



सत्यमेव जयते

**FINAL INVESTIGATION REPORT OF  
SERIOUS INCIDENT TO M/s ALLIANCE AIR  
ATR 72-600 AIRCRAFT  
VT-AIX AT DIU ON 26.01.2019**

**AIRCRAFT ACCIDENT INVESTIGATION BUREAU  
MINISTRY OF CIVIL AVIATION  
GOVERNMENT OF INDIA**

## **FOREWORD**

This document has been prepared based upon the evidences collected during the investigation and opinion obtained from the experts. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under Rule 11 of Aircraft (Investigation of Accidents and Incidents), Rules 2017 of India. The investigation is conducted not to apportion blame or to assess individual or collective responsibility. The sole objective is to draw lessons from this incident which may help in preventing such incidents in future.

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## **ABBREVIATIONS**

ATC	AIR TRAFFIC CONTROL
AGL	ABOVE GROUND LEVEL
BA	BREATH ANALYSER
CVR	COCKPIT VOICE RECORDER
DFDR	DIGITAL FLIGHT DATA RECORDER
FPS	FEET PER SECOND
MDA	MINIMUM DESCENT ALTITUDE
MOU	MEMORANDUM OF UNDERSTANDING
NOTAM	NOTICE TO AIRMEN
PF	PILOT FLYING
PM	PILOT MONITORING
PLA	POWER LEVER ANGLE
RA	RADIO ALTITUDE
ROD	RATE OF DESCENT
VFR	VISUAL FLIGHT RULES

**FINAL INVESTIGATION REPORT OF SERIOUS INCIDENT TO M/s ALLIANCE**  
**AIR ATR 72-600 AIRCRAFT VT-AIX AT DIU ON 26.01.2019**

1.	Aircraft Type	ATR 72-600
2.	Nationality	INDIAN
3.	Registration	VT - AIX
4.	Owner	M/s Elix Assets 7 Ltd.
5.	Operator	M/s Alliance Air
6.	Pilot – in –Command	ATPL Holder
7.	Place of incident	Diu Airport
8.	Last point of Departure	Mumbai
9.	Intended place of Landing	Diu
10.	Date of incident	26.01.2019
11.	Time of the incident	0744 UTC
12.	Passengers on Board	68
13.	Extent of Injuries	NIL
14.	Crew on Board	02+02
15.	Extent of Injuries	NIL
16.	Phase of Operation	Landing
17.	Type of Incident:	Abnormal Runway Contact

(ALL TIMINGS IN THE REPORT ARE IN UTC)

## **1. FACTUAL INFORMATION**

### **1.1 History of Flight**

ATR 72-600 aircraft while operating flight from Mumbai to Diu was involved in a serious incident during landing at Diu on 26.01.2019. The aircraft was under the command of pilot (PF) holding an ATPL with a CPL holder acting as PM. On the day of occurrence, prior to the incident flight, the same crew had operated Mumbai – Bhuj – Mumbai sector.

There were a total of 68 passengers and 04 crew members on board the aircraft. There was no fire or any injury to occupants onboard the aircraft.

The flight took-off from Mumbai at 0700 hours UTC and after release from Mumbai control, the aircraft came in contact with Diu ATC. Before initiating descent, the flight crew had discussed among themselves the weather, holding fuel, approach visuals and the circuit altitude. There was no NOTAM issued. The flight crew also discussed the go around altitude and the go around procedures. The flight was uneventful till top of descent. The aircraft joined right down wind for runway 05 of Diu at a circuit altitude of 1500ft.

Flap 15 was selected at a speed of 170 knots. The ROD at that moment was about 600 fpm. The aircraft was stable till 500 feet with the speed of approach as 112 knots. During final approach, close to threshold there was sudden small sideward movement/ disturbance. The aircraft floated for a while prior to final touchdown.

The touchdown was at 212 m from the threshold. The aircraft ballooned and touched (after 362 m from 1st touchdown) at 574m from the threshold. Paint marks were observed on the runway at the second point of impact. The aircraft again bounced and touched at 694 m from the threshold. During this impact, water drain rubbed with the ground for 3.3 m and the tail shoe & tail portion rubbed for 7.7 m almost parallel and by the side of centre line.

