



**INVESTIGATION REPORT  
ON  
HARD LANDING INCIDENT TO  
M/S SPICEJET LTD, B-737-800 AIRCRAFT VT-SFF  
WHILE LANDING AT  
CHHATRAPATI SHIVAJI INTERNATIONAL AIRPORT, MUMBAI  
ON  
23.09.2020**



**DIRECTORATE GENERAL OF CIVIL AVIATION**  
OPPOSITE SAFDARJUNG AIRPORT, AUROBINDO MARG, NEW DELHI-110003

**DISCLAIMER**

*In accordance with the Rule 3 (1) of Aircraft (Investigation of Accidents and Incidents) Rules, 2017, "The sole objective of investigation of this incident is the prevention of accidents and incidents and not to apportion a blame or liability."*

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**INVESTIGATION REPORT ON HARD LANDING INCIDENT TO**  
**M/S SPICEJET LTD. B-737-800 AIRCRAFT VT-SFF AT MUMBAI AIRPORT**  
**ON 23.09.2020**

1. Aircraft Type : B-737-800  
Nationality : Indian  
Registration : VT-SFF
2. Owner : Bank of Utah, Utah, USA
3. Operator : M/s Spicejet Ltd
4. Pilot in Command : ATPL Holder  
Extent of Injury : Nil
5. Place of Incident : Chhatrapati Shivaji International Airport,  
Mumbai
6. Geographical Location of Site : 19° 5' 50.6508"N, 72° 52' 27.2820"E
7. Last point of Departure : Ras Al Khaimah Airport, UAE
8. Intended place of landing : Chhatrapati Shivaji International Airport,  
Mumbai
9. Type of operation : Cargo Flight
10. Date and time of Incident : 23.09.2020, 14:29 Hrs
11. Passengers/Crew on Board : Crew-02,  
Passenger- 01 (AME)  
Extent of Injury : Nil
12. Phase of Operation : Landing
13. Type of Incident : Abnormal Runway Contact (Hard landing)

**(All the timing in the report is in GMT)**

## **SYNOPSIS**

On 23.09.2020, a B737-800 aircraft VT-SFF of M/s Spicejet Ltd was involved in hard landing incident during landing at Chhatrapati Shivaji International Airport, Mumbai, while operating a cargo flight from Ras Al Khaimah to Mumbai.

The aircraft took-off from Ras Al Khaimah Airport at 11:39 Hrs to Mumbai. The aircraft was without any cargo load having only 03 persons onboard including 02 crew and 01 AME. PIC was the pilot flying and First Officer was the pilot monitoring. The flight was uneventful till approach for landing at Mumbai. While landing at Mumbai the pitch attitude was very low and the aircraft made three pointers contact on the runway 27 with maximum vertical acceleration of 3.34g.

The PIC reported suspected hard landing. All the persons on-board the aircraft were safe. No pre/post incident fire was reported.

DGCA instituted the investigation into the cause of incident by appointing the Investigation In-charge under Rule 13(1) of the Aircraft (Investigation of Accidents and Incidents) Rules, 2017.

Investigation revealed that improper flare technique by the pilot flying (PF) caused the abnormal runway contact while landing.

## **1. FACTUAL INFORMATION**

### **1.1. HISTORY OF THE FLIGHT:**

On 23<sup>rd</sup> September, 2020, the aircraft VT-SFF departed from Delhi at 03:23 hrs. to operate the first flight of the day from Delhi to Mumbai with a different set of crew. The flight was uneventful and no snag was reported by the operating crew.

At Mumbai, the aircraft VT-SFF was handed over to the involved crew to operate a cargo flight from Mumbai to Ras Al Khaimah and return back to Mumbai. It was the first flight of the day for both the crew. The aircraft was released by a certified AME after carrying out the due transit inspection. The aircraft took-off from Mumbai at 07:52 Hrs and landed safely at Ras Al Khaimah at 10:49 hrs. After transit inspection, the aircraft departed from Ras Al Khaimah at 11:30 Hrs and took-off for

Mumbai at 11:39 Hrs. During the take-off & cruise from Ras Al Khaimah to Mumbai, the flying was normal. During approach at Mumbai, ATC reported a thunderstorm with rain and advised the aircraft to perform ILS approach on runway 27 in wet runway conditions. The crew confirmed to the ATC that runway 27 was visible to them. The PIC requested the ATC to increase the intensity of runway lights. Below 100 ft RA, the aircraft approach was in level flight configuration and it was not flared properly before allowing for touch down. Possibility of go-around in view of lack of flare or due weather conditions was not discussed by the crew. The aircraft made a three point touch-down on runway 27 with a vertical acceleration of 3.34g which was more than the structural limit of 2.1g as specified by the manufacturer. The crew reported suspected hard landing and made the tech log entry. CVR and DFDR data was downloaded. The aircraft was declared on ground (AOG) for further inspection.

## 1.2. INJURIES TO PERSON

<b>INJURIES</b>	<b>CREW</b>	<b>PASSENGERS</b>	<b>OTHERS</b>
<b>FATAL</b>	Nil	Nil	Nil
<b>SERIOUS</b>	Nil	Nil	Nil
<b>MINOR</b>	Nil	Nil	Nil
<b>NONE</b>	02	01	

## 1.3. DAMAGE TO AIRCRAFT

No damage to the aircraft was reported.

## 1.4. OTHER DAMAGE

NIL

## 1.5 PERSONNEL INFORMATION:

### 1.5.1. Pilot-in-Command

He is experienced pilot having vast flying experience on various aircraft. He is not involved in any Accidents or Serious Incidents previously. Details of his experience at the time of incident are given below:

Date of Birth	:	18.05.1989
Gender	:	Male
License type	:	ATPL
Date of Initial Issue	:	22.04.2015
Valid up to	:	23 <sup>rd</sup> June, 2025
Class I Medical Valid up to	:	24.02.2021
FRTTO No, valid till	:	13987, Valid till 21.10.2024
Last Ground Training (Refresher)	:	13.07.2020 to 17.07.2020
Date of last IR Check	:	17.08.2020
PPC check	:	17.08.2020
Aircraft Ratings:		
As PIC	:	B 737- 700/800/900, Cessna 152A, PA-34
Date of Endorsement	:	08.11.2016 for B-737

#### **Flying Details:**

Total Flying Experience	:	7362:30 hrs
Total Flying as PIC	:	7113:22 Hrs.
Total Experience as PIC on type	:	3208:38 Hrs.
Flying during Last One year	:	512:57 Hrs.
Flying during last 6 months	:	101:48 Hrs.
Flying during Last 30 days	:	43:34 Hrs.
Flying during last 7 days	:	16:53 Hrs.
During last 24 hours	:	05:55 hrs

