



सत्यमेव जयते

Final Investigation Report
on Serious Incident involving Alliance Air's
ATR-72-212A aircraft bearing registration VT-AIW
at Jabalpur on 12 March 2022

Aircraft Accident Investigation Bureau
Government of India
Ministry of Civil Aviation

FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an Accident/Incident shall be the prevention of accidents and incidents and not to apportion blame or liability. The investigation conducted in accordance with the provisions of the above said rules shall be separate from any judicial or administrative proceedings to apportion blame or liability.

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

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GLOSSARY

AAIB	Aircraft Accident Investigation Bureau
AAAL	Alliance Air Aviation Limited
AAL	Above Aerodrome Level
AIAHL	AI Asset Holding Limited
ABP	Able bodied passenger
AFM	Airplane Flight Manual
AIP	Aeronautical Information Publication
AMSL	Above Mean Sea Level
AOC	Air Operator Certificate
APP	Approach
ARC	Airworthiness Review Certificate
ASDA	Accelerate Stop Distance Available
ASR	Airport Surveillance Radar
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATPL	Airline Transport Pilot License
AUW	All Up Weight
C of A	Certificate of Airworthiness
CDFA	Continuous Descent Final Approach
CPL	Commercial Pilot License
CSN	Cycles Since New
CVR	Cockpit Voice Recorders
DA	Decision Altitude
DFDR	Digital Flight Data Recorder
DGCA	Directorate General of Civil Aviation
DME	Distance Measuring Equipment
DVOR	Doppler Very High Frequency Omni Range
ETA	Expected Time of Arrival
F/O	First Officer
FCOM	Flight Crew Operation Manual
FCTM	Flight Crew Training Manual
FDAP	Flight Data Analysis Program
FI	Flight Idle
ft	Feet
FRTOL	Flight Radio Telephone Operators' License
GI	Ground Idle
Hrs	Hours
IAS	Indicated Air Speed
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
IFR	Instrument Flight Rules
ILS	Instrument Landing System
IST	Indian Standard Time
Km	Kilometer
Kt	Knot
LATG	Lateral G

LDA	Landing Distance Available
LDTA	Landing Distance at time of arrival
LH	Left Hand
LLZ	Localiser
m	Metres
MDA	Minimum Decision Altitude
MEL	Minimum Equipment List
MHz	Mega Hertz
MLG	Main Landing Gear
MSN	Manufacturer's Serial Number
MTOW	Maximum Take Off Weight
NDB	Non Directional Beacon
NLG	Nose Landing Gear
NM	Nautical Miles
OM	Operations Manual
PA	Passenger Address
PAPI	Precision Approach Path Indicators
PF	Pilot Flying
PIC	Pilot in Command
PL	Power Lever
PM	Pilot Monitoring
QNH	Q Nautical Height
QRH	Quick Reference Handbook
RA	Radio Altitude
RESA	Runway End Safety Area
RH	Right Hand
RNAV	Area Navigation
SALS	Short Approach Lighting System
SB	Service Bulletin
SSFDR	Solid State Flight Data Recorder
TDZ	Touch Down Zone
TODA	Take-off Distance Available
TORA	Take-off Run Available
UTC	Universal Time Coordinated
VAJB	Jabalpur
V _{APP}	Approach Velocity
VFR	Visual Flight Rules
VIDP	Delhi
VMC	Visual Meteorological Conditions
VOR	VHF Omni directional Range

SYNOPSIS

On 12 Mar 2022, Flight 9I-9617 was scheduled to operate from Delhi to Jabalpur. The flight was operated by ATR-72-212A (600) aircraft bearing registration VT-AIW. The flight was operated by an ATPL holder PIC and a CPL holder Co-Pilot and they were assisted in the cabin by 02 cabin crew. There were 55 passengers on board the aircraft.

During landing at Jabalpur, the aircraft crossed the threshold at a height of about 60 feet and floated for approximately 19 seconds before making a late touchdown more than half way down the runway and bounced before touchdown again at about 1600 m from beginning of the Runway 24. The aircraft was left with only about 400 m of runway for braking. The aircraft continued to roll and started to deviate to the left of runway centerline as it exited the runway and entered RESA.

The aircraft rolled further in the RESA and came to halt about 60 m ahead of runway end and about 45 m left of runway center line. Airport Rescue and Fire Fighting vehicles also arrived at the site. As no fire or fuel leakage was found, no fire extinguishing agent or media was used. All passengers safely deplaned and were transported to the arrival area.

The occurrence was classified as a Serious Incident as per Aircraft (Investigation of Accidents and Incidents) Rules, 2017. With approval of Ministry of Civil Aviation, Sh Jasbir Singh Larhga, Deputy Director, AAIB was appointed as Investigator-in-Charge and Sh K Ramachandran, Assistant Director was appointed as Investigator to carry out investigation into circumstances of this serious incident vide order no. INV-12011/2/2022-AAIB dated 21 Mar 2022, under Rule 11(1) of Aircraft (Investigation of Accidents and Incidents) Rules, 2017

Final Investigation Report on Serious Incident involving Alliance Air's ATR-72-212A aircraft bearing registration VT-AIW at Jabalpur on 12 Mar 2022			
1.	Aircraft	Type	ATR 72-212A (600)
		Nationality	Indian
		Registration	VT-AIW
2.	Owner		M/s Gate District Ireland 4 Limited
3.	Operator		M/s Alliance Air Aviation Limited
4.	Pilot in Charge		ATPL Holder
5.	Co-Pilot		CPL Holder
6.	No. of Persons on board		59
7.	Date & Time of Incident		12 Mar 2022, 07:44 UTC
8.	Place of Incident		Jabalpur Airport
9.	Co-ordinates of Incident Site, AMSL		23°10'21"N 80°02'36"E, 1575 ft
10.	Last point of Departure		Delhi (VIDP)
11.	Intended landing place		Jabalpur (VAJB)
12.	Type of Operation		Scheduled
13.	Phase of operation		Landing
14.	Type of Occurrence		Abnormal Runway Contact and Runway Excursion
15.	Extent of Injuries		Nil

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

1. FACTUAL INFORMATION

1.1 History of flight

On 12 Mar 2022, Flight 9I-9617 was scheduled to operate from Delhi to Jabalpur. The flight was operated by ATR-72-212A aircraft bearing registration VT-AIW. The flight was operated by an ATPL holder PIC and a CPL holder Co-Pilot and they were assisted in the cabin by 02 cabin crew. There were 55 passengers on board the aircraft.

Aircraft departed from Delhi Runway 29 at 0553 UTC and cruised at FL170. Cruise and approach to Jabalpur were uneventful. While preparing for arrival at Jabalpur the aircraft speed was reduced to 170 kt. While the aircraft was at about 80 NM from Jabalpur, 2-way communication was established with ATC Jabalpur. At about 0717 UTC, crew reported ETA of 0735 UTC to ATC Jabalpur. ATCO informed the crew of 05 kt winds with bearing 310 degrees, 5 km visibility in haze, no significant clouds, 30°C temperature, 09°C dew point and QNH 1015.

At 0724 UTC while at about 54 DME (Distance Measuring Equipment), the crew requested ATC permission to descend and flight was cleared to descend up to FL110. Later, at 0729 UTC while at 30 DME, the crew requested further descend and were cleared for descend to transition level FL60. At 0732 UTC while at 20 DME crew requested further descend and were cleared for VOR/DME arc approach for Runway 24. While at 13 DME the speed was reduced and aircraft was prepared for VOR/DME arc approach for Runway 24. At 0740 UTC crew reported crossing final approach fix and were cleared to land. Surface winds reported at that time was 340°/05kt. Descent was initiated from 3200 ft for Continuous Descent Flight Approach (CDFA). Landing gear was extended at 07 DME and flaps were selected at 30 degree. As per the statement of the crew, they experienced thermal updrafts and the condition levers were set at 100% over ride in order to get more drag during descent.

The aircraft crossed the threshold at a height of about 60 ft and floated for approximately 19 seconds before making a late touchdown more than half way down the runway and bounced before touchdown again at about 1600 m from beginning of the Runway 24. The aircraft was left with only about 400 m of runway for braking. Fire services were alerted by the ATCO as he saw aircraft making a late touchdown. The aircraft rolled and started to deviate to the left of runway centerline as it exited the runway and entered RESA. The aircraft rolled further in the RESA and came to halt about 60 m on the unpaved area ahead of runway end and about 45 m left of runway center line.