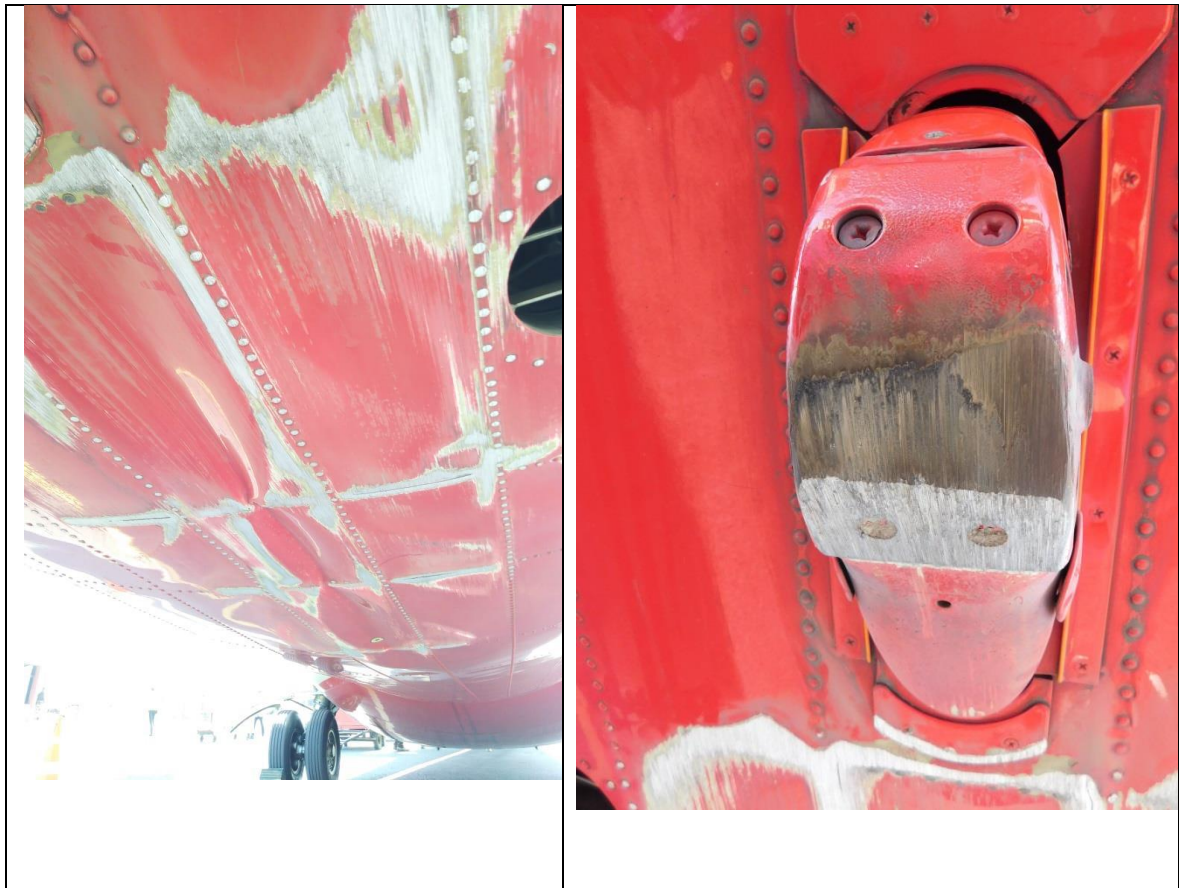
The aircraft thereafter rolled normally and taxied to apron under its own power. Normal disembarkation of passengers was carried out.

The weather reported at the time of landing at Diu was good with a visibility of approx. 6000 meters, winds 080/09 Knots and Temperature 28°C.