### 1.5.2. Co-Pilot

Date of Birth	:	18.01.1990
Gender	:	Male
Type of Licence	:	CPL,
Date of Initial Issue	:	23.06.2015

Valid till : 27.08.2025  
 Class I Medical Valid up to : 31.10.2020  
 FRT0 No, valid till : 19585, valid till 27.08.2025  
 Last Ground Training (Refresher) : 06.01.2020 to 09.01.2020  
 Date of last IR check : 11.08.2020  
 PPC check : 11.08.2020  
 Aircraft Ratings:  
     As PIC : Cessna 172, Piper Seneca PA 34  
     As FO : B-737  
 Date of Endorsement : 08.03.2018 for B 737

**Flying Details:**

Total Flying Experience : 1575:48 Hrs  
 Total Experience as FO on type : 1293:53 Hrs  
 Flying during Last One year : 435:01 Hrs.  
 Flying during last 6 months : 83:50 Hrs  
 Flying during Last 30 days : 33:48 Hrs  
 Flying during last 7 days : 17:30 Hrs  
 During last 24 hours : 05:55 Hrs

Both the crew underwent pre-flight breath analyser test at Mumbai as per the provision of CAR Section 5 Series F Part III. No indication of alcohol consumption by any of the involved crew was detected during the BA test. No exceedance in the Flight Duty Time for both the crew was observed as per the record available.

**1.6 AIRCRAFT INFORMATION:**

**1.6.1 Aircraft:**

<b>Manufacturer</b>	The Boeing Company
<b>Type</b>	B-737-800
<b>Constructor's S.No.</b>	30474
<b>Year of Manufacturer</b>	2000
<b>Certificate of Airworthiness</b>	7251, Issued on 04.10.2019

<b>Airworthiness Certificate</b>	<b>Review</b>	4-125/2019/AI (1)/ARC/7251, dated 04.10.2019 Valid till 03.10.2020 Renewal 04.10.2020, valid till 03.10.2021
<b>Category</b>		Normal
<b>Sub Division</b>		Normal - Mail/Goods.
<b>Certificate of Registration no. and validity</b>		No. 5148 Validity: 24.09.2029
<b>Owner</b>		Bank of Utah, Utah, USA
<b>Operator</b>		M/s Spicejet Ltd
<b>Minimum Crew Required</b>		02
<b>Maximum All Up Weight</b>		75,976 Kg
Empty Weight		38639.82 Kg
Max Usable Fuel		22137 Kg
Max Payloadwith full fuel		14830.19 Kg
Empty Weight C.G		640.57 in aft of datum
<b>Last Major Inspection</b>		A2 Check at aircraft TAFH 63375:04 Hrs/ AFC 33183 on 11.09.2020
Date of Aircraft weighment		12-Jul-2019

<b>1.6.2 Engine</b>	
<b>Manufacturer</b>	CFM.
<b>Type</b>	CFM-56-7B26
<b>Serial No.</b>	LH – 888115 RH – 877523
<b>Date of Manufacture</b>	LH - 16/11/2000 RH - 14/07/2000
<b>Last Major Inspection carried on</b>	LH Engine: 27/02/2017 RH Engine: 22/09/2019



<b>Hours Done Since New</b>	LH Engine: 58226:34 Hrs RH Engine: 55908:18 Hrs
<b>Cycle Since New</b>	LH Engine: 29498 Cycles RH Engine: 28971 Cycles
<b>Average Fuel Consumption</b>	Satisfactory

As per the approved weight schedule, MTOW of the aircraft is 75176 Kg, the Maximum Landing Weight is 65317 Kg, and the Maximum Zero Fuel Weight is 61688 Kg. As per the load and trim sheet for the incident flight, the calculated TOW was 53534 Kg, the calculated Landing Weight was 47687 Kg, and the calculated ZFW was 43344 Kg. The calculated LW was 17630 Kg below the MLW permitted for the aircraft. As per load distribution, there was no load in any of the cargo hold. In the cabin there was no load in P1 & P2 area. From P3 to P11, load of 4230 Kg was evenly distributed. C.G was within the limits. The aircraft was maintained as per the approved maintenance schedule and all the mandatory modifications applicable to the aircraft were complied with.

DFDR fitted on the aircraft had error in recording of Radio Altitude. The RA was recorded 26 ft when the aircraft was on the ground. On raising the query, M/s Spicejet Ltd. submitted that they had already taken up the matter with the software support company M/s Aerobytes Ltd on 02.07.2020. M/s Aerobytes had advised to subtract 30 ft from the recorded RA value to get the exact value. On raising the error while investigating the incident, M/s Spicejet Ltd again approached M/s Aerobytes to resolve the issue. Later on M/s Spicejet Ltd. reported that the software has been updated and error in the DFDR data recording has been rectified and provided the data of incident flight processed through updated software. On reviewing the revised data, it is observed that ROD recorded before the software update was also erroneous. (Refer tabulated data in Para 1.11)

After landing the incident flight, crew reported 'suspected hard landing'. DFDR and CVR data was downloaded and analysed. As per DFDR data, maximum vertical acceleration recorded was observed 3.34g against the manufacturer's prescribed limit of 2.1g. The landing was classified as hard landing.

Phase 1A and 1B inspection of aircraft was carried out for hard landing conditions by the engineering team as per AMM, No abnormality or damage was observed during the inspection. Further, the operator forwarded the data to the manufacturer (i.e. M/s Boeing Company) for further evaluation. Since, no damage/abnormality was observed during the hard landing inspection, the manufacturer advised the operator to release the aircraft. The aircraft was restored to normal and released for further flying on 24.09.2020.

## 1.7 METEOROLOGICAL INFORMATION:

As per the ATIS weather obtained by the crew at 1339 hrs. The visibility at Mumbai Airport was 2500m, with a wind speed 08 kts, wind direction 260°, and moderate showers of rain. Ahmedabad as the alternate airport had visibility of 4000 m, wind speed of 6 kts, and wind direction 240°.

