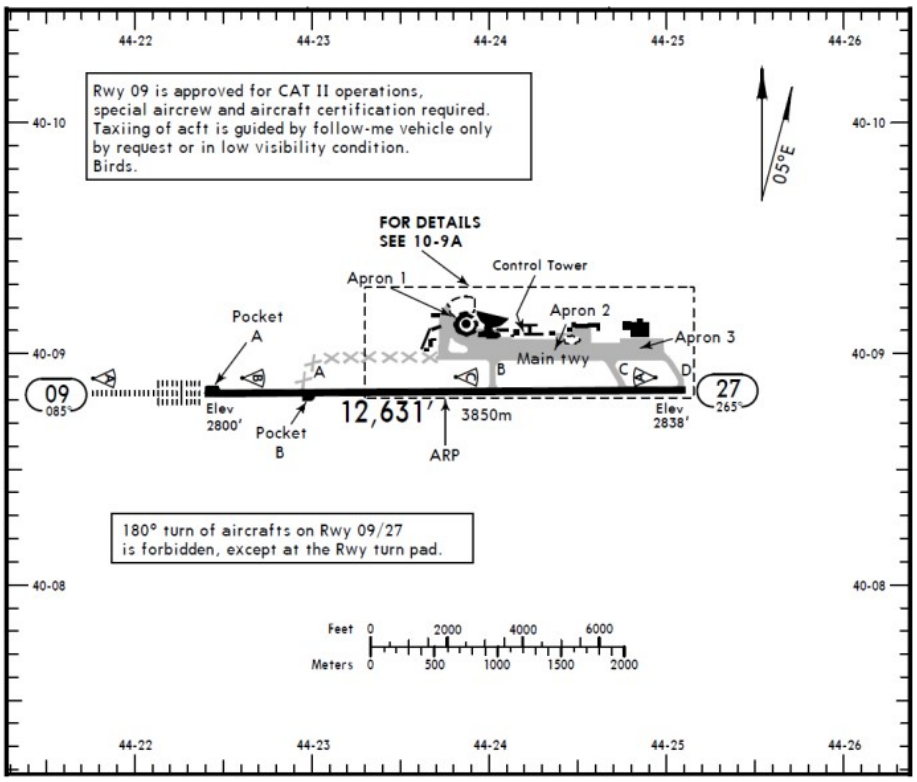
RWY (MAG BRG)	THR Coordinates	ELEV	TORA	TODA	ASDA	LDA	SLOPE	WIDTH
(ft)	(ft)	(ft)	(ft)	(ft)	(%)	(ft)		
09 (085°)	400849.75N 0442223.86E	2800	12631	13943	12631	12631	+0.30	183
27 (265°)	400850.60N 0442506.48E	2838	12631	13615	12631	12631	-0.30	183

Note:

(a) **Runway Strip Dimension: RWY 09/27:** 4150m x 300m

(b) **PCN of Runway Surface:** RWY 09/27 – 80/R/C/X/T Asphalt/Concrete

(c) **RESA: RWY 09/27:** 150m X 112m



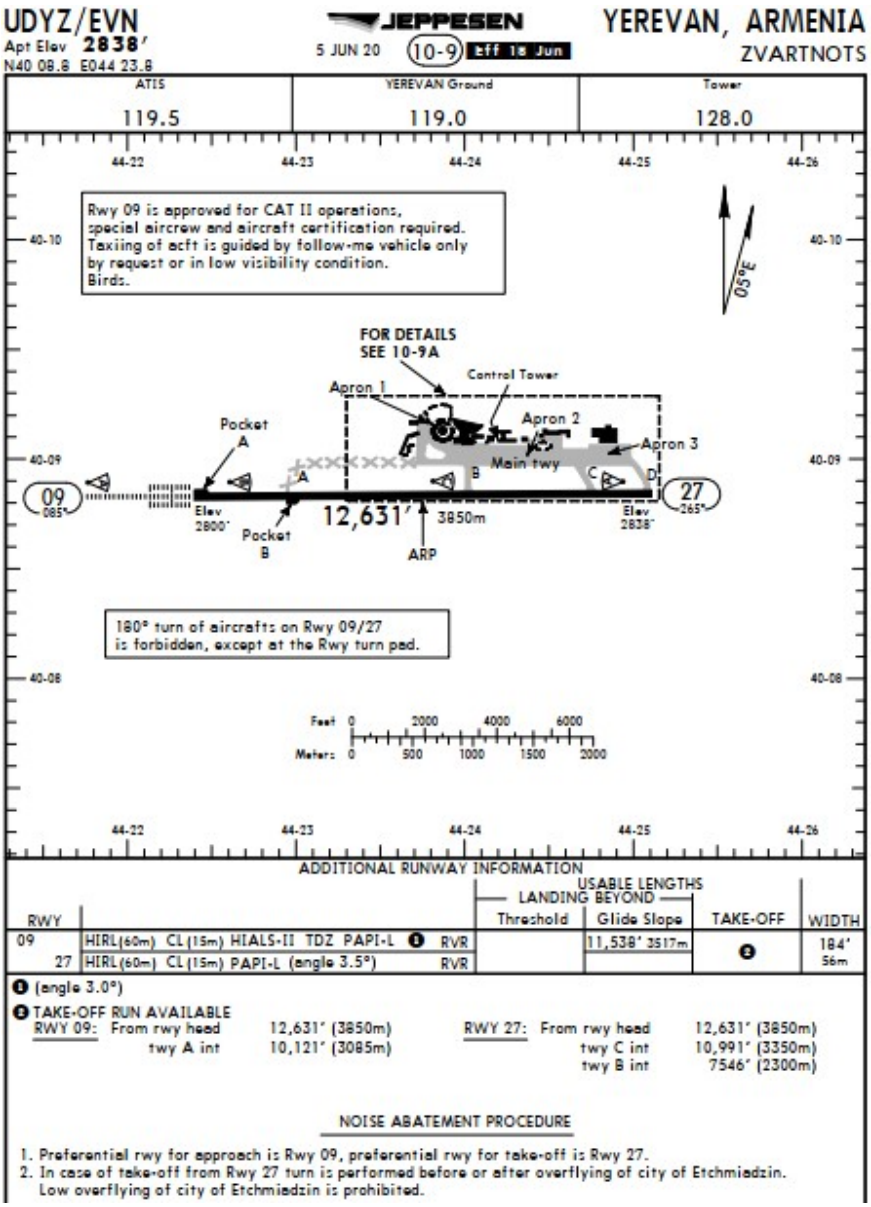
Yerevan, Armenia Airport Layout

Taxiway Characteristics

Designator	Surface	Width	Strength (PCN)
A	Asphalt/Concrete	17m	30/R/C/X/T
B	Asphalt/Concrete	23m	82/F/C/W/T
C	Asphalt/Concrete	23m	63/R/C/X/T
D	Asphalt/Concrete	23m	82/F/C/W/T

Additional Procedures, Aircraft Performance and Limitations: Nil
Special Crew Qualification: Nil

1.17.1.4 Jeppesen Chart for EVN(as available in EFB)



The information in the aerodrome chart indicates the following:
Take-off run available for RWY 09:
From RWY 09 head is 3850m (12,631ft).
From RWY 09 and TWY 'A' intersection is 3085m (10,121ft).

Take-off run available for RWY 27:
From RWY 27 head is 3850m (12,631ft).
From RWY 27 and TWY 'C' intersection is 3350m (10,991ft).
From RWY 27 and TWY 'B' intersection is 2300m (7,546ft).

1.17.1.5 SpiceJet Supplementary Performance Procedure Manual (B737)

Take-off Analysis Charts- Policy and Procedures

- Boeing On Board performance tool is the primary source for Take-off and Landing calculations. Take-off Analysis charts (TAC) are provided when OPT is not available for any airport or in-case of OPT failure.
- TAC's are provided for FULL RUNWAYS, MAX THRUST, BLEEDS OFF and OPTIMUM FLAPS ONLY.

Regulatory Requirements

The Boeing 737NG AFM states that: "Operations at reduced take-off thrust based on an assumed temperature higher than the actual ambient temperature is permissible if the airplane meets ALL applicable performance requirements at the planned take-off weight and reduced thrust setting." The above is achieved by ensuring that Pilots use only the certified 'Performance Database', either by using iPad 'EFB OPT' application.