### 1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR / NONE	04	68	Nil

### 1.3 Damage to Aircraft



The bottom surface of fuselage rear section (Frame-33 to Frame-40) between stringer 19LH to 19 RH suffered damages.

### 1.4 Other Damage

Nil

## 1.5 Personnel information

### 1.5.1 Pilot Flying (PF)

Age	42 years
License	ATPL holder
Date of Issue	15.11.2016
Valid up to	14.11.2021
Class	Single/Multi Engine, Land
Category	Aeroplane
Endorsements as PIC	ATR72-600
Date of Med. Exam	17.12.2018
Med. Exam valid upto	16.12.2019
FRTTO License.	Valid
Total flying experience	4738 hours
Experience on Type	2820 hours
Experience as PIC on type	1823 hours
Total flying experience during last 06 months	435 hours
Total flying experience during last 90 days	242 hours
Total flying experience during last 30 days	89:58 hours
Total flying experience during last 07 Days	25 hours
Total flying experience during last 24 Hours	05:31 hours

### 1.5.2 Pilot Monitoring (PM)

Age	29 years
License	CPL holder



Date of Issue	31.03.2010
Valid up to	30.03.2020
Class	Single/Multi Engine, Land
Category	Aeroplane
Endorsements as PIC	C-172, PA-34
Date of Med. Exam	14.11.2018
Med. Exam valid upto	13.11.2019
FRTTO License.	Valid
Total flying experience	2685 hours
Experience on Type	2369 hours
Total flying experience during last 06 months	305 hours
Total flying experience during last 90 days	179 hours
Total flying experience during last 30 days	50 hours
Total flying experience during last 07 Days	08:48 hours
Total flying experience during last 24 Hours	08 hours

## 1.6 Aircraft Information

The aircraft is certified in Normal (Passenger) category, for day and night operation. The maximum operating altitude is 25,000 feet. Maximum take-off weight is 23000 Kg and maximum landing weight is 22350 Kg. The Aircraft length is 27.166 meters, wing span is 27.050 meters and height is 7.72 meters. The distance between main wheel centres is 4.100 meters and Engine Ground Clearance is 3.19 meters.

The aircraft bearing MSN 1268 was manufactured in year 2015. The aircraft was registered with DGCA under the ownership of M/s Elix Assets Ltd. The aircraft is registered under Category 'A' with Certificate of Registration No.

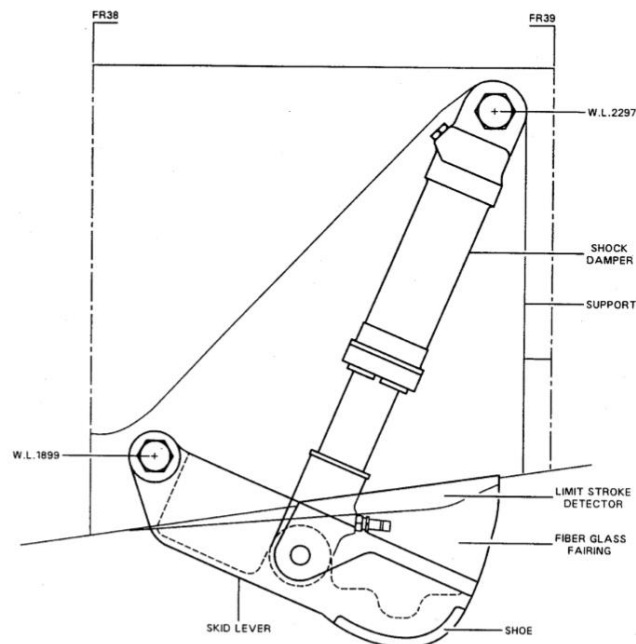
4655. The Certificate of Airworthiness Number 6765 under "Normal Category" subdivision Passenger/ Mail/ Goods was issued by DGCA.

The aircraft and its engines were maintained as per the maintenance program consisting of calendar period/ flying hours or cycles based maintenance approved by DGCA. The aircraft had logged 5164:24 airframe hours on the date of incident.