The crew was also provided with TAF (Terminal Aerodrome Forecast) report that was valid from 23.09.2020; 00:00 hrs to 24.09.2020; 06:00 hrs, reflecting expected meteorological conditions at source and destination airports including various alternate airports. The report is appended below:

### SEJ DXB/SHJ/MCT/RKT/DOH TAF generated on 23-09-2020 AT 04:24 UTC

TAF OMDN 222258Z 2300/2406 13007KT 8000 NSC PROB30 2301/2304 4000 HZ BECMG 2308/2310 33012KT BECMG 2315/2317 12005KT =

TAF OMDN 222258Z 2300/2406 14007KT 5000HZ NSC PROB30 TEMPO 2300/2303 2500 BR BECMG 2303/2305 8000 NSW BECMG 2309/2311 34015KT PROB30 TEMPO 2310/2313 4000 BLDU BECMG 2315/2317 16005KT PROB30 2322/2404 4000 HZ =

TAF OMRK 222258Z 2300/2406 VRB02KT 5000 NSC BECMG 3308/2310 34012KT BECMG 2314/2316 10005KT =

TAF OMEJ 222300Z 2300/2400 30006KT BECMG NSC TEMPO 2300/2303 VRB03KT 5000HZ BECMG 2304/2306 09008KT BECMG 2314/2316 VRB03KT TEMPO 2319/2403 29005KT =

TAF OMAA 222300Z 2300/2406 VRB92KT 6000 NSC TEMPO 2300/2304 0200 FG VV/// BECMG 2302/2304 12010KT BECMG 2310/2313 34015KT BECMG 2316/2318 06006KT PROB30 TEMPO 2323/2403 3000 BR BECMG 2401/2403 14012KT =

TAF OMSJ 222258Z 2300/2406 14007KT 7000 NSCPROB30 2300/2304 4000 HZ BECMG 2308/2310 33012KT BECMG 2315/2317 14005KT =

TAF OMAL 222300Z 2300/2406 08010KT CAVOK PROB30 TEMPO 2305/2309 08020KT 4000 BLDU –

TAF OOMS 222300Z 2300/2406 2700KT 8000 NSC BECMG 2306/2308 34012KT BECMG 2316/2318 24007KT =

TAF OPKC 230330Z 2306/2412 24005G15KT 6000 SCT030 BECMG 2318/2320 24007KT 5000 HZ SCT020 TEMPO 2400/2404 24007KT 5000 HZ SCT020 =

TAF OIKB 222300Z 2300/2406 04006KT 7000 NSC BECMG 2305/2307 17008KT TEMPO 2308/2313 23016KT BECMG 2319/2321 07008KT

TAF OIZH 222300Z 2300/2406 02008KT 8000 NSC TEMPO 2309/2317 02010KT PRO30 5000 SA –

TAF VABB 222300Z 2300/2406 27008KT 2500 -RA HZ FEW012 SCT018 FEW030TCU/CB BKN090 TEMPO 2300/2306 1200 TSRA SHRA BECMG 2306/2308 3000 -KA HZ FEW012 SCT01B BKN090 TEMPO 2309/2318 1500 TSRA SHRA FEW012 FEW030TCU/CB BKN090 BECMG 2313/2315 21008KT 2500 DZ HZ TEMPO 2321/2406 1200 TSRA SHRA FEW012 FEW030TCU/CB BKN090 BECMG 2402/2404 26008KT 3000 -DZ HZ FEW018 SCT025 BKN090 =

TAF VAAH 222300z 2300/2406 16003KT 4000 HZ FEW020 SCT080 BECMG 2301/2303 29006KT 2500 RR HZ FEW020 BECMG 2304/2306 4000 HZ FU FEW020 SCT025 BECMG 2307/2309 5000 FU FEW020 FEW030TCU BECMG 2310/2312 24004KT FEW020 BECMG 2313/2315 21005KT 4000 BECMG 2319/2321 24003KT HZ BECMG 2322/2324 00000KT BECMG 2401/2403 27005KT 2000 BR HZ FEW020 BECMG 2404/2406 24006KT 4000 HZ =

TAF VAPO 222130Z 2300/2312 27010KT 6000 SCT020 BKN090 TEMPO 2309/2312 4000 -RA SCT015 SCT020 FEW030TCU BKN090 =

TAF VANP 222300Z 2300/2406 22002KT 2000-RA BR FEW012 SCT018 BKN080 BECMG 2304/2306 23005KT 4000 -RA BR FEW018 SCT025 FEW030TCU TEMPO 2310/2314 32015G25KT 1000 TSRA SCT018 SCT025 FEW030CB BKN080 DECMG 2320/2322 22005KT 2500 BR SCT018 BKN090 BECMG 2404/2406 24005KT 4000 BR SCT018 SCT025 FEW030TCU =

TAF VOMM 222300Z 2300/2406 VRB02KT 4000BR SCT020 BKN100 BECMG 2303/2304 25010KT 6000 BECMG 2306/2307 25010G25KT TEMPO 2309/2315 SCT020 FEW025TCU/CB BKN100 BECMG 2315/2316 25008KT 4000 DZ/DR BECMG 2403/2404 25010KT 6000 =  
TAF VOBL 222300Z 2300/2406 27010KT 6000 SCT012 SCT080 TEMPO 2300/2303 3000 DZ BR BKN008 SCT012 BKN080 TEMPO 2309/2315 4000 RA DZ SCT008 SCT018 FEW025CB BKN080 TEMPO 2321/2403 3000 DZ BR BKN008 SCT012 BKN080 =  
TAF VOHS 222300Z 2300/2406 26008KT 5000 DZ BR BKN010 SCT015 OVCORO TEMPO 2300/2303 25012KT 2500 BR BECMG 2305/2307 30008KT 6000 SCT015 SCT025 BKN100 TEMPO 2309/2316 21008KT 3000 TSRA SCT010 FEW030CB OVC080 BECMG 2316/2318 25007KT 5000 DZ BR SCT015 BKN100BECMG 2404/2406 27010KT 4000 SCT015 SCT025 BKN100 =  
TAF VOCL 222300Z 2300/2406 10005KT 3000 RA/BR SCT012 BKN080 TEMPO 2300/2302 2000 RA/BR BECMG 2306/2307 27010KT 5000 HZ SCT012 BKN080 TEMPO 2310/2314 3000 RA/BR SCT012 FEW025CB BKN080 BECMG 2315/2316 VRB03KT 2500 BR FEW006 SCT012 BKN080 TEMPO 2323/2402 2000 RA/BR BECMG 2405/2406 30010KT 5000 HZ SCT012 SCT090 =

As per the TAF report, from 1300hrs to 1500hrs on 23.09.2020, expected visibility at Mumbai was 2500m with wind speed 08kt and wind direction 210° and for Ahmedabad airport visibility was 4000m. From 0900 hrs to 1800 hrs thunderstorm and shower of rain was also expected at Mumbai.

While approaching for landing at Mumbai, ATC also reported visibility as 2500m in TSRA and rain over the airfield.