A 'REDUCED THRUST TAKE-OFF' (using the EFB OPT always ensures that the aircraft:

a) Has sufficient runway length for:
   i. 115% of 'all-engine take-off distance'
   ii. One engine inoperative take-off distance
   iii. Accelerate-stop distance
b) Achieves the one engine inoperative climb gradient for:
   i. First segment
   ii. Second segment
   iii. Final segment
c) Clears all obstacles in the intended take-off flight path.

SpiceJet Procedure for 'REDUCED THRUST TAKE OFF':

In order to obtain the maximum benefits of 'Reduced Thrust Take off", the following steps are to be followed (in this sequence), with the intention of obtaining 'MAXIMUM ASSUMED TEMPERATURE' using 'EFB OPT' application:

a) Thrust RTG: OPTIMUM Derate
b) Assumed Temperature: MAX (default setting when using OPTIMUM DERATE)
c) Flap: OPTIMUM (Pilot discretion)
d) Bleed: ON (Bleeds OFF when performance limited with Bleeds On')
e) Improved Climb: YES

1.18. Additional information:

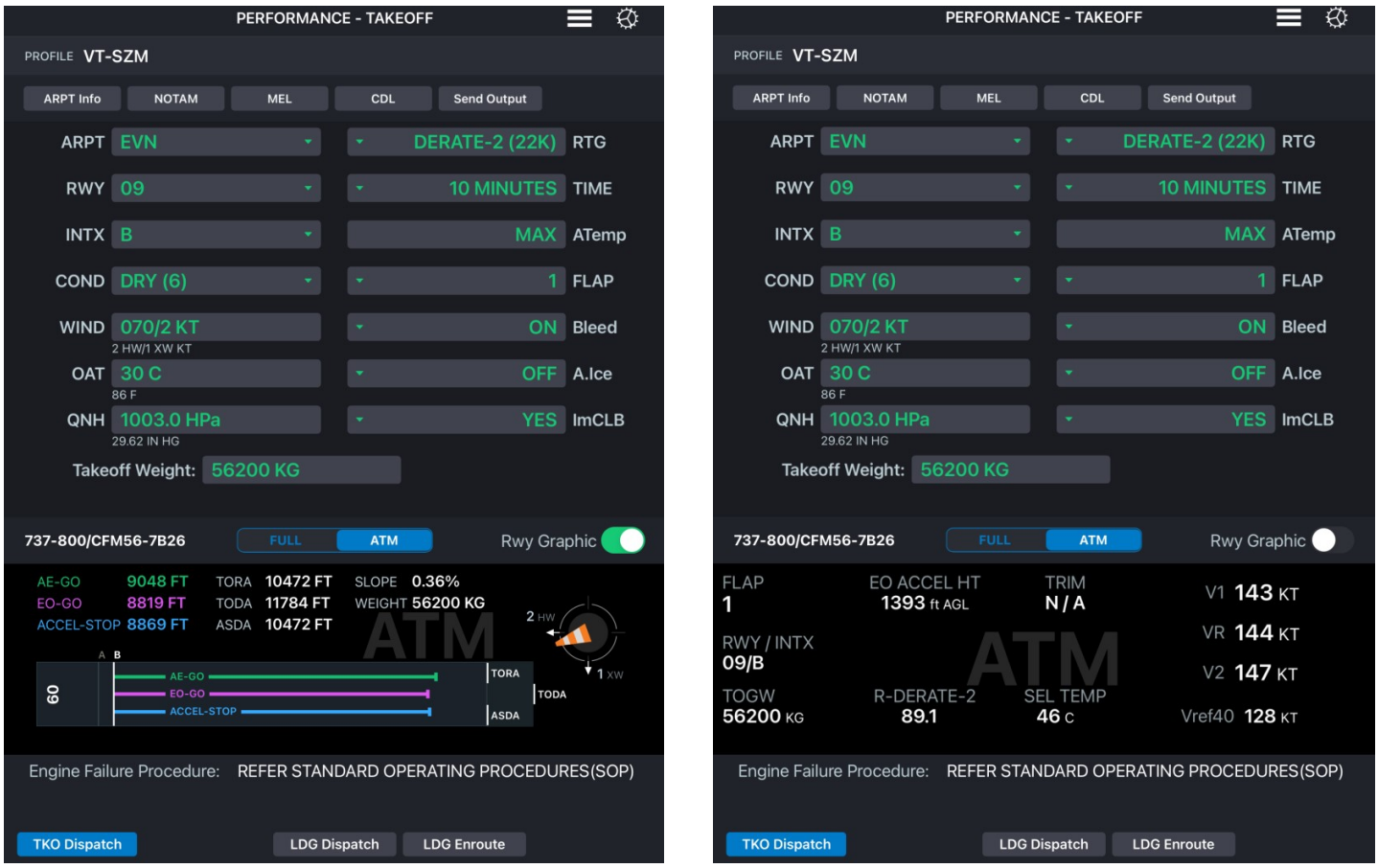
1.18.1 Boeing analysis of the incident flight:

Boeing after review of the incident data has informed that, the airplane was positioned at 7672 ft beyond the Runway 09 threshold. Based on the airplane's position relative to the runway threshold before take-off roll, the available runway longitudinal distance was approximately 4959 ft. The airplane was configured at flaps 1, with recorded take-off speeds at 143/144/147 knots, and with the engines derated at fixed derate level 2 and an assumed temperature method thrust reduction. Liftoff occurred at approximately 12,897 ft beyond the threshold, 266 ft beyond the end of the TORA towards the end of the stopway as the airplane reached the nominal liftoff pitch attitude of 8.5 degrees that corresponds to flaps 1.

1.18.2 OPT Take-off Performance Calculation:

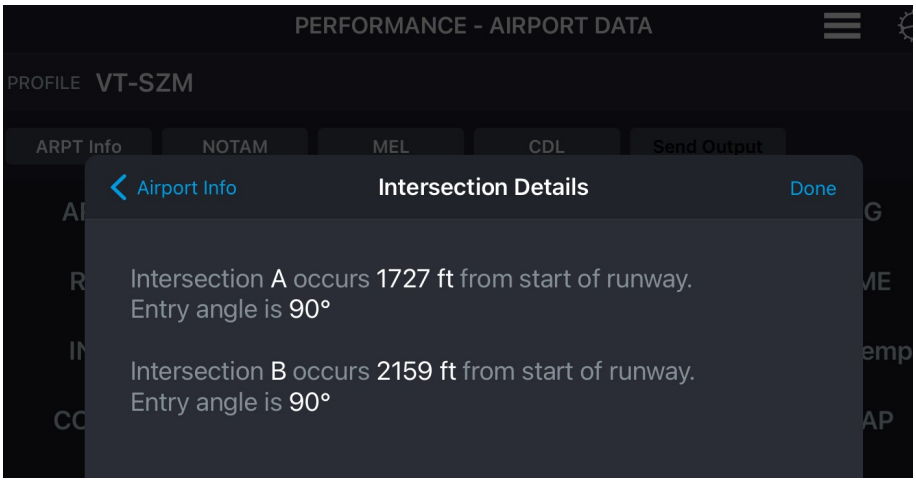
The performance calculation performed by the crew is depicted below:-
Airport : EVN, RTG : OPTIMUM
RWY : 09 TIME 10 MINUTES
INTX : B
COND : DRY
WIND : 070/2KT
OAT: 30C
QNH 1003.0 HPa
ATM

The output was FLAP: 1, ACCEL HT 1393ft AGL, RWY/INTX 09/B
TOGW 56200KG
R-DERATE 2 89.1
SEL TEMP 46 c
V_1 143KT, V_R 144KT, V_2 147KT, Vref40 128KT