The aircraft was last weighed on 13.11.2015 and the weight schedule prepared was duly approved by DGCA. As per the approved weight schedule, Empty weight CG was 13.928 meters aft of datum. Prior to the incident flight, the weight and balance of the aircraft was well within the operating limits.

Airworthiness Directives, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine have been complied with as on date of incident.

### **Supplementary Gear**

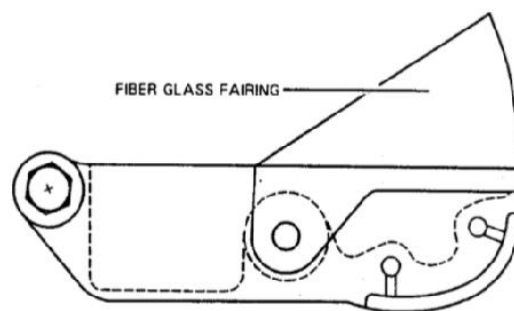


A non-retractable type tail skid is installed on the rear section of the aircraft fuselage in order to avoid fuselage contact with the runway when the take-off or the landing attitude has an angle of 8 degrees or greater. The equipment

includes a skid lever attached to the fuselage at FR 38 and a shock damper which is connected to the fuselage by a ball joint hinge at FR 39.

### **Skid lever**

The skid lever is made from an aluminum alloy forging. A replaceable stainless-steel plate (shoe), attached by four screws to the skid lever, covers the contact area. A fiber glass fairing, aerodynamically shaped, is attached by five screws to the upper part of the skid lever to prevent water and stones from entering when the tail skid is not compressed.

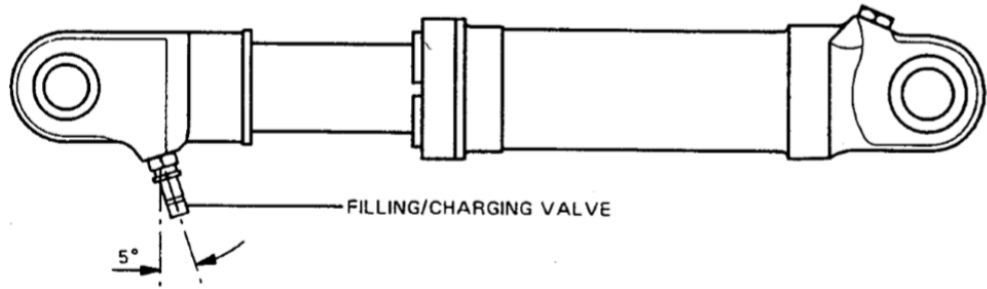


The skid lever is attached to the fuselage structure and to the shock damper by two steel pins with self-lubricating bushings. To avoid aerodynamic problems, the gap between the skid lever and the fuselage fairing, is closed by seals.

On both sides of tail skid, the fuselage is equipped with structural vertical “Limit Stroke Detectors”. These items are designed in order to be deformed when the skid lever stroke is greater than 112 mm. Only these two “Limit Stroke Detectors” are painted red.

### **Shock Damper**

The tail skid shock damper is an oleo-pneumatic type with a separator piston between the oil and the nitrogen. The nitrogen chamber is located in its lower part and the upper cylinder is hinged to the fuselage structure and the lower one (sliding rod) is hinged to the skid lever.



**1.7 Meteorological information**

The following is the meteorological information of the date of incident as per METAR for Diu Airport,

Time (UTC)	Wind Dir (Degree)	Speed (kts)	Visibility (meters)	Temp (°C)	QFE (hpa)	QNH (hpa)
0700	090	10	6000	28	1018	1019
0730	080	09	6000	28	1018	1019

**1.8 Aids to navigation**

There was no navigational aid available at the airport. Aircraft carried out VFR approach.

**1.9 Communications**

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

**1.10 Aerodrome information**

There is one single runway 05/23 having dimensions 1634 m X 45 m at Diu. The airport has no functional navigational aids. The ATC is controlled and manned by Airport Authority of India.

On 05 end of the runway, there are trees and is very close to the sea. The direction of winds keeps on varying due topography creating downdraft for touchdown.