## **1.8 AIDS TO NAVIGATION:**

Mumbai Airport is equipped with navigational aids like ILS, DME, DVOR, NDB, PAPI etc. Night landing facility on RWY 27 was available with CAT III Instrument Landing System (ILS). Aircraft and crew were also qualified for CAT III Landing. Since, CAT I landing conditions were available, normal landing was performed by the crew. No limitation on serviceability/use of any navigational aid was reported by ATC or by flight crew of the aircraft, at the time of the incident.

## **1.9 COMMUNICATIONS:**

Two-way communication was available at Mumbai Airport at the time of the incident. No unserviceability of any communication aid was reported by the ATC as well as by the flight crew.

## **1.10 AERODROME INFORMATION:**

Chhatrapati Shivaji International Airport, Mumbai is the primary international airport in the state of Maharashtra. Its operation is controlled by Mumbai International Airport Pvt Ltd (MIAL) which is the joint venture of M/s Airports

Authority of India and M/s GVK Industries Ltd. It is the licensed airport. It has two crossed runways 14/32 and 09/27. Details of each runway and limitations are given below:

RWY	Dimension (M)	TORA	TODA	ASDA	LDA	RESA	ILS
09	3448 x 60	3187	3187	3187	3045	240 x100 M	CAT I
27		3448	3448	3448	2965	240 x100 M	CAT II
14	2871 x 45	2871	2871	2871	2471	55 x 90 M	CAT I
32		2871	2871	2871	2673	150 x100 M	Simple App

The involved aircraft was cleared for ILS approach on runway 27. Geographic location of the Airport is at Latitude 19° 5' 50.6508"N, and Longitude. 72° 52' 27.2820"E.

### 1.11 FLIGHT RECORDERS:

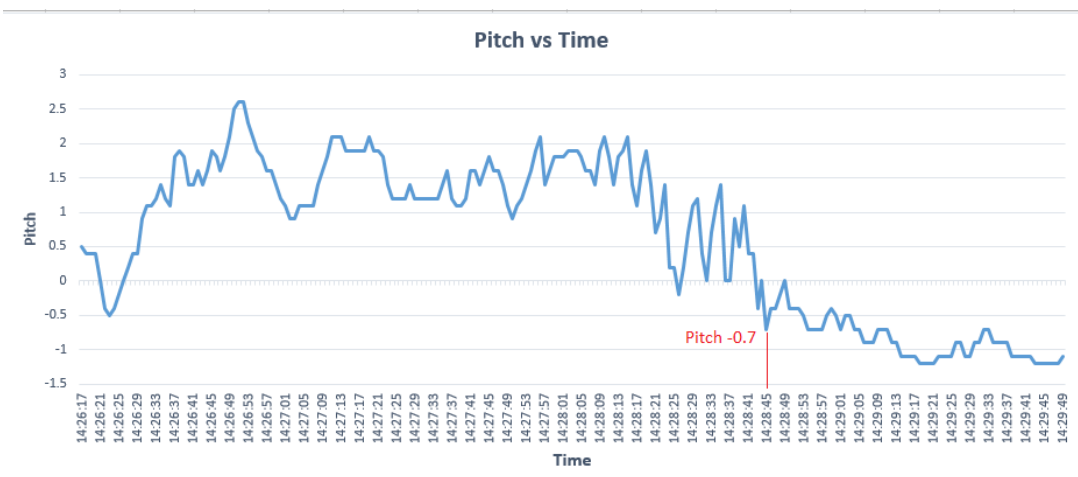
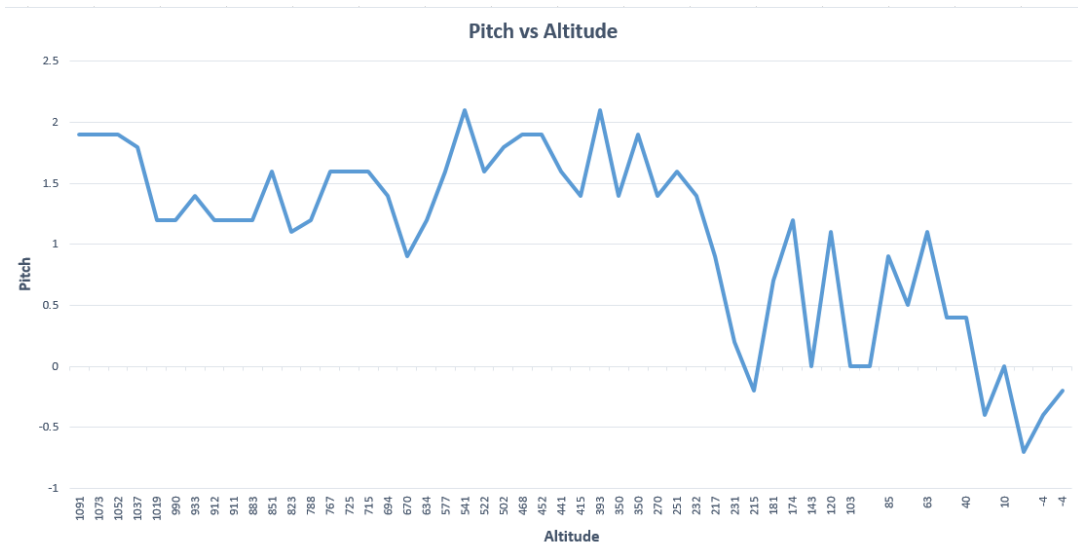
The aircraft was fitted with both CVR and DFDR of L3 TECHNOLOGIES.