After the aircraft stopped the crew shut down the engines. The Cabin Crew waited for command from the cockpit and checked outside for condition. No fire or signs of fuel leakage were noticed. All passenger in the cabin were safe. Cabin Crew In-Charge called cockpit and enquired about cockpit situation. Situation of the cabin was also communicated to the cockpit crew.

Airport Rescue and Fire Fighting vehicles also arrived at the site. As no fire or fuel leakage was found, no fire extinguishing agent or media was used. PIC called for normal disembarkation and accordingly cabin crew announced all passengers to vacate the aircraft one by one with their hand baggage. All passengers safely deplaned and were transported to the arrival area.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Total
Fatal	0	0	0
Serious	0	0	0
Minor	0	0	0
None	04	55	59

1.3 Damage to aircraft

The aircraft suffered damage primarily to its #03 and #04 RH Main Landing Gear wheels. RH Main Landing Gear brake hydraulic pipes were damaged and LH Taxi Light Bracket on the Nose Landing Gear was damaged as can be seen in the Fig 1 below:



Figure 1: Damages on Landing Gear

1.4 Other damage

Two Runway End Lights were reported damaged as the aircraft exited the Runway. Figure 2 shows the aircraft wheel marks passing over Runway end lights.

The lights were repaired before the resumption of runway operations.



Figure 2: Aircraft wheel marks on runway

1.5 Personnel Information

1.5.1 Pilot in Command

Age	32 Years
License	ATPL
Date of Issue of License	06 January 2020
License Validity	05 January 2025
Date of Class I Med. Exam.	21 September 2021
Class I Medical Validity	20 September 2022
Date of issue FRTOL License	15 June 2012
Validity of FRTOL License	17 July 2033
Endorsements as PIC	17 May 2021
Total flying experience	3000 Hrs
Total flying experience on type	2766.40 Hrs
Last Flown on type	ATR 72/600
Total flying experience during last 1 year	213:32 Hrs
Total flying experience during last 6 Months	213:32 Hrs
Total flying experience during last 30 days	40:58 Hrs
Total flying experience during last 07 Days	12:09 Hrs
Total flying experience during last 24 Hours	01:56 Hrs
Rest period before flight	39:00 Hrs

PIC had joined Alliance Air in Dec 2016 as a Co-Pilot and was released for flying as co-pilot in Aug 2017. She was issued ATPL by DGCA in Jan 2020 and was released for Line Flying as PIC in Oct 2021. She had undergone her last Flight Check and Ground Classes on 28 Oct 2021.

1.5.2 Co-Pilot

Age	35 Years
License	CPL
Date of Issue of License	11 March 2014
License Validity	01 April 2024
Date of Class I Med. Exam.	09 May 2022
Class I Medical Validity	22 May 2023
Date of issue FRTOL License	12 Nov 2013
Validity of FRTOL License	11 Nov 2023
Endorsements as First Officer	21 Feb 2020
Total flying experience	1800 Hrs
Total flying experience on type	1476.07 Hrs
Last Flown on type	ATR 72/600
Total flying experience during last 1 year	511:22 Hrs
Total flying experience during last 6 Months	511:22 Hrs
Total flying experience during last 30 days	45:25 Hrs
Total flying experience during last 07 Days	04:9 Hrs
Total flying experience during last 24 Hours	04:9 Hrs
Rest period before flight	16:20 Hrs

The Co-Pilot had completed his annual Ground Training on 29 May 2021 and undergone his last Proficiency Check on 23 Jul 2021

1.6 Aircraft Information

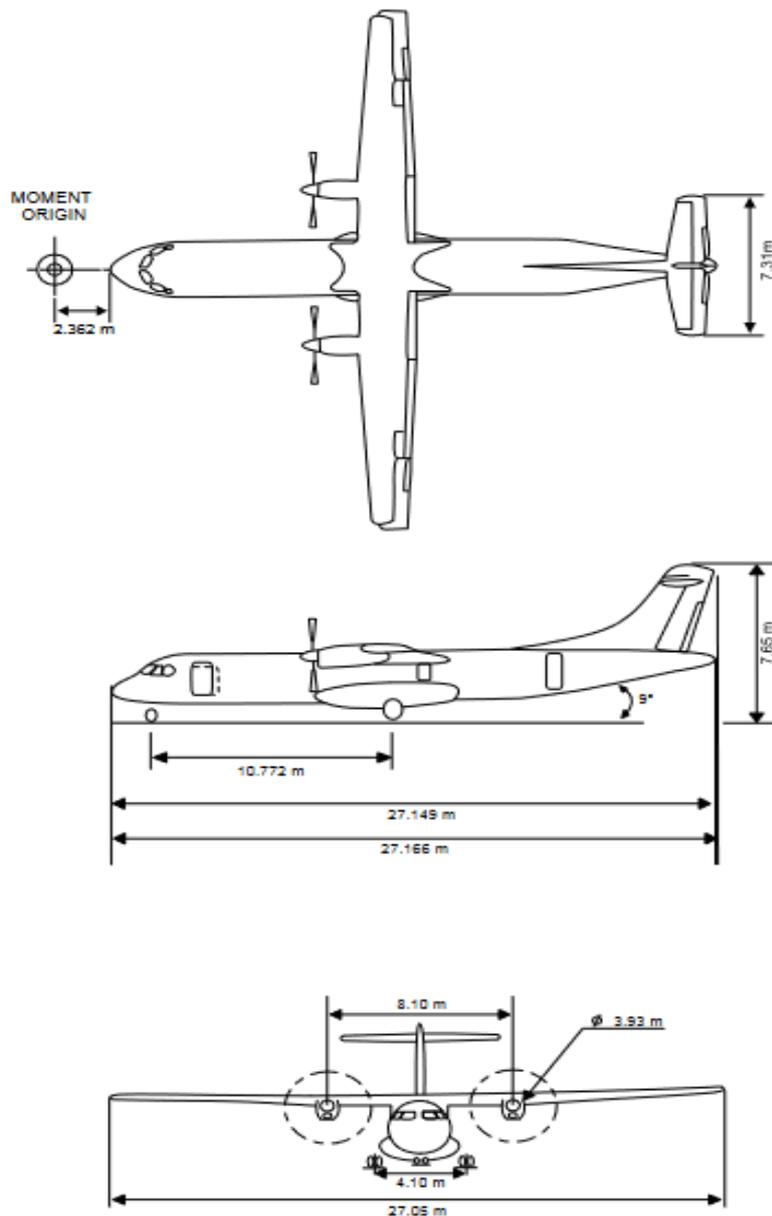


Figure 3: Aircraft Layout

The ATR 72-212A is a twin-engine turboprop, short-haul aircraft manufactured by ATR-GIE (Avions de Transport Régional). The aircraft is certified in the transport category for day and night operations, in the following conditions when the appropriate equipment and instruments required by the airworthiness and operating regulations are approved, installed and in an operable condition:

- VFR and IFR
- Flight in icing conditions
- Reverse thrust taxi (single or twin engine)

The aircraft VT-AIW was manufactured by M/s ATR-GIE in Oct 2015. The aircraft bearing MSN 1272, was registered in India under ownership of M/s Gate District Ireland 4 Limited with M/s DAE

Leasing (Ireland 17 Limited) as a Lessor and Alliance Air Aviation Limited as an Operator. The Certificate of Registration was issued on 28 July 2021 and was valid up to 13 Oct 2027. The initial Certificate of Airworthiness was issued on the aircraft on 10 Nov 2015 in Normal category Sub-division Passengers/Mail/Goods.

The Certificate of Airworthiness remains valid subject to validity of Annual Renewal Check (ARC). The last Annual Renewal Check was carried out on 02 Feb 2022 and valid up to 02 Feb 2023. The minimum operating crew requirement was 'two' and maximum all up weight was 23000 Kg. The operations limitation for tailwind conditions is 10 kt and crosswind limitation for operations on a dry runway is 35 kt. The aircraft can operate on runway with maximum mean Runway Slope of \pm 2%.

The aircraft was last weighed on 18 Sept 2021 and the weight schedule was prepared and duly approved by DGCA. As per the approved weight schedule the empty weight of the aircraft is 13358 Kg. Maximum usable fuel quantity is 5000 Kg. Maximum payload with fuel tanks full is 4134 Kg. Empty weight CG is 13.99 m aft of Datum. The next weighing is due on 17 Sep 2025. The maximum take-off weight of the aircraft was 23000 Kg. The weight and balance of the aircraft was within the operating limits.