**Satellite Image (Google) of Diu Airport**



**Diu Airport (CCTV Image)**

### **1.11 Flight recorders**

The aircraft was equipped with Cockpit Voice Recorder (CVR) and Digital Flight Data Recorder (DFDR) as given below:

**CVR:** Make: L3, Part No. 2100-1225-22, S/N: 001266147

**DFDR:** Make: L3, Part No. 2100-4245-00, S/N: 001209500

The data was downloaded and was available for investigation. The CVR replay indicated that the crew were not wearing headsets.

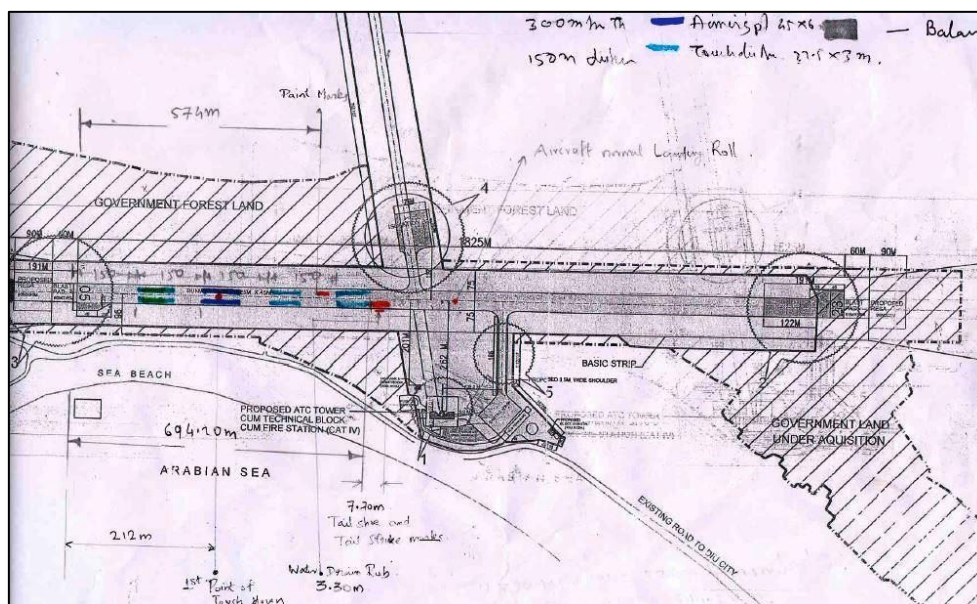
**Relevant DFDR readout is as follows:-**

GMT	IAS Kts	Radio Alt Ft	Vert Acc G	Pitch Att Deg	Roll ATT Deg	PLA1 Deg	PLA2 Deg	Wind Dir Deg	Wind Spd Kts
7:44:26	122	79	1.14	0	2	45	45	43	13
7:44:27	116	77	0.96	0	-1	44	44	43	13
7:44:28	118	70	0.96	-1	-4	44	44	44	13
7:44:29	118	62	0.95	-1	1	44	44	44	13
7:44:30	118	53	0.93	-1	0	44	44	44	13
7:44:31	116	44	0.98	-1	5	44	44	44	13
7:44:32	115	33	1.14	1	-3	44	44	42	13
7:44:33	113	26	1.19	1	-2	44	44	42	13
7:44:34	115	20	1	-1	3	44	44	42	13
7:44:35	117	14	0.9	-1	4	44	44	43	13
7:44:36	117	7	1.07	1	2	44	44	44	13
7:44:37	117	4	1.3	4	-1	36	36	44	13
7:44:38	112	4	0.92	1	-4	36	35	44	13
7:44:39	107	1	0.87	1	-4	36	35	44	13
7:44:40	103	1	1.71	7	-1	36	36	43	13
7:44:41	103	4	0.96	5	3	36	36	44	13
7:44:42	98	5	0.8	2	7	36	36	46	12
7:44:43	100	1	0.97	5	5	36	36	46	12
7:44:44	102	2	1.13	8	-1	36	36	47	12
7:44:45	93	6	0.81	7	0	19	19	47	12
7:44:46	87	1	0.68	6	2	19	18	48	12
7:44:47	83	-3	0.4	-1	1	19	18	48	12
7:44:48	79	-1	1.08	4	0	19	18	47	12
7:44:49	80	-2	0.98	4	1	20	19	47	11
7:44:50	77	-3	0.97	0	1	19	18	47	11
7:44:51	77	-3	1.02	0	1	19	18	47	11
7:44:52	69	-4	1.08	0	0	19	18	47	11
7:44:53	63	-4	1.04	-1	-1	19	18	47	11
7:44:54	60	-3	0.99	0	0	19	18	48	11
7:44:55	58	-4	1.02	0	0	19	18	48	11