CVR : Part No. 2100-1020-00                      S. No. CVR 000649021

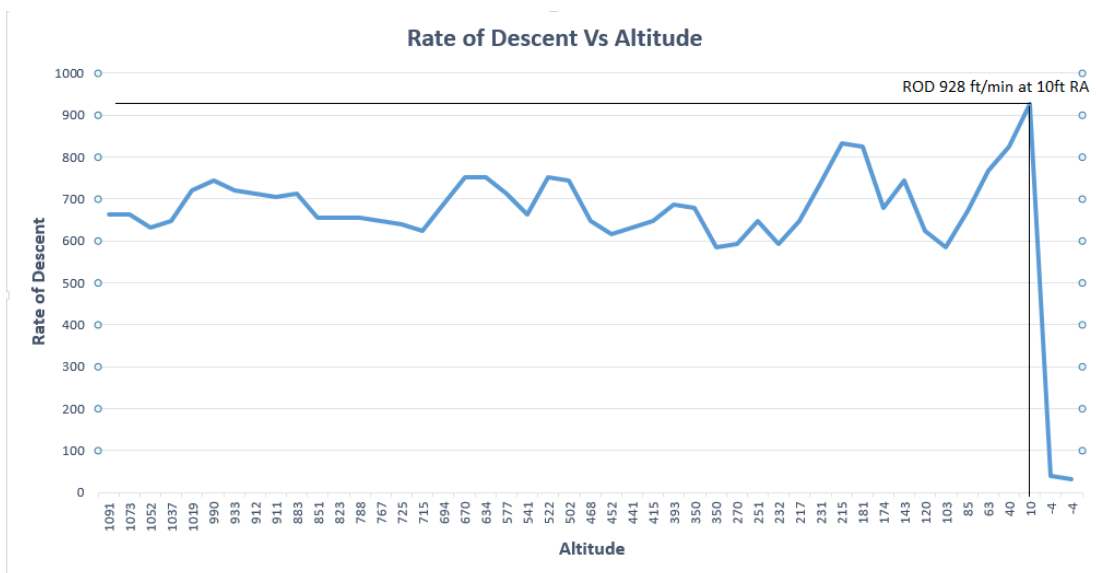
DFDR : Part No. 2100-4043-00                      S. No. 000739577

#### DFDR:

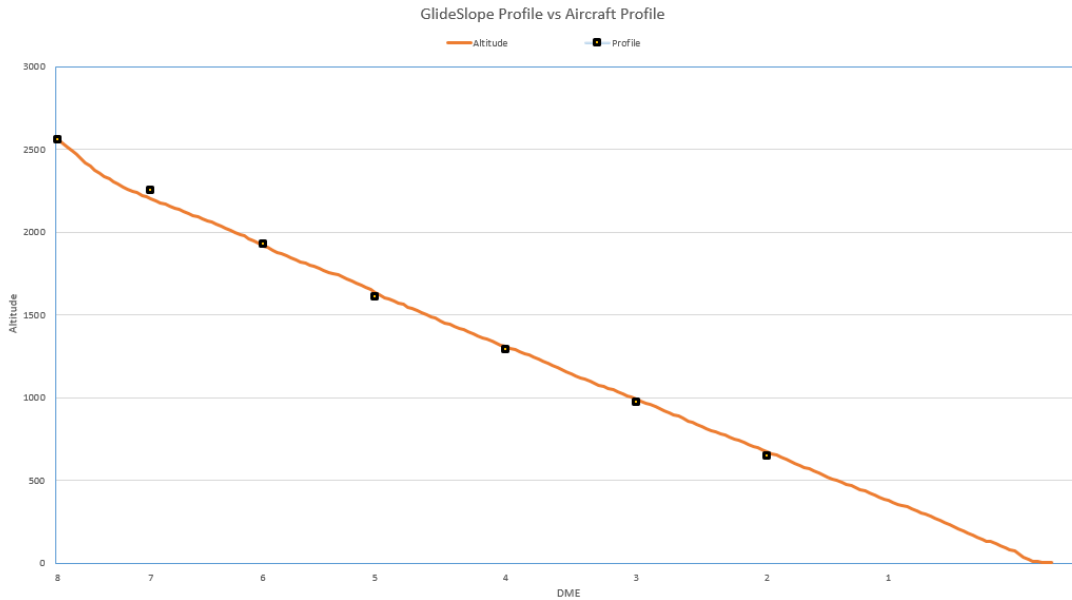
As per DFDR data, the aircraft approach was observed at very low pitch and mostly the aircraft remained in level flight configuration. The approach at low pitch or negative pitch remained continue below 100 ft RA and maximum pitch recorded was 1.1 for a fraction of second. Before touch down the aircraft was in nose down tendency and at the time of touch down the pitch input changed from -0.7 to +0.4 which was also very low. No flare was observed before allowing the aircraft to touch down. As per Flight Data limits defined by the operator touchdown with pitch below 0.5 is classified as amber exceedance and pitch below 0.3 is classified as Red exceedance.



An increase in rate of descent was also observed from the flight data below 100ft RA. The maximum rate of descent was recorded 928 ft/min just before the touchdown.



N1 of both the engines were also higher than the idle rpm at the time of touch down that indicates the touch down with slight power. All the wheels came in contact with the runway within a fraction of second and the aircraft made a three-pointer landing with a high vertical acceleration of 3.34g. The wind direction changed from 250° to 320° within 03 seconds (about 1.5 sec before and 1.5 sec after touch-down) however, the wind speed was 3 to 4 kts which had no significant effect on the landing profile.



Initial DFDR data provided by the operator had an error in recording Radio Altitude. After the incident, M/s Aerobytes updated the software and processed the data recoded for incident flight again using updated software. On reviewing revised data, the ROD recorded before updation of the software was also found erroneous. The difference in ROD below 100 ft RA before and after software update is reflected in tabulated form. Old data is highlighted in **black**:

GMT	SELEC TED HDNG	CAPT HDNG	RADIO HEIGHT (comb)	Radio Height before software update	CAPT PITCH ATT	LEFT MAIN GEAR AIR/GND	RIGHT MAIN GEAR AIR/GND	NOSE GEAR AIR/GND	VERT ACC	INER- TIAL VERT SPD	VERT SPD before software update	ENG 1 N1 TACHO	ENG 2 N1 TACHO	WIND SPD	WIND DIREC TION TRUE
142836	270	270.4	103	133	0	Air (0)	Air (0)	Air (0)	0.89	-584	-570				
									0.91						
					D 0.4	Air (0)	Air (0)	Air (0)	0.91						
									0.89						
					D 0.5	Air (0)	Air (0)	Air (0)	0.88						
									0.93						
					D 0.4	Air (0)	Air (0)	Air (0)	0.98						