The scrutiny of the Aircraft Log books revealed that as on date of occurrence, the aircraft had completed 12328:44 Hrs. The aircraft was equipped with two PW127M engine. The LH Engine had completed 8125:37 Hrs and 7517 CSN on the date of incident. The RH Engine had completed 5440:32 Hrs and 5020 CSN on the date of incident. All applicable AD, SB and modifications were complied on aircraft on the day of incident.

The aircraft and its engines were being maintained as per the DGCA approved 'Aircraft Maintenance Program' consisting of calendar period/ flying hours or cycles. Last major inspection before the incident was 1A Check carried out on 06 Oct 2019. Subsequently, all inspections (Pre-flight checks, Extended Transit, 'A' Checks) were carried out as and when due before the incident.

1.7 Meteorological Information

Weather reported as per Jabalpur METAR from 0700UTC to 0800 UTC is as below:

Jabalpur METAR	0700 UTC	0730 UTC	0800 UTC
Wind	310°/05 knots	010°/07 knots	320°/07 knots
Visibility	5000m	5000 m	5000 m
Weather	HAZE	HAZE	HAZE
Clouds	NSC	NSC	NSC
Temperature	30°C	30°C	31°C
Dew pt	09°C	09°C	09°C
QNH	1015	1014	1014

The winds reported to crew at the time of landing clearance was 340° and 05 kt.

1.8 Aids to Navigation

Jabalpur airport is equipped with DVOR/DME. The identification is JJB is available on CH83X on frequency 113.600 MHZ. The coordinates of transmitting antenna are 231046.0N, 800334.7E

1.9 Communications

Air Traffic Services communication facility is available at Jabalpur Airport on frequency 122.33 MHZ. VT-AIW came in contact with Jabalpur Tower at 0717 UTC and maintained positive contact with ATC till the end of flight. The transcript of relevant communication with ATC is tabulated below:

Time (UTC)	Caller	Narrative
07:17:30	LLR617	JABALPUR LLR617
07:17:34	TWR	LLR617 JABALPUR TOWER
07:17:47	TWR	...LATEST JABALPUR METAR, SURFACE WIND 310 DEGREE 05 KNOTS, VISIBILITY 5KMS, WEATHER HAZE, NO SIGNIFICANT CLOUD, TEMPERATURE 30, DEW POINT 09, QNH 1015
07:24:10	LLR617	JABALPUR LLR617 REQUEST DESCEND
07:24:16	TWR	REPORT PRESENT POSITION
	LLR617	54 DME INBOUND JJB ON RADIAL 356
07:25:22	TWR	LLR617, DESCEND TO FL110
07:29:04	LLR617	REQUEST FURTHER DESCEND LLR617
07:29:08	TWR	REPORT PRESENT POSITION
	LLR617	30 DME INBOUND
	TWR	... DESCEND TO TRANSITION LEVEL FL60 QNH 1015
07:32:01	LLR617	LLR617 REQUEST FURTHER DESCEND, 20 DME INBOUND
07:32:08	TWR	... CLEARED VOR DME ARC APPROACH RUNWAY 24...
	TWR	REPORT LEVEL PASSING
	LLR617	7000 NOW
07:40:54	LLR617	FINAL APPROACH FIX RUNWAY 24, LLR617
	TWR	LLR617, TOWER, RUNWAY 24 CLEARED TO LAND SURFACE WIND ZERO CORRECTION 340 DEGREE 05 KNOTS
07:44:35	TWR	LLR617 JABALPUR TOWER
07:45:22	LLR617	SIR REQUEST TO SHUT DOWN AT PRESENT POSITION
07:45:34	TWR	CFT ARE COMING TO SITE SIR

1.10 Aerodrome Information

Jabalpur Airport is located about 20 km from Jabalpur City. The IATA code is JLR and ICAO code is VAJB. The geographical co-ordinates of Jabalpur Airport are **23°11' 00.12" N, 080°03'37.57" E**. Airport elevation is 1626 feet. The Airport Reference code is 4C. The Runway Characteristics as per the AIP is given below:

Runway	Dimensions of runway (in m)	THR elevation and highest elevation of TDZ of precision APP runway	Slope of runway and associated stopway	Dimensions of strips (in m)	Dimensions of runway end safety areas (in m)
06	1988 x 45	THR:1575.0 FT TDZ: 1592.0 FT	0.77%	2108 x 150	90 x 90
24	1988 x 45	THR:1626.0 FT TDZ: 1626.0 FT	-0.77%	2108 x 150	90 x 90

Strength of pavement (PCN and associated data) and surface of runway and associated stop-ways is published as 44/F/C/X/U Asphalt. PCN in THR 06 to 610 m is published as 48/R/C/X/U. The declared distances at Jabalpur Airport are as below:

Runway Designator	Take-off run available TORA (m)	Take-off distance available TODA (m)	Accelerate stop distance available ASDA (m)	Landing distance available LDA (m)
06	1988	1988	1988	1988
24	1988	1988	1988	1988



Figure 4: Satellite image of Jabalpur Airport

Details of Approach and Runway lightings at Jabalpur Airport as per published e-AIP, India is given below:

Runway Designator	Type, length and intensity of approach lighting system	Runway threshold lights, colour and wing bars	Type of visual slope indicator system	Length, spacing, colour and intensity of runway edge lights	Colour of runway end lights and wing bars
06	SALS 300 M	Green	PAPI LEFT/3.00 DEG	1988 M 60 M White LIH	Red
24	LIH				

Runway friction test at Jabalpur is carried out on annual basis as per the approved Aerodrome Manual. The Regional Headquarter of Airport Authority of India at Mumbai airport provides airport with surface friction test vehicle to test the friction as per requirement. The last friction test carried before the incident was on 23 July 2021, the results are given below:

Speed	Friction Coefficient at 03 M from CL	Friction Coefficient at 06 M from CL
95 Km/hr	0.85 μ	0.83 μ
65 Km/hr	0.84 μ	0.84 μ

The maintenance planning level for Runway Friction is 0.47 μ and Minimum Friction Level is 0.34 μ . The result of Friction test done on 23 July 2021 was satisfactory.

The ARFFS are determined as per ICAO Annex 14 Chapter 9 table 9.1. Critical aircraft for Jabalpur Airport B-737 and accordingly the ARFFS as per category VI is provided at Jabalpur Airport.

The airport has been granted following temporary exemptions for Civil Aviation Requirements by DGCA as per the Aerodrome Manual.

SI No	CAR Section / DGCA Observation no.	Exemption	Temporary / permanent
1.	3.4.4	A strip including a non-precision approach runway shall extend laterally to a distance of at least: 150 m where the code number is 3 or 4; and 75 m where the code number is 1 or 2; on each side of the centre line of the runway and its extended centre line throughout the length of the strip.	Temporary Upto 31.03.2022.
2.	3.4.8 3.4.12,3.4.13, 3.4.14,3.4.16	Grading of runway strips That portion of a strip of an instrument runway within a distance of at least: 75 m where the code number is 3 or 4; and 40 m where the code number is 1 or 2; from the centre line of the runway and its extended centre line shall provide a graded area Slopes on runway strips and Strength of runway strips	Temporary Upto 31.03.2022.

Aerodrome is equipped with CCTV system covering all ANS area/equipment, Terminal, Airside and other areas, however, the footage was not being recorded for any camera due to some technical glitch.

1.11 Flight Recorders

The aircraft VT-AIW was equipped with Flight Data Recorder and Cockpit Voice Recorder in accordance with CAR Section 2, Series I, Part V. The DFDR and CVR units were removed from the aircraft at Jabalpur and data download was carried out at DGCA's Flight Recorders Lab.