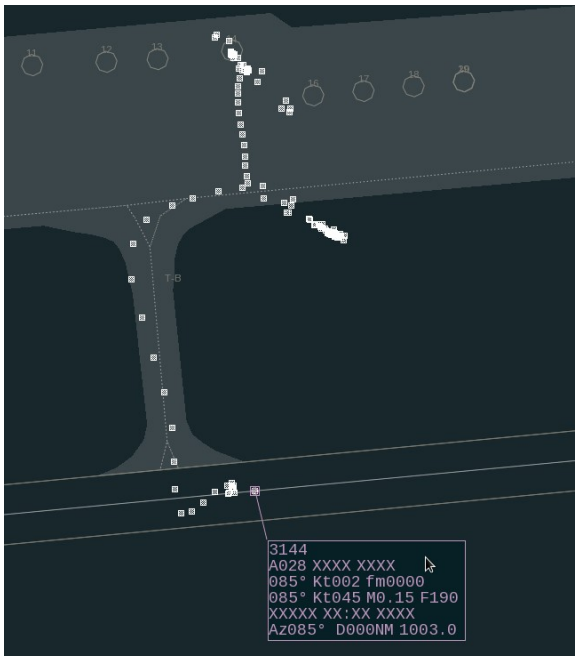
OPT input data and its output used for take-off from Yerevan (UDYZ)

It can be seen that the output also gives a 'Rwy Graphic' representation. This indicates the declared distances for the selected runway and taxiway intersection, along with relative locations of the taxiways.



Runway intersection details indicated in OPT

1.18.3 ARMATS Radar playback:



Radar playback image indicating position of SG9029 at beginning of take-off run (11:49:40 UTC) after line-up on RWY09 from TWY B intersection.

Radar playback image indicating position of SG9029 (11:50:12 UTC) at liftoff beyond TORA of RWY09.

1.19 Useful or effective investigation techniques:-

Nil.

2. Analysis:-

2.1 Serviceability of the aircraft:-

VT-SZM is a Boeing 737-800 aircraft manufactured in 2012 and operated by M/s Spice Jet Ltd. The aircraft was issued a Certificate of Registration on 01.08.2016 by DGCA-INDIA and its ARC was valid as on date of incident. The last major inspection performed prior to the incident was 8 yearly checks conducted in November 2020 at 25997 FH/ 13493 FC. The aircraft had accumulated a total of 27858:05 hrs since new as on date of incident.

There were nil defects related reported prior to/ at the time of incident. The aircraft was released in a serviceable condition from Yerevan, UDYZ to Delhi on 23.07.2021. The serviceability of the aircraft was not a factor which contributed to the incident.

2.2 Electronic Flight Bag and OPT:-

The use of onboard EFB and it's OPT function for performance calculation by SpiceJet for 737 aircraft is approved by DGCA.

The OPT administration (in SpiceJet) is governed by internal processes which is controlled by Performance Engineering division. The procedure for addition of new airport definition including its runway details is defined in the SpiceJet Performance Engineering and Navigation Manual.
When a requirement to add a new airport to the existing database arises, the performance engineering department is responsible for preparing the airport database in a notepad file for OPT application. The process requires one Performance Engineer to prepare the required notepad file, which needs to be verified by a second Performance Engineer. Once the approval from DGM-Performance Engineering is obtained the database is updated in the OPT (TEST iPad) and is checked by another Performance Engineer.

Yerevan (UDYZ) station did not exist in the OPT database of SpiceJet prior to April 2021. Due to requirements for charter/ non-scheduled flights the airport data was created in the STAS (Standard Take-off Analysis Software); however the intersection data was not updated as per AIP. The #INT 'B' was configured to be at a distance of 2159ft from RWY 09 beginning, whereas it was located at a distance of 7546ft from beginning of RWY 09.

The process of crosschecking the database would ideally require comparing the notepad file with the airport charts/AIP to determine the validity of the measurements described in the notepad file. Whereas in this case, crosschecking of the notepad database file (STAS) by a second Performance Engineer was skipped by the Performance Engineer (who prepared the file) and it was deployed on the TEST iPad.

During validation of the OPT TEST data by the second Performance Engineer, it was cross checked with the notepad file instead of the AIP data; hence the process of crosscheck could not detect the error made in definition regarding the distance of TWY'B' intersection from beginning of RWY 09.

2.3 Flight Crew- Route and Aerodrome qualification:-

Yerevan (UDYZ) is not categorised as a performance limited aerodrome. It had been classified by SpiceJet as a Category 'B' aerodrome in the SOP for Yerevan (UDYZ).
Crew performed self-briefing prior to operating the flight sector, which is as per the requirements. This was the first take-off performed by First Officer from Yerevan (UDYZ). The PIC had operated one flight prior to the incident from Yerevan on 13.07.2021(Yerevan-Belgrade-Yerevan).