GMT	SELEC TED HDNG	CAPT HDNG	RADIO HEIGHT (comb)	Radio Height before software update	CAPT PITCH ATT	LEFT MAIN GEAR AIR/GND	RIGHT MAIN GEAR AIR/GND	NOSE GEAR AIR/GND	VERT ACC	INER- TIAL VERT SPD	VERT SPD before software update	ENG 1 N1 TACHO	ENG 2 N1 TACHO	WIND SPD	WIND DIREC TION TRUE
									0.99						
142837	270	271.1			0	Air (0)	Air (0)	Air (0)	1	-568	-555	46	41.5		
									1.03						
					U 0.2	Air (0)	Air (0)	Air (0)	1.04						
									1						
					U 0.4	Air (0)	Air (0)	Air (0)	0.99						
									1.01						
					U 0.7	Air (0)	Air (0)	Air (0)	1.02						
									0.98						
142838	270	271.1	85	115	U 0.9	Air (0)	Air (0)	Air (0)	0.95	-672	-705			5	
									0.95						
					U 0.9	Air (0)	Air (0)	Air (0)	0.98						
									0.97						
					U 0.7	Air (0)	Air (0)	Air (0)	0.93					3	
									0.93						
					U 0.7	Air (0)	Air (0)	Air (0)	0.92						
									0.92						
142839	270	271.8			U 0.5	Air (0)	Air (0)	Air (0)	0.93	-728	-690				295.3
									0.95						
					U 0.7	Air (0)	Air (0)	Air (0)	0.95						
									0.96						
					U 0.7	Air (0)	Air (0)	Air (0)	0.97						299.9
									1						
					U 0.9	Air (0)	Air (0)	Air (0)	1						
									1.01						
142840	270	271.4	63	93	U 1.1	Air (0)	Air (0)	Air (0)	1.03	-768	-765				
									1.08						
					U 1.1	Air (0)	Air (0)	Air (0)	1.06						
									1.01						
					U 0.9	Air (0)	Air (0)	Air (0)	0.96						
									0.97						
					U 0.5	Air (0)	Air (0)	Air (0)	0.98						
									0.98						
142841	270	271.4			U 0.4	Air (0)	Air (0)	Air (0)	0.99	-768	-870	53.38	51.4		
									0.97						
					U 0.4	Air (0)	Air (0)	Air (0)	0.96						
									0.97						
					U 0.4	Air (0)	Air (0)	Air (0)	0.93						
									0.95						
					U 0.2	Air (0)	Air (0)	Air (0)	1						

GMT	SELEC TED HDNG	CAPT HDNG	RADIO HEIGHT (comb)	Radio Height before software update	CAPT PITCH ATT	LEFT MAIN GEAR AIR/GND	RIGHT MAIN GEAR AIR/GND	NOSE GEAR AIR/GND	VERT ACC	INER- TIAL VERT SPD	VERT SPD before software update	ENG 1 N1 TACHO	ENG 2 N1 TACHO	WIND SPD	WIND DIREC TION TRUE
									1.05						
142842	270	271.1	40	70	U 0.4	Air (0)	Air (0)	Air (0)	1.02	-824	-900			4.5	
									0.99						
					U 0.2	Air (0)	Air (0)	Air (0)	0.95						
									0.96						
					0	Air (0)	Air (0)	Air (0)	0.91					3.5	
									0.89						
					D 0.4	Air (0)	Air (0)	Air (0)	0.89						
									0.9						
142843	270	271.1			D 0.4	Air (0)	Air (0)	Air (0)	0.89	-888	-945				295
									0.9						
					D 0.2	Air (0)	Air (0)	Air (0)	0.99						
									1.03						
					0	Air (0)	Air (0)	Air (0)	1.03						249.6
									0.98						
					0	Air (0)	Air (0)	Air (0)	0.97						
									1.05						
142844	270	270.7	10	40	0	Air (0)	Air (0)	Air (0)	1.03	-928	-675				
									1.02						
					0	Air (0)	Air (0)	Air (0)	0.98						
									0.97						
					D 0.4	Air (0)	Air (0)	Air (0)	1.03						
									0.97						
					D 0.7	Air (0)	Air (0)	Air (0)	0.96						
									0.94						
142845	270	270.7			D 0.7	Air (0)	Air (0)	Air (0)	0.97	-360	-525	52.13	47.4		
									1.02						
					D 0.4	Air (0)	Air (0)	Air (0)	1.13						
									1.22						
					U 0.4	Gnd (1)	Air (0)	Air (0)	2.86						
									3.34						
					U 0.4	Gnd (1)	Gnd (1)	Gnd (1)	1.22						
									0.75						
142846	270	272.1	-4	26	D 0.4	Gnd (1)	Gnd (1)	Gnd (1)	0.7	-40	-315			4	
									0.43						
					D 1.2	Gnd (1)	Gnd (1)	Air (0)	0.65						
									0.7						
					D 1.4	Gnd (1)	Gnd (1)	Gnd (1)	0.78					2.5	
									1.34						
					D 0.9	Air (0)	Gnd (1)	Gnd (1)	1.46						



GMT	SELEC TED HDNG	CAPT HDNG	RADIO HEIGHT (comb)	Radio Height before software update	CAPT PITCH ATT	LEFT MAIN GEAR AIR/GND	RIGHT MAIN GEAR AIR/GND	NOSE GEAR AIR/GND	VERT ACC	INER- TIAL VERT SPD	VERT SPD before software update	ENG 1 N1 TACHO	ENG 2 N1 TACHO	WIND SPD	WIND DIREC TION TRUE
									1.29						
142847	270	272.5			D 0.4	Gnd (1)	Gnd (1)	Gnd (1)	0.85	-32	-75				319.6
142848	270	272.8	-4	26	D 0.2	Gnd (1)	Gnd (1)	Gnd (1)	0.95	32	-405				
142849	270	271.1			0	Gnd (1)	Gnd (1)	Gnd (1)	1.03	-16	-405	39.5	39.6		
142850	270	269.6	-4	26	D 0.4	Gnd (1)	Gnd (1)	Gnd (1)	0.88	56	-495			2	
142851	270	269.3			D 0.4	Gnd (1)	Gnd (1)	Gnd (1)	0.92	-8	-525				306.2

## CVR:

As per CVR recording, after obtaining necessary clearance from ATC the aircraft initiated to descend. All the checklists were performed by the crew while approaching for the landing. Crew confirmed to the ATC that runway 27 was visible to them. Issue of reduced visibility during approach or possibility of Go-around in view of reduced visibility was not discussed by the crew while approaching for landing. However, the PIC requested the ATC to increase the intensity of runway lights.