1.11.1 Cockpit Voice Recorder

Transcript of CVR was prepared and the relevant extract from the CVR transcript is given below:

CVR ELAPSED TIME (HRS)	Approximate Time UTC	CALLER	CONVERSATION/NARRATIVE
1:17:45	07:17:37	P2	JABALPUR ALLIED 617
1:17:51	07:17:43	ATC	ALLIED 617 JABALPUR TOWER
1:29:36	07:29:28	P1	HELLO
1:29:37	07:29:29	CC	CABIN SECURED FOR LANDING
1:29:39	07:29:31	P1 CALL WITH CC	OK MA'AM...30 DEGREE TEMPERATURE
1:32:54	07:32:46	P1	SIX THOUSAND EIGHT HUNDRED FEET NOW
1:40:05	07:39:57	P1	SET LANDING GEAR DOWN
1:40:43	07:40:35	P2	THREE GREEN, FLAP 30° SET

CVR ELAPSED TIME (HRS)	Approximate Time UTC	CALLER	CONVERSATION/NARRATIVE
1:40:44	07:40:36	P1	CHECK
1:40:45	07:40:37		Crew carries out Before Landing Checklist
1:41:29	07:41:21	P1	RUNWAY VISUAL
1:42:32	07:42:24	P2	AUTO PILOT OFF. SET YAW DAMPER OFF, RUDDER TRIM NEUTRAL
1:42:35	07:42:27	P2	YAW DAMPER OFF, RUDDER TRIM CENTRED
1:42:42	07:42:34	RADIO ALTITUDE CALL	APPROACHING MINIMUMS
1:42:45	07:42:37	P1	RUNWAY VISUAL, DECISION TO LAND
1:42:53	07:42:45		MINIMUM MINIMUM
1:42:54	07:42:46	P1	LANDING
1:43:03	07:42:55	P1	CL 100% OVER RIDE
1:43:12	07:43:04	RA CALLOUT	500
1:43:13	07:43:05	P1	CHECK
1:43:24	07:43:16	RA CALLOUT	200
1:43:32	07:43:24	RA CALLOUT	100
1:43:37	07:43:29	RA CALLOUT	50, 40, 30, 20, 10
1:43:53	07:43:45	P1	ARRE YAAR (OH MAN)
1:43:57	07:43:49		Sound of touchdown and aircraft subsequently exiting runway.

During CVR replay, it was observed that no call for any deviation was made. There was no call for Go-Around or Handover/Takeover of controls.

1.11.2 Digital Flight Data Recorder

The DFDR data was downloaded at DGCA Lab and decoded with assistance from BEA, France. From the DFDR report it was observed that aircraft experienced a longitudinal wind component of 05 kt headwind at around 500 ft RA and around 05 Kt tailwind before touchdown. At touchdown, right crosswind of 05 kt was experienced by the aircraft.

The FMS recorded gross weight was 20.2 t leading to a $V_{mHBFLAPS30}$ for 21 t (rounded immediate superior) of 107 kt, selected IAS in auto mode was 107 kt. During approach, AP was engaged in LNAV – VS mode. It was disengaged at ~1000 ft RA and 10 seconds later FMA mode was no more engaged. Between 1000 ft RA and the touchdown

- IAS was in average at 124 kt, with a standard deviation of 3 kt.
- It was 17 kt above the IAS target (auto).
- The vertical speed was in average at -600 ft/min

During approach power levers were maintained around 50° and torque was between 27 % and 41 %. Power levers angle is recorded at HMU level and does not correspond to the pedestal ones.

Flight Idle (FI) =35° and Notch = 75° positions can be used for HMU references. At around 650 ft RA, NP changed on both engine from 82% to 100%. Power management rotator was not modified and remained on TO. This NP increase was the consequence of Condition Levers set at 100%.

Based on GPS position, the Runway 24 threshold was crossed with a radio height of ~60 ft, IAS at 126 kt increasing toward 134 kt and torque at 37%. The pitch attitude was -2.8°. During the next about 17 seconds the torque increased reached peak of 40%. At RA 10 ft the aircraft was at 500 m from threshold and PLA1 & PLA2 were at 55.5° and 56.2°, and corresponding torque was at 39 % and 41.5 % on engine 1 & 2 respectively. Power Lever began to retard thereafter for next about 12 seconds till aircraft was 1600 m from threshold and torque decreased.

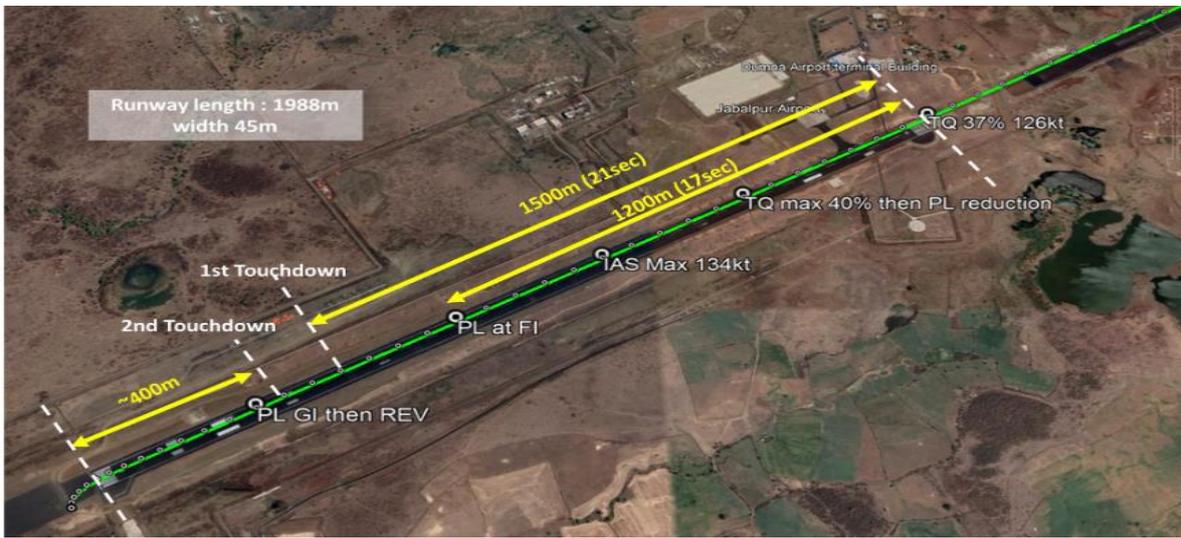


Figure 5: Distance to Flight Idle and Touchdown

IAS remained around 130 kt during the floating phase. As soon as PL were retarded at FI (35°), IAS began to decrease. Aircraft had floated for 1500 m before touching down at 07:43:52 UTC which was about 21 seconds after crossing threshold. During the 21 seconds after crossing threshold

- Several nose up and nose down orders were applied by PIC who was Pilot Flying (PF)
- Pitch angle varied between -3° and +1°, with a global trend to increase
- Radio height was decreasing and remained around 1-2 ft.
- No significant peaks were recorded on accelerometers

Aircraft had touched down with

- +1.7 G of vertical load factor.
- 119 kt of IAS
- -2.1° of pitch angle and
- +3° of right roll angle.
- A rudder deflection of 1/3 of full deflection to the left.

Hereafter, control inputs from the co-pilot were observed from the DFDR data. Aircraft then bounced and a right roll order was applied. A second touchdown occurred with

- +1.5 G of vertical load factor
- 115 kt of IAS
- -2.6° of pitch angle and

- -3.4° of left roll angle was recorded.

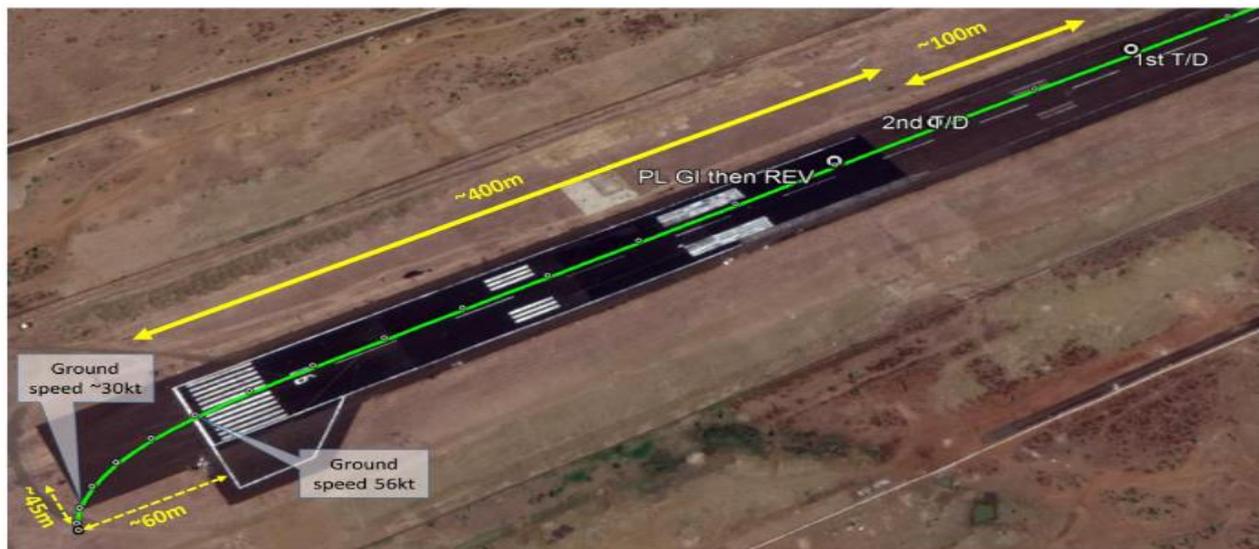


Figure 6: Touchdown and aircraft exit from runway

At first WOW signal, IAS was recorded as 104 kts compared to selected IAS (V_{app}) 107 Kts. Both touchdowns were done with negative pitch attitude. Around one second after the 2nd touchdown, Power levers were set from FI to REV during ~2 seconds then set at GI. Both crew member pressed brake pedals, brake pressure reached 3000 psi.