2.4 Flight planning and Performance Calculation:-

Both the PIC and First officer were informed in advance on 21.07.2021 for the planned schedule, which consisted of positioning (as ACM) on flight from Delhi-Yerevan and to operate the return sector on 23.07.2021 from Yerevan-Delhi.

Crew reportedly performed the review of Yerevan (UDYZ) airport during their travel as ACM from Delhi to Yerevan. After arrival at Yerevan, ATIS indicated that the runway condition was 'DAMP'; the crew obtained update from ATC that the present runway condition was 'DRY' and hence it was decided that First Officer would perform the take-off from Yerevan. Both the PIC and First officer were qualified for Supervised Take-off and Landing.
It is the responsibility of the operating crew to cross check the available runway length and performance requirements for a departure (including whether an intersection take-off can be performed or not). The PIC and First Officer performed the take-off performance calculations independently through OPT function in their company issued EFB's.

Though the OPT 'RWY graphic' indicated the TWY 'B' location to be very near to TWY 'A' and RWY 09 beginning, neither of the crew members realised the discrepancy regarding indication of location of the TWY 'B'.
The available distances are clearly mentioned in the Jeppesen chart (which was available in the EFB used by either crew members) a proper review of the airport layout/chart prior to performing the performance calculations would have alerted the crew members of the error w.r.t definition of location of the TWY 'B' in OPT. This indicates that a deeper review of the layout of Yerevan (UDYZ) was not conducted by either of the operating crew prior to operating the flight, even though this was the first take-off being performed by the First Officer (PF) and the second take-off from Yerevan (UDYZ) for the PIC (PM).

The following were considerations made for performance calculations by the operating crew:
Take-off weight of 56200kg, 'OPTIMUM' engine rating, 'DRY' runway, 'OPTIMUM' Flap setting, Wind 070/2kt,OAT(Outside Air Temperature) 30ºC and QNH 1003.0 Hpa.
Crew cross checked the calculations and the EFB calculated output was for FLAP 1, ACCEL HT=1393ft AGL, Engine R-Derate 2 89.1, V_1=143kt, V_R=144kt, V_2=147kt and Vref40= 128kt.

Performance analysis was performed for the same conditions (as above) as used for the take-off by the crew during departure from Yerevan (UDYZ) [Derate 2 selection with 09-B intersection

departure (DRY Runway)] and the outcome of the analysis indicated that the required Take-off distance for dispatch - distance to 35' height AGL (all-engine go take-off distance) was 9048ft and is based on a balanced decision speed (V_1). The calculated distance to V_1 was 5817ft. The calculated take-off distance for an engine-out scenario was 8819 ft. The distance required for a safe rejection of take-off run was 8869 ft.

The TWY 'B' RWY09 intersection departure did not meet performance requirements for the given take-off weight (56200kg) for a safe take-off or a rejected take-off.

SpiceJet operations to Yerevan (UDYZ/EVN) were non-scheduled/charter flights which were planned from May 2021, the first flight was operated on 02.07.2021. Prior to the incident a total of 25 flights were operated by Spice Jet Ltd. departing from UDYZ/EVN, full RWY length was utilised by these 25 departures of SpiceJet flights prior to the incident flight and no reports were raised regarding the error in the definition of TWY 'B' intersection. The error in configuration of the TWY'B' location remained latent in nature and was not detected even though operations were being conducted to Yerevan (UDYZ) until it was brought out by the active failure of aircraft being unable to achieve the desired performance during take-off for the subject flight.

2.5 Operational handling:-

The First officer was the Pilot Flying (PF) and the PIC was the Pilot Monitoring (PM) for the sector. The same was decided based on crew discussion and in compliance of applicable limitations for a supervised take-off. Based on Boeing analysis of the DFDR data, the aircraft was positioned at about 7672 ft beyond the Runway 09 threshold after lining up from TWY 'B' intersection. This meant that before the initiation of the take-off run, the available runway longitudinal distance was approximately 4959 ft. Based on performance calculations performed though OPT, the airplane was configured at flaps 1, take-off speeds were 143/144/147 knots (V_1, V_R and V_2 respectively); and with the engines derated at fixed derate level 2 combined with an assumed temperature (46º C) method thrust reduction.