CVR transcript FL70 onwards is reflected below:

UTC Timing		
14:18:49	ATC	SG-7044 descent to FL70
	P2 to ATC	Descent level 70, SG-7044
14:19:00	ATC	SG-7044, turn right heading 230 to intercept localizer RWY 27
	P2 to ATC	Right heading 230 to intercept localizer RWY 27, SG-7044
14:19:32	ATC	SG-7044, descent 3800ft, QNH 1004
	P2 to ATC	Descent 3800ft, QNH 1004, SG-7044
14:20:18	P2	Localizer Alive
	P1	Check
	P2	VOR LOC captured
	P1	Check
14:21:18	P1	Flaps 1
	P2	Speed check, flaps 1 selected and moving
14:21:49	P1	Transition...
	P2	Transition approach checklist
	P2	Approach checklist, altimeters
	P1	1004, passing 5100
	P2	1004 set, approach checklist complete
14:23:34	P1	Flaps 5
	P2	Speed check, flaps 5, selected and moving
14:24:35	SYNC CALL	2500

14:24:36	P2	Glide slope captured
	P1	Heading altitude selected
14:25:17	P1	Gear DOWN, flaps 15
	P2	Check, flaps 15, moving...
14:26:02	P1	Flaps 30
	P2	Speed check, flaps 30, selected and moving
14:26:19	P1	Landing checklist
	P2	Landing checklist: Engine start switches
	P1	CONT
	P2	Speedbrake
	P1	ARMED
	P2	Landing gear
	P1	DOWN
	P2	Flaps
	P1	30, Green light
	P2	Landing checklist completed
14:26:36	P1	Wipers...
	P1	Wipers high....full high....
14:27:02	P2	1000ft stabilized right 5kts
	P1	Check
14:27:18	ATC	SG-7044, RWY 27, clear to land wind 270 degree 05 kts
	P2 to ATC	RWY 27, Clear to land, SG-7044
14:27:22	SYNC CALL	1000
	P2	Cleared to land
14:27:35	Auto pilot disengage horn activated	
14:27:50	P2	500 stabilized, 6 ahead right 5 kts
	P1	Check
14:28:19	P2	Approaching MINIMA
	SYNC CALL	+100
14:28:20	SYNC CALL	Minimums
	P1	Landing
14:28:33	SYNC CALL	100
14:28:34	SYNC CALL	50
14:28:35	SYNC CALL	30
14:28:36	SYNC CALL	20 10....
	P2	Speedbrake UP, auto brakes DISARM
14:29:19	P1	N7?
14:29:21	ATC	SG-7044, vacate via N8, right on N, contact 121.9
	P2 to ATC	Right on N, 121.9, SG-7044
	P2	N8 captain

Flight crew did not discuss the possibility of the go-around in view of adverse weather conditions and inadequate flare as per DRDR data, although both the engines were kept at power higher than the idle power.

### **1.12 WRECKAGE AND IMPACT INFORMATION:**

Suspected hard landing was reported by the crew and the entry was made in the Techlog. The aircraft was declared on ground at Mumbai airport for necessary inspection. No damage/abnormality was observed during the inspection. In consultation with the manufacturer, the aircraft was released for normal flying on 24.09.2020.

### **1.13 MEDICAL AND PATHOLOGICAL INFORMATION:**

Both the crew underwent pre-flight breath analyser check as per the provision of CAR Section 5 Series F Part III. No indication of alcohol consumption by any of the involved crew was observed during the check.

### **1.14 FIRE:**

There was no pre/post incident fire.

### **1.15 SURVIVAL ASPECTS:**

All three persons on-board the aircraft including 02 flight crew were safe.

### **1.16 TESTS AND RESEARCH:**

Nil

### **1.17 ORGANIZATIONAL AND MANAGEMENT INFORMATION:**

M/s Spicejet Ltd. is a scheduled airline operator with its main base at IGI Airport, New Delhi. It started its operation in May 2005 with B-737-800 aircraft. Later on the airline expanded its operation by introducing B-737-900 aircraft followed by the induction of Bombardier DHQ 8, B-737-Max, B-737-700 aircraft into its fleet. It is operating in Domestic and International sectors with a mixed fleet of Boeing 737 series and DHQ 8 aircraft. The airline is headed by a CMD who is the Accountable Manager assisted by a dedicated team of aviation and management professionals in their respective areas.

### **1.18 ADDITIONAL INFORMATION:**

As per the PIC statement, the ATC reported visibility of 2500m TSRA with rain over the airfield, and runway 27 conditions as wet and asked for ILS approach.

The approach was stabilised at 500ft. Before that he requested ATC to increase the runway lights to its maximum intensity. However, below 50 ft to touch down, he experienced glare on the windshield due to high intensity of lights and rain. It further resulted in an inefficient flare or no flare and being a slightly high power touchdown resulted into high vertical acceleration. He further admitted that no other aircraft diversion was reported before or after the incident on 23.09.2020 at Mumbai Airport.

The first officer submitted that he was the pilot monitoring and controls were with the PIC. The aircraft was stabilised at 1000 ft and then at 500 ft and the autopilot was disengaged at 700ft. However, the aircraft made a hard landing due to the lack of flare. He further admitted that the aircraft landed on the main landing gear. Also, the PIC had made the PDR / Techlog entry as 'Hard landing on main wheels'.

#### **1.19 USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES.**

Nil.

## **2. ANALYSIS:**

**2.1. Technical Aspects:** Aircraft had valid Certificate of Airworthiness. The ARC was last renewed on 04.10.2019 which was valid till 04.10.2020. All the inspections were carried out as per the approved inspection schedules. Last major inspection carried out was A2 Check at aircraft TAFH 63375:04 Hrs/ AFC 33183 on 11.09.2020. All the mandatory modifications applicable to the aircraft were complied with.

The calculated TOW was 53534 Kg, and the calculated Landing Weight was 47687 Kg. The calculated LW was 17630 Kg less than the MLW permitted for the aircraft. Cargo was only 4230Kg that was evenly distributed in the aircraft and C.G was within the limits. Structural limit of vertical acceleration at the time of touch down is 2.1g as specified by the manufacturer.

The DFDR installed on the incident aircraft records Radio Altitude as 26 ft when the aircraft is on the ground. The software support company M/s

Aerobytes had advised the operator to subtract 30 ft from the RA value recorded on DFDR to get the exact value. After the incident, M/s Aerobytes updated the software to rectify the error. The data for the incident flight was processed again it came to the notice that ROD shown before software update was also erroneous. As per previous data, maximum ROD below 100 ft was 945ft/min just 02 seconds before touchdown that is found 928ft/min. just a second before the touchdown as per revised data. After software update, the errors discussed above have been rectified. ROD is the more significant factor in investigation of hard landing incidents. Analysis of data before software update may not be considered as reliable for monitoring of data for exceedence specifically ROD exceedences for the particular aircraft.

**2.2. Operational Aspects:** PIC had sufficient flying experience to fly the aircraft. He had 7362:30 hrs of total flying experience out of which 7113:22 Hrs on type of the aircraft. He had flown B-737 aircraft as PIC for 3208:38 Hrs. He was not involved in any Accidents or Serious Incidents previously.

First Officer had total flying of 1575:49 Hrs out of which 1293:53 Hrs. on B-737 aircraft as First Officer. He was not involved in any accident or serious incident previously.

Both crew had valid licenses. Both the crew underwent pre-flight breath analyser test and they were found not under the influence of alcohol consumption. FDTL of both the crew was within the limit.