At ~1800 m from threshold with ~200 m runway remaining, Ground speed was 100 kt. Heading was 242°. LATG was null. The rudder started to deflect to the right to reach full deflection 4 seconds later and remained at this position during 2 seconds before being deflected toward the full opposite direction.

At ~60 kt, the aircraft reached the white stripes of the opposite side of the runway, Heading started to decrease (left turn) and LATG became positive. The heading decrease was consistent with the positive LATG, meaning aircraft was accelerating leftward.

Based on GPS position the aircraft crossed the end of the runway with ~56 kt of ground speed and exited the paved surface of the runway strip with ~30 kt of ground speed. When aircraft exited the runway, the right effort and deflection on rudder was transformed into a left effort and deflection. Aircraft stopped approximately ~60 m after the runway end, at ~45 m on the left of the centerline with a residual right roll angle of +5° and 134° of heading.

1.12 Wreckage and Impact Information

Not relevant to this incident.

1.13 Medical and Pathological Information

As per prevalent regulations, operating cockpit crew had given the undertaking that they are not under any influence of alcohol/psychoactive substance in last 12 hrs from the time of reporting for the duty. No injury to any crew or passenger was reported.

1.14 Fire

There was no fire reported.

1.15 Survival Aspects

The serious incident was survivable / none of the passengers or crew was injured.

1.16 Tests and Research

Not relevant to this incident

1.17 Organizational and Management Information

Alliance Air is a scheduled Air Transport Operator. It is an autonomous, wholly owned subsidiary of AI Asset Holding Limited (AIAHL) and is registered as Alliance Air Aviation Limited (AAAL). The airline operates ATR 72-212A aircraft fitted with PW-127M engines configured for 70-72 seats, ATR 42-600 aircraft fitted with PW-127F engines configured for 48 passenger seats and Do-228 aircraft fitted with TPE331-10GP-511D engines configured for 16 passenger seats.

Alliance Air Aviation Limited was issued Initial Air Operator Certificate in May 1997. The Airline engages in commercial air transport operations and the AOC was last revised on 28 Dec 2021. The AOC is valid till 30 April 2023. The AOC authorises the Company to conduct Scheduled Commercial Air Transport operations in accordance with the operations specifications. The airline complies with the operational specifications prescribed by DGCA from time to time.

The procedures and instructions have been established by the airline to plan and execute commercial air transport flights in accordance with Company's policy and contained in the Operations Manual duly approved by DGCA.

1.17.1 Flight Data Analysis Program

The Flight Safety Department of the airline had established Flight Operations Quality Assurance program for its ATR fleet to ensure 100% monitoring of SSFDR data in accordance with DGCA approved Flight Safety Manual, Issue IV, Revision 0, dated 2 Aug 2021. Later with revision in DGCA's CAR Section F, Part 2, Issue II, the Flight Safety Manual was revised as Issue IV, Revision1, dated 8 Aug 2022.

As per the revised manual, the number of flight parameters to be monitored were curtailed from 106 parameters to 56 parameters. Apart from various other changes, Long Landing was introduced as a parameter to be monitored in Flight Data Analysis Program (FDAP) during revision of Flight safety Manual, the same was not being monitored earlier. Long Flare (time) is listed as one on the parameter to be monitored in both the pre-revised and revised Flight Safety Manual.

It was informed by the airline that even though Long Flare and Long Landing were listed as parameters to be monitored in their Flight Safety Manual, the same was not being done as the software was not capable of capturing these exceedance. By end of February 2022, the FDA software was configured for monitoring Long Flare and by end of April 2022, FDA software was configured to capture Long Landings as well.

The DFDR data of the incident flight was run through the airline's FDA software. The incident flight was flagged for Long Flare (High Severity) and High Rate of Descent between 500 feet -100 feet (Low Severity) in their Flight Data Analysis program for approach and landing phase.

Airline was also requested to provide details of any exceedance monitored during last 02 years in approach and landing phase of any flight prior to incident flight operated by the PIC as Pilot Flying. As per the details provided by airline, PIC was involved in 06 instances of Long Flare (High Severity). All these instances were monitored from 06 – 10 March 2022. However, no immediate action was taken by the airline on these exceedance.

As per the airline, the exceedance limits are being further revised and refined in consultation with DGCA and other ATR fleet operators for better monitoring of exceedance and to execute better mitigation measures.

1.17.2 Aerodrome Categorization and Crew Qualification

Jabalpur airport is categorised as Category B Aerodrome as per Para A.17.1.5.1 of Chapter 17 of Operations Manual Part A. As per the OM, prior to operating to a Category B aerodrome the PIC should be briefed or self-briefed by means of programmed instruction on the Category B aerodrome(s) concerned and should certify that he has carried out these instructions.

1.17.3 Landing Procedure

The Landing Procedure are laid in the Para A28.1.9, Chapter 28 of Operations Manual and is quoted below:

“(a) Before landing check list must be completed by the time the aircraft crosses the final approach or before reaching MDA or by 1500 ft in case of a visual approach.

(b) All landings shall be made with the recommended landing flap. The aircraft speed should not exceed VAPP+10 kts for a normal approach after application of wind corrections as laid down in the aircraft FCOM/FCTM.

(c) Landing techniques stipulated in the aircraft FCOM/FCTM should be followed and no attempt be made to unnecessarily float the aircraft to achieve a smooth touchdown. Landings must be attempted with caution if wind shear has been reported or is anticipated.

(d) Landings will not be made on runways where there is standing water, slush or wet snow to a depth in excess of the limitations laid down in the Aircraft Flight Manual.

(e) Pilots should be alert for a possible loss of direction control associated with the use of engine reverser. If corrective action to maintain direction control is not effective, the throttles should be returned to reverse idle and the aircraft stopped using brakes. Flight Manual stopping distances are based on using brakes without using engine reverser.

(f) Loss of directional control on a dry runway during landing and reject take-off is characterized by the ability to control the heading of the aircraft but not its track. The problem centers around the cornering capabilities of the tyres and side loads on the landing gears. Throttles should not be

returned rapidly from high reverse thrust to forward thrust because of the high residual RPM which would remain when the engine returns to forward thrust.

(g) All landings should be made as near as possible to the target 1000 ft touchdown area on the runway. Alter landing unless otherwise instructed. Pilots must clear the active runway as soon as possible. Back tracking on an active runway or a parallel runway is prohibited unless approved by ATC”

1.17.4 Normal Landing Procedure

As per Alliance Air Operations Manual Part B, Chapter 2 Para B2.1.12, the crew is required to follow FCOM PRO.NOP.NOR.PROCEDURES for ATR 72-600. The Landing procedure given at PARA NOR.22 is as below:

NOR.22 Landing		REV	5.1																
			ALL																
PF	PM																		
At DH or MDA +100 ft	▶ HUNDRED ABOVE ANNOUNCE																		
At DH or MDA	▶ MINIMUM ANNOUNCE																		
<ul style="list-style-type: none"> ■ If visual references acquired <ul style="list-style-type: none"> ▶ VISUAL REF..... ANNOUNCE ▶ APPROACH..... CONTINUE ■ If visual references not acquired <ul style="list-style-type: none"> ▶ GO-AROUND..... ORDER & INITIATE <i>"Announce , Go-around, set power, flaps one notch".</i> ▶ AP DISCONNECT & ANNOUNCE ▶ CAVALRY CHARGE..... CANCEL <i>Press twice AP disconnection pb to cancel</i> ▶ YD DISENGAGEMENT..... ORDER 	<ul style="list-style-type: none"> ▶ YD DISENGAGE & ANNOUNCE ▶ AFCS YD ALARM..... CLEAR ▶ YAW TRIM..... CHECK 																		
At 50 ft AAL	▶ 50 FT AAL ANNOUNCE <i>If no automatic call-out</i>																		
At 20 ft AAL	▶ 20 FT AAL ANNOUNCE <i>If no automatic call-out</i>																		
<ul style="list-style-type: none"> ▶ PL 1+2..... FI ▶ FLARE..... PERFORM 																			
<p>On Ground</p> <ul style="list-style-type: none"> ▶ BRAKES..... AS RQRD <i>Brakes use (start of application, intensity, ...) can be adapted to actual landing conditions in accordance with performances and limitations (brake energy, ...)</i> • At nose landing gear touch down ▶ PL 1+2..... GI 	<ul style="list-style-type: none"> ▶ IDLE GATE RETRACTION CHECK <i>PULL if no automatic retraction</i> ▶ LO PITCH..... CHECK & ANNOUNCE <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>ENG</th> <th>LO PITCH</th> <th>ANNOUNCE</th> <th>REVERSE</th> </tr> </thead> <tbody> <tr> <td rowspan="3">2 ENG</td> <td>2</td> <td rowspan="2">2 LOW PITCH</td> <td>NORMAL USE</td> </tr> <tr> <td>1</td> <td>NO REVERSE</td> </tr> <tr> <td>0</td> <td>NO REVERSE</td> </tr> <tr> <td>1 ENG</td> <td>1</td> <td>1 LOW PITCH</td> <td>USE WITH CARE</td> </tr> </tbody> </table>	ENG	LO PITCH	ANNOUNCE	REVERSE	2 ENG	2	2 LOW PITCH	NORMAL USE	1	NO REVERSE	0	NO REVERSE	1 ENG	1	1 LOW PITCH	USE WITH CARE		
ENG	LO PITCH	ANNOUNCE	REVERSE																
2 ENG	2	2 LOW PITCH	NORMAL USE																
	1		NO REVERSE																
	0	NO REVERSE																	
1 ENG	1	1 LOW PITCH	USE WITH CARE																

Further, the Landing Procedure published in FCOM PRO.NOP.ANOR.ADDITIONAL NORMAL PROCEDURES for ATR 72-600 at Para ANOR 1.3 is as below:

“In order to minimize landing distance variations, the following procedure is recommended:

- Maintain standard final approach slope (3°) and final V_{APP} until 20 ft is called on radio altimeter.
- At <<20ft>> call by PM, reduce to FI and flare visually as required

Note

20 ft leaves ample time for flare control from a standard 3° final slope

- *As soon as main landing gear is on ground*
 - *Control Nose Wheel Impact*
 - *Both PL:GI*
 - *Both LO PITCH labels: check ON green*

Caution

If thrust dissymmetry occurs or if one NO REV red reverse video label appears on EWD, the use of any reverser is prohibited.

In this case the propeller pitch change mechanism is probably locked at a positive blade angle, resulting in a positive thrust for any PL position.

- *Use foot brakes as required*
- *As speed reduces, and not later than about 40 kt (estimated) CAPT takes NWS control, F/O hold control column fully forward.*

Note

1) MAX reverse is usable down to full stop if required but to minimize flight control shaking due reverse operations at high powers, it is helpful to release slowly PL back to GI when reaching low ground speeds (below 40 kt estimated)

2) MAX braking is usable without restriction down to full stop, whatever the runway conditions may be, provided ANTISKID is operative.

3) The tail bumper (with damping capabilities) effectively protect the tail in case of excessive attitude (resulting from prolonged/floating flares) provided the rate of sink at touchdown does not exceed 5 ft/s

4) In case of significant bounce, a go-around should be considered.

As per above procedures, the Pilot Flying (PF) was required to retard Power Lever to Flight Idle, after 20 ft auto callout and initiate Flare as required.

1.17.5 Calculation of Landing Distance

The necessary information for compliance with all flight profiles for the determination of various limitations are given in Chapter 6 of OM Part C. As per Para C 6.5, crew is required to follow PER.10C of FCOM for ATR 42/72 or Dev.2 of AFM for ATR 42/72 for calculating landing runway length requirements for dry and wet conditions including systems failures which affect the landing distances.

The LDTA calculation are used for calculating Landing Distance Required based on conditions prevailing at the time of arrival. The calculated Landing Distance (LDTA) for the incident flight as per airline's policy was 1028.16 m.

1.17.6 Stabilized Approach Criteria

The following is the stabilized approach criteria followed by the airline:

An approach is considered stabilized when all of the following criteria are met:

- *Lateral path (Loc, Radial or RNAV path) is tracked*
- *Landing configuration is established*
- *Energy management:*
 - *Vertical path (Glide, Altitude versus Distance or RNAV path) is tracked*
 - *Power setting is consistent with appropriate aircraft weight, Head/Tail wind component and vertical guidance requirements*
 - *Speed and pitch attitude are relevant to actual conditions*
- *Briefing and checklists are completed*

Only small deviations are allowed if immediately called out and corrected:

- *Altitude during initial approach: ± 100 ft*
- *Lateral guidance on final approach segment: half LOC scale deviation for precision approach or $\pm 5^\circ$ on radial for conventional non-precision approach or 0.15 NM for RNAV approaches*
- *Vertical path on final approach segment: half GS scale deviation or + 200/-0 ft for non-precision approaches*
- *Altitude deviation at DA or MDA: 0 ft*
- *Speed 0/+10 kt*

Only small adjustments in pitch and/or heading are allowed to stay on track:

- *Maximum sink rate is 1000 ft per minute*
- *Maximum rate of descent adjustments are ± 300 ft per minute from target rate*
- *Bank angles are no more than 15°*
- *Localizer guidance adjustments are done within heading bug width*
- *GS guidance adjustments must be within $\pm 2^\circ$ of pitch change"*

1.17.7 Safe Landing and Missed Approaches

Airline in Para A28.1.9.2 of the Operations Manual has recommended following guidelines for safe landings:

- a) *The preference of runway – The runway selection plays an important role to ensure safety of aircraft. It is therefore advised, as far as practical landings must be performed in headwinds.*
- b) *Stabilized Approach – Approach should be stabilized by 1000ft AAL in IMC and 500 ft AAL in VMC conditions (Stabilization criteria is mentioned in OM Part A Chapter 25, para A 25.1). If the approach is not stabilized, executing a missed approach/ Go-Around is a safe procedure and non-punitive in nature. It is encouraged anytime situation becomes unsafe for landing.*
- c) *Approach Speed – The Approach Speed (V_{app}) must be maintained during approach and it provides sufficient safety margins. Any variations between $V_{app} - 0$ and $V_{app} + 10$ are permissible.*
- d) *Bounced Landing – If aircraft bounces during touchdown, follow the recommended procedure as per OM Part A para A 28.1.9.1.*

e) *Touchdown Zone – During landing, the aircraft should touchdown within the touchdown zone of the runway. For any reason if aircraft starts floating on the runway or landing can't be performed within specified touchdown area, a Go-Around must be performed.*

Further, Para A 27.1.2 provides an illustrative but not exhaustive list of situations wherein missed approach or go-around should be executed. The Commander has the necessary authority to discontinue an approach and execute a missed approach/ Go-Around. When, for any reason, it is judged that an approach cannot be continued to a safe, successful landing, a missed approach/Go-Around is flown. Whenever missed approach/Go-Around is executed, the flight crew must have no other consideration in mind except the safety of aircraft and its occupants. As per the stated policy following are some of the situations which may require Missed approach/ Go-Around:

- the approach is not stabilized.
- the approach speed is more than $V_{APP}+10$ Knots
- a safe landing will not result from the approach
- the aircraft is destabilized during wind shear/or the Pilot is unable to maintain the aircraft within the prescribed flight path.
- The aircraft is not positioned so as to allow a controlled touchdown when the designated runway touchdown zone with a consequent risk of aircraft damage with or without a runway excursion if the attempt is continued

A decision to go-around is usually taken by the PIC, but may be taken by either Pilot. Once a go-around decision is taken, it must be announced (by either Pilot) with a clear and loud call of 'Go-Around'.

1.17.8 Rapid Deplaning

In accordance with guidance contained in Cabin Safety Circular 1 of 2016 issued by DGCA, airline has prepared a Safety Emergency Procedures Manual and included policy on Rapid Deplaning at Para 4.4.15 of the said manual.