After initiation of the take-off run, while accelerating past 100kt, the crew observed that the runway end was fast approaching and the aircraft had not accelerated to the calculated speeds for a safe take-off. During take-off from RWY 09 TWY'B' intersection, the rapidly approaching runway end was contrary to what the crew had expected based on their performance calculations. Observing the rapidly approaching runway the crew found themselves in a critical situation which warranted immediate action with insufficient runway remaining for performing a Rejected Take-off. The PIC instinctively took over the controls and a slow rotation was initiated passing 123kt.
Boeing analysis concluded that, Lift-off occurred at approximately 12,897 ft beyond the threshold, 266 ft beyond the end of the TORA as the airplane reached the nominal lift-off pitch attitude of 8.5 degrees that corresponds to flaps 1.

The FCOM and Flight Crew training manual references indicates that there is no restriction on the crew regarding moving the thrust lever to a higher setting during an emergency situation, which warrants higher thrust requirement during take-off when additional thrust is needed on both

engines (during the take-off with a combination ATM and fixed derate also). Since both the engines were operating normally the crew could have advanced the thrust lever to the full rated thrust for enhanced performance, whereas take-off was continued without any change in thrust settings.

Since the pilots calculated the performance before departure and were confident of the take-off performance calculations, observation of the rapidly approaching runway end was unexpected for pilots. There was a loss of situational awareness and inadequate reaction to advance the thrust levers to a higher thrust setting. PIC eventually initiated a slow rotation at approximately 21kt below the rotation speed. The comparatively low weight of the aircraft and availability of sufficient clearway averted a major risk of collision.

The available runway distance between centerline of TWY 'B' and RWY 09 end is 1550m (5085ft), whereas based on the calculated performance data the required distance to V_1 was 5817ft and distance to V_R was 6001ft. The distance required for a safe rejection of take-off run was 8869ft, it was not possible to perform a safe rejected take-off within the confines of the runway after passing 100kt due to the flaw in performance calculations as a result of the OPT configuration error.

3. Conclusion

3.1 Findings:

1. The Airworthiness Review Certificate and Certificate of Registration of VT-SZM were valid as on the date of incident.
2. The Operating cockpit crew members were having valid licences, ratings and qualifications for operating the aircraft.
3. The aircraft was maintained by M/s SpiceJet Ltd. in accordance with the certified aircraft maintenance program (AMP) and applicable Airworthiness Directive, Service Bulletins were complied with.
4. The crew members who operated the incident flight sector flight SG-9029 were subject to Breath-analyzer test for alcohol consumption at Delhi prior to departure to Yerevan (involved crew travelled as ACM) and they were cleared after a 'Negative' test result.
5. The aircraft was released in a serviceable condition from Yerevan (UDYZ), Armenia on 23.07.2021 for operating SG-9029 (Yerevan to Delhi). The subject sector was the return sector (positioning flight) after operating a non-scheduled flight SG-9028 from Delhi (VIDP) to Yerevan (UDYZ), Armenia. There were no defects reported prior to the incident sector.
6. PIC was the Pilot Monitoring and the First Officer was the Pilot Flying for the flight sector, briefing was completed prior to departure.
7. FDTL of both the flight crew members were within the specified limits.
8. The flights operated to Yerevan (UDYZ) were not a part of the operator's International Flight Schedule and was part of Non-scheduled commercial operations.
9. During the configuration of the EFB OPT data for Yerevan (UDYZ) by SpiceJet Performance Engineering department, the location of TWY'B' was configured as 658m (2159ft) from start of RWY09. Whereas TWY B is located after 2300m (7546ft) from beginning of RWY 09. The actual remaining runway length from TWY 'B' RWY 09 intersection till runway 09 end is 1550m (5085ft).
10. Boeing On-board Performance Tool (OPT) is the primary source for Take-off and Landing calculations available to the operating crew.
11. During pre-flight preparation at Yerevan (UDYZ), the PIC and First Officer carried out independent performance calculations with same input values for departure from TWY 'B' RWY09 intersection. TWY'B' RWY 09 intersection was indicated as a suitable option in OPT performance calculations and same was selected for departure by the operating crew.
12. The incident flight was the second flight operated by the PIC from Yerevan (UDYZ) and the first flight operated by the First Officer from Yerevan (UDYZ). Flight crew did not verify the stark contrast in available runway distances between Jeppesen 10-9 aerodrome chart (available in EFB) and the OPT runway graphic after take-off performance calculations, indicating a lack of in-depth review of the departure aerodrome charts.
13. The take-off speeds calculated after performance calculation through OPT - V_1, V_R and V_2 were 143kt, 144kt and 147kt respectively.