As per the weather reports, the expected visibility was 2500m at Mumbai Airport during the expected period of landing of VT-SFF. While approaching for landing, ATC reported same visibility in thunderstorm with rain over the airfield. The aircraft was cleared for ILS approach as runway conditions were wet. PIC requested ATC to increase the intensity of runway lights. However, he claimed that he experienced glare on the windshield due to high intensity of lights and rain below 50 ft to touch down. This indicates the error of judgement by the flight crew for landing in the existing weather conditions.

DFDR data analysis revealed that the aircraft approach for landing was at a very low pitch and continued with the nose down tendency or in level flight below 100ft RA. Increase in rate of descent also observed and just a second before the touchdown it reached to 928 ft/min. No flare was observed before allowing the aircraft for touch down and pitch change recorded from -0.7 to +0.4 at the time of touch down which was very low. All the three wheels touched the runway within a fraction of second and the aircraft made a three-pointer landing with a high vertical acceleration of 3.34g. The engines were also observed producing slightly high energy than the idle power.

A Change in wind direction from 250° to 320° with a wind speed of 3 to 4 kts was also recorded. This wind speed might not have a significant effect on the landing profile. The sudden change of wind direction might have caused some effect on the directional control of the aircraft. However, no significant changes in the directional profile were observed from the DFDR analysis.

As per CVR data, crew followed all the checklists. Possibility of go around in view of the inclement weather and unstabilised approach was never discussed by them while approaching for landing till touchdown.

The above explanation revealed that the PIC could not flare the aircraft properly and landed with an inadequate flare or no flare and with slightly high power which resulted touch down with high vertical acceleration. The crew failed to examine the feasibility of weather conditions for safe landing and to take the possibility of go around into consideration in view of unstabilised approach due to lack of flare.

**2.3. Factors Leading to Incident:** From the above analysis, it is observed that the aircraft was not properly flared and approach was at very low pitch. The weather was reported with rain over the airfield and runway conditions were reported wet. Crew did not consider the possibility of go-around in view of the adverse weather conditions and lack of flare. Just a second before the touchdown ROD increased to 928ft/min. that was very high. Aircraft touched down with slightly high power and made three pointer

landing with vertical acceleration of 3.34g against the structural limit of 2.1g. Crew reported suspected hard landing.

### **3. CONCLUSIONS:**

#### **3.1. FINDINGS:**

1. Aircraft had valid Certificate of Airworthiness. All the applicable checks for maintenance as per the approved schedule and mandatory modifications were performed on the aircraft.
2. The aircraft actual landing weight was well within the maximum landing weight permitted for the aircraft.
3. Both the crew had sufficient flying experience on the type of aircraft.
4. Both the crew had undergone Pre-Flight Breath Analyser test and they were not observed under the influence of alcohol.
5. Flight Duty Time of both the crew was found to be within the limits.
6. Weather was adverse with reported thunderstorms and rain over the airfield.
7. Runway condition was reported wet and the aircraft was cleared for ILS approach.
8. Aircraft Controls were with the PIC and First officer was the pilot monitoring.
9. Intensity of runway lights was increased on request of the PIC. The submission of the PIC that he experienced glare due to high intensity of runway lights indicates error of judgement on his part for landing in the existing weather conditions.
10. The aircraft approach was either with a nose-down tendency or had a level flight.
11. Rate of Descent just before the touchdown was recorded very high (reached 928 ft/min just a second before the touch down).
12. The aircraft was not properly flared before touch down and the pitch input (change from -0.7 to +0.4) was very low at the time of touch down.

13. The aircraft touched down with slightly high energy and made three-pointer landing with a vertical acceleration of 3.34g against the structural limit of 2.1g specified by the manufacturer.
14. Crew did not discuss or consider the possibility of go around in view of the adverse weather and unstabilised approach.
15. DFDR was recording higher value of RA when aircraft was on ground. The error has been rectified by the software company after the incident. This factor has not contributed to the incident.

### **3.2 PROBABLE CAUSES:**

Improper flare technique by the pilot flying (PF) caused the abnormal runway contact while landing.

### **4. SAFETY RECOMMENDATIONS:**

Corrective action as deemed fit by DGCA, in view of errors on the part of crew.



(Rupinder Singh)  
Investigator In-charge

Place: New Delhi  
Dated : 09.05.2022



## **ABBREVIATIONS USED IN THE REPORT**

AD	:	Airworthiness Directive
AFC	:	Airframe Cycles
AME	:	Aircraft Maintenance Engineer
AMM	:	Aircraft Maintenance Manual
ALW	:	All-up Landing Weight
ASDA	:	Accelerate-Stop Distance Available
ATC	:	Air Traffic Control
ATIS	:	Automatic Terminal Information Service
ATPL	:	Airline Transport Pilot License
AUW	:	All-up Weight
CAR	:	Civil Aviation Requirements
C.G.	:	Center of Gravity
CPL	:	Commercial Pilot License
CVR	:	Cockpit Voice Recorder
DGCA	:	Directorate General of Civil Aviation
DFDR	:	Digital Flight Data Recorder
DI	:	Daily Inspection
DVOR	:	Doppler VHF Omnidirectional Range
FDTL	:	Flight Duty Time Limitations
FEW	:	Few clouds
FO	:	First Officer
HZ	:	Haze
IAS	:	Indicated Air Speed
ICAO	:	International Civil Aviation Organisation
ILS	:	Instrument Landing System
IMD	:	Indian Meteorological Department
IST	:	Indian Standard Time
LDA	:	Landing Distance Available
MIAL	:	Mumbai International Airport Pvt Ltd
MLG	:	Main Landing Gear

NDB	:	Non Directional Beacon
NLG	:	Nose Landing Gear
NOSIG	:	No Significant Change
OVC	:	Overcast Cloud
PDR	:	Pilot Defect Report
PIC	:	Pilot-in-Command
POH	:	Pilot's Operating Handbook
PAPI	:	Precision Approach Path Indicators
QNH	:	Pressure Setting to Indicate Elevation
RA	:	Radio Altitude
RESA	:	Runway End Safety Area
ROD	:	Rate of Descent
RWY	:	Runway
SB	:	Service Bulletin
TAFH	:	Total Airframe Hours
TAF	:	Terminal Aerodrome Forecast
TODA	:	Take-off Distance Available
TORA	:	Take-off Run Available
TOW	:	Take-off Weight
UTC	:	Universal Time Coordinated
VHF	:	Very High Frequency
VOR	:	VHF Omni Range
ZFW	:	Zero Fuel Weight