### 1.12 Wreckage and impact information

The touchdown was 212 m from the threshold. Thereafter, aircraft ballooned and touched (after 362 m from 1st touch) at 574 m from threshold. It bounced and touched at a distance of 694 m from threshold. The impact with ground during first touchdown was heavy. The airplane bounced yet again and after covering a distance of 874m (from threshold), it continued to roll normally. The second bounce was shallow and the aircraft after stopping on the runway taxied to apron under its own power. During touchdown, tail of the aircraft got rubbed against the runway surface.



**Sketch indicating impact / rubbing marks on the runway**



**The Aircraft position at the time of ballooning**



**The Aircraft position at the time of first impact**



**The Aircraft position at the time of second impact**





**Tail Skid marks during the first impact**



**Tail Skid marks during second impact**

### **1.13 Medical and pathological Information**

Both cockpit crew and cabin crew had undergone Breath analyser check during the pre-flight medical check prior to the flight and BA result were found negative. After the incident, the breath analyser test was carried out and the same was found to be negative.

### **1.14 Fire**

There was no fire.

### **1.15 Survival aspects**

The incident was survivable.

### **1.16 Tests and research**

Nil

### **1.17 Organizational and management information**

The organisation is headed by CEO who reports directly to the Chairman of M/s Air India. The ED (Ops) and Chief of Flight Safety are accountable for day to day running of the airline. All services pertaining to engineering are outsourced to AIESL which is a subsidiary of M/s Air India.

The operator has MOU with Air India for all Ground Handling duties & management and for Airlines Security & management.

### **1.18 Additional information**

#### **1.18.1 Stabilized Approach Procedure**

Flight crew as per Company Policy will execute a missed approach or go around if the aircraft is not stabilized. An approach is considered stabilized when all of the following criteria are met:

- Aircraft is in landing configuration
- On the correct flight path
- The indicated air speed is not more than  $V_{ref}+10$  Knots and not less than  $V_{ref}$

- Sink rate is not more than 1000 feet per minute. A special briefing is required if the rate of descent required is more than 1000 feet per minute.
- Power setting is appropriate for the aircraft configuration
- All briefings and checklists are complete

It is a known fact that crew had not gone around in majority of cases when the situation clearly called for a go around. The execution of a missed approach is neither an indication of poor performance nor the regulator requires any explanation for carrying out a missed approach due to not being stabilized on approach.

In case approach gets destabilized or cannot be stabilized, the PM is required to call "Approach Not stabilized". If there is no reaction from PF, he will again call "Approach Not Stabilized Go Around." PF will immediately carry out a "go around".

#### **1.18.2 Minimum Altitude for Stabilised Approach**

If an approach gets destabilized due to any significant deviation, it must be stabilized latest by

- a) 1000 ft AGL on a precision approach
- b) Establishing the required visual segment and leaving MDA for non precision approach
- c) 500 ft AGL on a visual approach

#### **1.18.3 ATR Abnormal & Emergency Procedures**

As per the ATR Abnormal & Emergency Procedure, bouncing at landing usually is the result of combination of Windshear, Thermal activity, Excessive sink rate, late flare initiation, incorrect flare technique, Excessive airspeed and Power-on touchdown.