Rapid Deplaning is required in situations when passengers and crew need to deplane immediately and quickly. A rapid deplaning is when passengers and/or crew rapidly exit the aircraft via the boarding doors and stairs, for precautionary measure. A rapid deplaning may be initiated by the pilots or, in their absence, the Sr. Cabin crew.

Following actions are required to be performed by the Cabin crew to ensure the rapid deplaning is performed in a calm and orderly fashion:

- stairs are in place;
- Direct passengers to go to the designated exit(s) and leave their baggage behind: 'Leave the aircraft immediately (specify by which door) and please leave all of your personal belongings behind';
- Cabin crew closest to the exit door(s) or a designated Able-bodied Passenger (ABP) will lead passengers into the terminal;
- Cabin crew must remain alert in case an emergency evacuation becomes necessary; and
- Rapid deplaning is complete when the last passenger or crewmember leaves the aircraft.

1.18 Additional Information

1.18.1 Video Footage from Media

CCTV cameras at airport were functional but the system was not preserving the video recordings. However, a video of incident landing made by some person on the aircraft was publicly available on social media. Screen shots from the footage are shown in the figure below:



Figure 7

Figure 7 shows the aircraft crossing the Runway 24 threshold and crossing the touch down zone of Runway 24. Aircraft took about 07-08 seconds to cross the touch down zone of Rwy 24 and reached touch down zone of opposite runway (Runway 06) in another about 11 seconds.



Figure 8

Figure 8 shows the frame where aircraft appears to have made first touchdown after crossing the 3rd set of Runway 06 TDZ marking and slightly bounced before touching down over 2nd set of Runway 06 TDZ marking.



Figure 9

Figure 9 shows aircraft rolling after touchdown over aiming point of Runway 06, 1st set of Runway 06 TDZ markings and Runway 06 Threshold. The aircraft can be seen having deviated to the left before crossing the threshold of Runway 06. From the video it was observed that the aircraft took about 21 seconds to touch down after crossing Runway 24 threshold.



Figure 10

Figure 10 shows aircraft rolling in runway strip and entering the RESA. Aircraft rolled for about 12 seconds after first touchdown before it overran the Runway 06 threshold and in another 04 seconds it exited the paved area or Runway Strip.

1.18.2 Site Survey

The investigation team from AAIB reached Jabalpur in the morning of 13 March 2022. The team surveyed the site and examined the aircraft. The wheels marks of the aircraft were visible. Location of wheels marks were plotted on the runway layout. **Figure 11** shows the runway 06 side

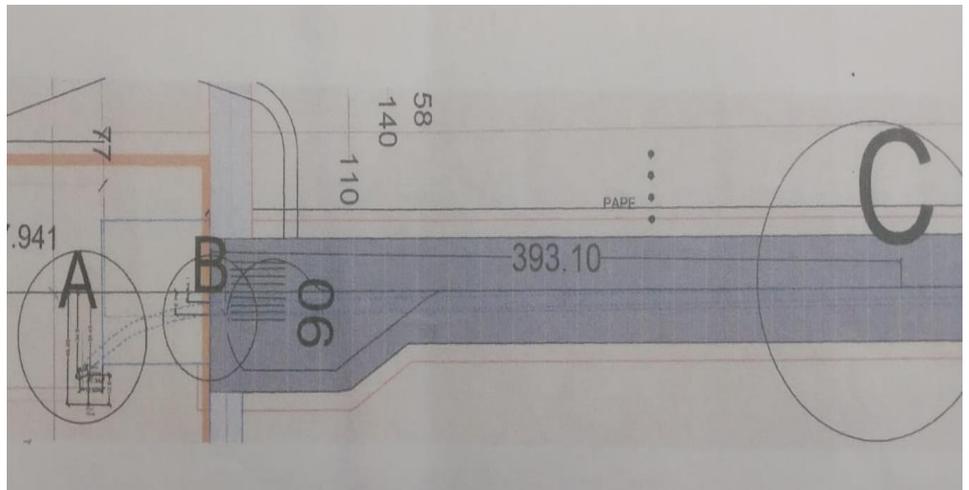


Figure 11: Location of wheel marks plotted on Runway 6

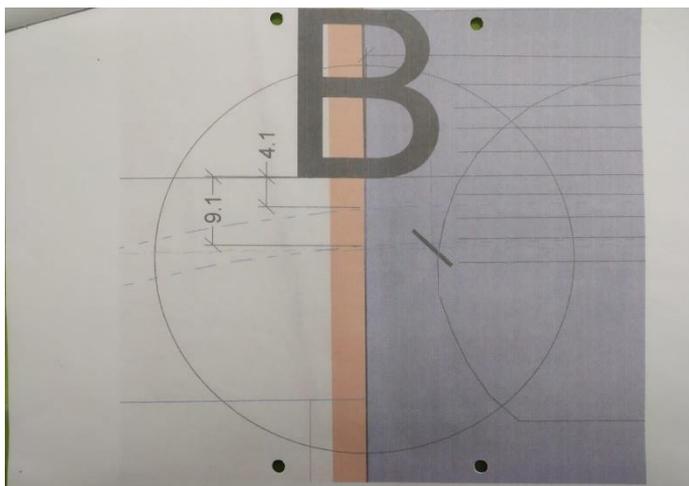


Figure 12

with the point C in the figure showing the location up to which the wheel marks could be traced. This point is approximately 393 m from the runway end.

Point B shows the location of wheel marks as the aircraft exited the runway and Point A shows the final location of aircraft after it came to a halt. The expanded view of point B and A are shown in the **Figures 11 and 12**.

As the aircraft exited the runway the RH wheel and LH wheel were 4.1 m and 9.1 m left of Runway Centerline.

Figure 13 shows the exploded view of point A showing the distance of all three Landing Gears from runway center line and edge of paved surface. Aircraft nose wheel was approximately 45 m left of runway center line and about 8 m from paved surface of runway strip.

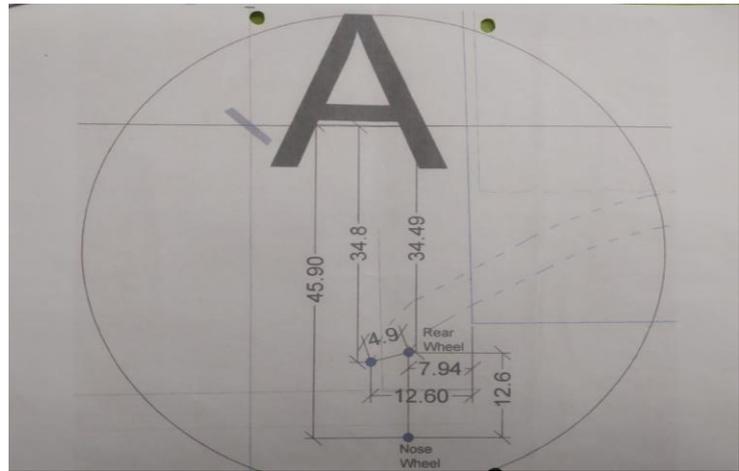


Figure 13

1.19 Useful or Effective Investigation Techniques

Not relevant to present case

2. ANALYSIS

2.1 Serviceability of Aircraft

The aircraft was maintained as per the Aircraft Maintenance Program approved by the DGCA. There was no record of any snag or deferred maintenance action that could have contributed to the incident.

From the DFDR recording of flight it was concluded that the aircraft and all its system were serviceable and airworthy. The brakes performed as per the braking action applied by the crew and satisfactory brake pressure was observed from the DFDR data.

There was no maintenance due on the aircraft as on date of incident. The aircraft was returned to service after maintenance and repair carried in consultation with the OEM and approved by DGCA. Aircraft serviceability was not a factor in this incident.

2.2 Flight Data Monitoring and Crew Performance

Both pilots had valid license and ratings and were meeting all qualifications for operating this flight. The airline had an active Flight Data Monitoring Program, where data from all flights was monitored to flag any exceedance in operations or performance parameters. There is no record of any exceedance monitored on any flight operated by the crew during the period preceding two years from the date of incident.

It was also informed by the airline that, even though Long Flare was one of the parameter required to be monitored as per Airline's Flight Safety Manual and DGCA requirements, airline did not have capability to monitor Long Flare till end of Feb 2022.

Airline's Flight Data Monitoring Software underwent some changes and enhancements in Feb-Apr 2022. On requirement of the investigation team, when details of any exceedance during approach and landing found on flights operated by the PIC was sought, 06 instances of Long Flare (High

Severity) during the period 06-10 March 2022 were flagged. No corrective action in form of feedback or training to pilot was initiated by the Airline for these events.