14. The TWY'B' RWY09 intersection departure with selected configuration (Derate#2) did not meet performance requirements for a safe take-off, rejected take-off or continued take-off following an engine failure. The required distance to balanced decision speed (V_1) was 5817ft; required distance to V_R was 6001ft and distance required for a safe rejected take-off was 8869ft.
15. The runway length available (TORA) from TWY 'B' intersection was 1550m (5085ft), which was significantly lower than required to achieve the V_1, V_R and V_2 speeds / the calculated aircraft performance.
16. The engine thrust setting used was De-rate #2, the corresponding engine N1 rpm of 89% was achieved. The thrust setting was not increased after perceiving the lack of adequate runway length for take-off, indicating a lack of situational awareness.
17. The airplane was positioned at 7672 ft beyond the Runway 09 threshold for take-off (after line-up from TWY B). Based on the airplane's position relative to the runway threshold before take-off roll, the available runway longitudinal distance was approximately 4959 ft.
18. Aircraft started takeoff run at 11:49:22UTC. N1 of both engines reached 88% at 11:49:36UTC and further increased to 89% during the take-off roll.
19. After initiation of the take-off run during acceleration, passing about 100kt, the runway end became visible and the crew realised that the remaining runway length was insufficient to achieve either the calculated take-off speeds or to safely perform a rejected take-off.
20. The aircraft did not achieve the desired V_1 speed within the TORA of RWY09 and a slow rotation was initiated at 123kt (at 11:50:03 UTC) against a calculated V_R of 144kt. Nose gear was airborne about a second later following which pitch was increased to 8.5°UP by 11:50:09UTC and MLG was also airborne at airspeed of 141kt CAS.
21. The aircraft lift-off was achieved at about 266ft beyond the end of TORA of RWY09.
22. Passing 39ft radio altitude, the aircraft CAS was 144kt even though the calculated V_2 speed (at 35ft) was 147kt.
23. There was no damage to the aircraft and no injuries to the occupants. No damage has been reported to any ground installations.

3.2 Probable cause:-

The aircraft did not achieve the required performance as the take-off was initiated from a runway intersection with performance calculated for a much longer runway length than the actual runway length available.

Following were the contributory factors:

- Error in configuration of the OPT tool, i.e., the location of TWY'B' - RWY 09 intersection was erroneously configured in the OPT data which resulted in TWY'B' being indicated as a viable option for departure to the operating crew.
- Lack of awareness of the aerodrome layout due to inadequate review of the aerodrome chart by the flight crew.

4. Safety Recommendations:-

Nil, in-view of actions already taken by M/s SpiceJet, as detailed below:

Corrective actions taken by M/s SpiceJet:

1. Airport data for EVN airport has been revised to remove the RWY 09-B intersection departure in the Boeing OPT application.
2. The performance engineer who prepared the EVN airport database for OPT and the performance engineer who crosschecked the EVN airport database for OPT have been subjected to corrective training for points detailed in findings and cause.
3. Necessary corrective actions have been taken on the operating crew w.r.t points detailed in findings and cause.

Preventive actions taken by M/s SpiceJet:

1. An Operations Circular has been issued, containing specific instructions for operating crew to cross check the OPT intersection data with Jeppesen 10-9 charts.
2. 'JEPPESEN AIRPORT DATA' is now being used by SpiceJet for runway data (including intersection data) to populate the OPT; which would mitigate the possibility of incorrect entry of data by SpiceJet in OPT data.

05/06/2023

(LINJU VALAYIL PHILIP)
Assistant Director Air Safety
Investigator-In-Charge

Date: 05.06.2023
Place: New Delhi