In order to prevent bouncing, it is emphasized that there should be correct approach speed and correct rate of descent. The correct landing technique is Power reduction shall be initiated passing 210 ft. The touchdown shall occur with power levers at Flight Idle. In coordination with power reduction, the pilot flying progressively adjusts aircraft pitch to flare the aircraft.

### **1.18.3.1 Recovery from a light bounce (Five feet or less)**

In case of a light bounce, the following typical recovery technique can be applied:-

- Maintain a normal landing pitch attitude:
  - Do not increase pitch or allow the pitch attitude to increase, particularly following a firm touchdown with a high pitch rate.
- Continue the landing;
- Keep thrust at idle; and,
- Be aware of the increased landing distance.

### **1.18.3.2 Recovery from a high bounce (More than five feet)**

In case of a more severe bounce, do not attempt to land. The following rejected landing technique must be applied.

- Maintain a normal landing pitch attitude
- Initiate a rejected landing by advancing power levers to the ramp.
- Maintain the landing gear and flap configuration
- Be ready for a possible second touch down
  - Do not try to avoid a second touchdown during the go-around. Should this happen, the second touch down would be soft enough to prevent damages to the aircraft, if pitch attitude is maintained.
- When safely established in the rejected landing and no risk of further touchdown exists (i.e., with a steady positive climb), follow normal go-around procedure.

## **1.19 Useful or effective investigation techniques**

Nil

## **2. ANALYSIS**

### **2.1 General**

- Both operating crew were appropriately licensed and qualified to operate the flight.
- The aircraft had a valid Certificate of Airworthiness and was issued Certificate of Release to Service at the airport of departure. Airworthiness Directive, Service Bulletins, DGCA Mandatory Modifications were complied with. Transit inspections were carried out as per approved transit inspection schedules and all higher inspection schedules including checks/ inspection as per the manufacturer's guidelines specified in Maintenance Programme and approved by the Quality Manager.
- The weather at the airport at the time of incident was fine and is not a contributory factor to the incident.
- On 05 end of the runway, direction of winds keeps on varying due topography and seasonal thermal effects creating downdraft for touchdown.

### **2.2 Circumstances leading to the incident**

Following analysis of the occurrence has been carried out based on DFDR data and the CCTV footage.

#### **(A) Aircraft at 79 feet above the ground**

During approach into Diu, when aircraft was at 79 feet above ground, the flight data indicates that the aircraft was in landing configuration with flaps 30, Gross Weight 21320 Kgs, winds of 13 kts. from 043 degrees and IAS of 122 Kts. Calculated Vapp was 113 Kts. with a pitch of 0 degrees. Power Lever Angle (PLA) for both engines 1 & 2 was 45/45.

From the CCTV footage, it could also be seen that the aircraft was experiencing light turbulence due to winds because of adjacent topography and the seasonal thermal effect.



Aircraft at 79 feet (approx.) above the ground

**(B) 53 feet Radio Altitude to Momentary Touchdown**

When the aircraft was at 53 feet RA, the flight data indicates that the aircraft was in landing configuration with flap 30, pitch of -1 degrees, experiencing winds from 044 degrees at 13 kts with an IAS of 118 Kts. PLA of both engines was 44/44. Power Lever Angle (PLA) for Engine 1 & 2 was moved from 44/44 (07:44:36) to 36/36 (07:44:37) i.e. there was slight reduction in PLA. There was a drop in IAS by 5 Kts from 122 Kts at 79 feet RA to 115 Kts at 20 feet RA. Descent Rate observed at 07:44:27 was -2 fps which increased to -11 fps by 07:44:32 in 5 seconds clearly indicating a sink.



Flare initiation

Between approximately 50 feet RA and the flare initiation, the aircraft was observed on CCTV footage to be “sinking” at a very fast rate, this could be attributed to either down draft causing loss of speed as there was no change in power setting during that period.



Ballooning

To arrest this aircraft 'sink', PF gave a 'pitch up' input which lead to the aircraft ballooning with a momentary touch of the runway (also observed from the CCTV footage). PF controlled the sink rate from -11 fps (descent) at 07:44:32 to -1 fps at 07:44:40.