The above indicates that Airline's FDAP failed to effectively monitor and capture adverse events on flights operated by the crew and hence actual exceedance including Long Flare may never have been captured.

The occurrence flight on 12 Mar 2022, was also captured in the FDA software for Long Flare (High Severity). Presently, airline is in process of revising its exceedance parameters in consultation with DGCA and other ATR fleet operator for further refinement.

Absence of proper flight data monitoring and corrective actions to address the deviation was a factor in the incident.

2.3 Passenger Deplaning

Cabin Safety Circular 1 of 2016 issued by DGCA provides guidance material for preparation of Safety Emergency Procedure Manual and provides for inclusion of Rapid Deplaning in the training syllabus. Accordingly, airline has included details of Rapid Deplaning in para 4.4.15 of Airline's Safety Emergency Procedures Manual.

On the day of incident, PIC exercised its discretion to carry out Normal Disembarkation after assessing the situation. Even though all passengers were safely deplaned and transported to arrival area, Rapid Deplaning would have been a better option. In situations where full scale evacuation is not required, Rapid Deplaning is advantageous over normal deplaning as emergency exits are not used and passengers are required to deplane via boarding doors and stairs without their hand baggage as precautionary measure. This reduces deplaning time in an emergency situation such as present case and also allow for full scale evacuation in case the situation deteriorates unexpectedly.

2.4 Aerodrome Environment and Runway Condition

Jabalpur aerodrome is operated and maintained by Airports Authority of India as a licensed airport with approval of DGCA. Jabalpur Airport is classified as Code 4C aerodrome and categorized as Category B aerodrome by the airline operator.

The runway dimension for Runway 24 used by the incident flight is 1988 m X 45 m. Landing Distance Available for Runway 24 is 1988 m. As per the report of runway friction test carried out on 23 July 2021, the value of runway friction was found to be 0.8 μ which was significantly above the maintenance planning level for Runway Friction (0.47 μ) and Minimum Friction Level (0.34 μ). During the visit of Investigation Team to Jabalpur, the condition of the runway in general was observed to be good. A slope of -0.77 % was present on Runway 24 which is within the performance limitation of the aircraft.

A RESA of 90m X 90m is available on both ends of the runway. The RESA was able to arrest the motion of aircraft as it exited the runway and aircraft stopped in RESA about 08 m ahead of paved area and about 60 m from the end of Runway 24. The aircraft encountered 5 kt headwind at 500 ft which changed to 5 kt tailwind just before touchdown. At touchdown the aircraft encountered

05 kt crosswind. The winds encountered were within the performance limitation of the aircraft. Aerodrome environment or the Runway condition were not a significant factor in the incident.

2.5 Circumstances leading to the Incident

The flight was operated by an appropriately licensed crew meeting the qualification requirements of operating to Jabalpur which has been classified as Category B Aerodrome by the airline. During investigation it was found that, the PIC had during the period between 06th to 10th Mar 2022, been involved in 06 instances of high severity Long Flare for which no corrective training or feedback was provided to the PIC by the airline. It is possible that the PIC may have been involved in more such instances which were not captured by airline's FDAP. No corrective action in terms of feedback or training to the pilot was taken by the airline.

On 12 Mar 2022 the crew flew VOR24 approach into Jabalpur and carried out a CDFA approach for Runway 24. The crew sighted the runway at about 07:41 UTC while at about 1700 feet and decided to land. PIC was the PF and at controls during landing. Autopilot was disengaged at 1000 ft.

The aircraft was at about RA 60 ft on crossing threshold with IAS 126 kt which was 19 kt above target IAS. The average IAS from 1000 ft to touchdown had remained at approx. 17 kt above the IAS target against permissible +10 kt above target IAS as per the stabilized approach criteria.

The torque was 37% with PL at 57 degree. On advancing about 270 m ahead of threshold the aircraft was at RA 22. Torque had continued to rise and reached a peak of about 40% before delayed retardation of PL at about RA 10 ft, 500 m ahead of threshold possibly to attempt a soft landing.

The aircraft pitch varied from negative 3° to positive 1° during flare and the aircraft continued to float as PL reached FI from 57 degree in about 12 seconds. In the meanwhile the IAS reached a peak of 134 kt. As soon as PL were retarded at FI, the IAS began to decrease and aircraft touched down with just about 500 m runway length left and bounced before touching down again with about 400 m runway length left to stop. This was significantly less than Landing Distance Requirement of 1028.16 m as per LDTA calculations to stop the aircraft in prevalent conditions. The airline's FDA software also indicated a Long Flare of about 19 seconds. There was neither an attempt to Go-around, nor any such call from the PM.

After second touchdown, control inputs from PM were observed from the DFDR data, however, there was no call for control handover or takeover noticed in CVR. PL were retarded to GI and both crew applied full brakes. Aircraft decelerated but exited the runway at a ground speed of about 56 kt and continue to roll before exiting the paved surface at 30 kt of ground speed and came to halt in RESA.

The findings from DFDR data, video footage and physical marks of aircraft tyres on the runway corroborate each other.

3. CONCLUSION

3.1 Findings

- 1) The Certificate of Airworthiness, Certificate of Registration and Airworthiness Review Certificate of the aircraft were valid on the date of incident and the aircraft was airworthy.
- 2) Flight crew were medically fit and their licences were current to operate the flight. Both crew met the requirements for operating flight to Jabalpur which was a Category B aerodrome.
- 3) Airline was not monitoring Long Flare as required by the DGCA approved Flight Safety Manual till end of February 2022.
- 4) Six instances of Long Flare in 04 days prior to incident flight were observed from the data provided by the airline. It is possible that many such instances were never monitored by the airline prior to February 2022 due software limitations.
- 5) No corrective training or feedback was provided to the PIC by the airline with respect to Long Flare or other exceedance which were not flagged in the FDAP.
- 6) Flight experienced 05 Kt headwinds during approach which changed to 05 kt tailwinds before touchdown and 05 kt cross winds during touchdown, however the winds were within operational limitations of the aircraft.
- 7) Runway 24 has a slope of -0.77% as per the published AIP, which was within the operational limitations of the aircraft.
- 8) The approach was not stabilized as average IAS during approach remained 17 kt above the target IAS which was 107 kt. The peak value reached was 134 kt which was significantly above the target IAS.
- 9) The airline's FDA software indicated a Long Flare of about 19 seconds.
- 10) Aircraft mostly remained in a negative pitch attitude during flare and both touch downs.
- 11) There was lack of call-outs by PM for deviation in flight parameters during approach.
- 12) Crew did not consider "Go-Around" and continued with landing while remaining runway length was insufficient to stop. No call for "Go-Around" was monitored in the CVR recording.
- 13) The Co-Pilot who was the PM, took over the controls after second touchdown, but there was no call for handover or takeover of controls observed in the CVR recording.
- 14) The crew did not exercise option of rapid deplaning and opted for normal deplaning after making assessment of cabin and external condition.

3.2 Probable causes of the Serious Incident

The probable cause of the Serious Incident was

- Un-stabilized approach
- Inappropriate flare
- Delayed retardation of power levers to Flight Idle.
- Not initiating go-around when safe landing could not be assured

Airlines inability to monitor deviations from Flight Parameters in FDAP and provide corrective training or feedback to crew was a contributory factor leading to the incident.

4. SAFETY RECOMMENDATIONS

It is recommended that

4.1 Airline should carry out complete monitoring of Flight Data for all parameters defined in the Flight Safety Manual and provide feedback and corrective training to its crew based on trends monitored in FDAP in a timely manner.

4.2 Airline may review its FDM parameters to see the feasibility of including inappropriate flare and delayed retardation of power levers to Flight Idle as a parameter to be monitored in the FDM.

4.3 Airline should re-iterate to its pilots the importance of adherence to stabilized approach criteria.

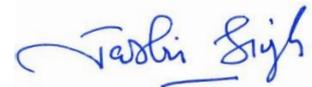
4.4 Airline should re-iterate to its pilots the importance of proper briefings and callouts for any deviations from the flight path.

4.5 DGCA should issue instructions to all airline to encourage their pilots to exercise option of rapid deplaning in emergency situations or incidents when full scale evacuation may not be required.



K Ramachandran
Investigator

Date: 22 Dec 2022



Jasbir Singh Larhga
Investigator-in-Charge