Pitch increased from -1 degrees to 4 degrees over 2 seconds & then reduced to 1 degree and then increased to 7 degrees over 3 seconds. (DFDR time frame from 07:44:35 to 07:44:40).

At the time of momentary ground contact, aircraft 'Pitch' was 7 degrees and the IAS had dropped to 103 Kts. Aircraft speed dropped by 19 Kts from 79 feet RA (07:44:26) to touchdown (07:44:40).

**(C) First momentary touchdown to first positive touchdown**

During ballooning it is observed that the PIC gave forward nose input which can be seen in the CCTV footage & flight data with the pitch reducing from 7 degrees to 5 and then to 2 degrees over 2 seconds. (DFDR time frame from



07:44:40 to 07:44:42). Between 07:44:40 to 07:44:42, aircraft bounce had reached a “Radio Altitude of more than 5 feet”.



First Touchdown



Maximum Bounce height (more than 5 feet)

After first touchdown, the pitch increased to 8 degrees (07:44:44) and aircraft then bounced to 6 feet RA.





Pitch before 2<sup>nd</sup> touch down

**(D) Positive touchdown**

CCTV footage & DFDR data shows a pitch attitude of -1 degrees and IAS of 83 Kts. Power Lever Angle (PLA) Engine 1 & 2 were moved from 36/36 to 19/18 between 07:44:44 to 07:44:47.



2<sup>nd</sup> touchdown (tail touching)

### **3 CONCLUSION**

#### **3.1 Findings**

1. The aircraft was having a valid Certificate of Registration and Certificate of Airworthiness.
2. All maintenance schedules, mandatory modifications and checks were carried out as per the requirements. There were no defects / snags pending rectification.
3. The weather reported at the time of landing was visibility approx. 6000 meters, winds 080/9 Knots and temperature 28<sup>0</sup>C.
4. The aircraft was on a scheduled flight (Mumbai – Diu) under the command of an appropriately licensed ATPL holder with a CPL holder acting as First Officer.
5. This was the third sector of the day operated by the same crew.
6. The medical of both cockpit crew members was valid. Both had undergone pre-flight medical checks including BA & post –Flight medical checks, which was negative.
7. The aircraft while landing on R/w 05 end experienced light turbulence due to change of wind direction.
8. The flight crew was operating to the airfield for more than a year and used to manage the typical wind movements by maintaining speed little higher than the calculated approach speed.
9. No abnormalities were observed on the flight from Mumbai, enroute and till flare at Diu.
10. The approach got destabilized owing to the loss of speed (19 Kts) due to sink experienced between 53 feet RA and flare height. PF tried to control the approach by giving pitch up input leading to ballooning of the aircraft to 5 feet RA (07:44:42) after momentary contact with the runway surface.
11. After the ballooning / momentary touchdown, the PF permitted the aircraft pitch from 7 degrees at touchdown (07:44:40) to decrease to 2 degrees (07:44:42) and then increased to 8 degrees at second touchdown (07:44:44).

12. After the touchdown, the aircraft again bounced up to 6 feet RA (07:44:45). The flight crew should have initiated a go-around as per the ATR Bounce Landing recovery technique.


### 3.2 Probable cause of the Accident

- Unstabilised Approach due to sudden downdraft just after flaring and pilot not going around resulted in ballooning followed by bouncing (twice) of the aircraft which was aggravated due to wrong bounce recovery technique.
- Pilot Monitoring not calling out for Go-Around

## 4 SAFETY RECOMMENDATIONS

- 4.1 The operator may incorporate proper Go Around procedures in case of unstabilised approach and bounce recovery technique in line with ATR procedures.
- 4.2 The operator may emphasize the bounce recovery techniques in every ground refresher and simulator training.

  
(Shilpy Satiya)  
Investigator

  
(R.S. Passi)  
Investigator-In-Charge

Date: 31/01/2020  
Place: Delhi