

**Final Investigation Report of Abnormal Runway Contact Incident to
M/s.Trujet ATR72 aircraft, Registration VT-TMM on 16/11/2020 at Mysuru Airport**

1. Aircraft Type	: ATR72-212A
Nationality	: Indian
Registration	: VT- TMM
2. Operator	: M/s Turbo Megha Airways Pvt. Ltd., (M/s. Trujet) Hyderabad
3. Owner/ Lessor	: M/s Constellation Aircraft Leasing Ltd., Ireland
4. Pilot in Command Extent of Injury	: ATPL License Holder : Nil
5. First Officer Extent of Injury	: CPL License Holder : Nil
6. Place of Incident	: Mysuru Airport (VOMY),India
7. Coordinates of incident site	: Latitude- 12°13'56.85"N, Longitude -76°39'22.84"E
8. Date and Time of Incident	: 16/11/2020, 14:20:55 UTC
9. Last point of Departure	: Belgaum Airport (VOBY),India
10. Intended place of landing	: Mysuru Airport (VOMY), India
11. Type of operation	: Passenger Aero plane- Scheduled Operation
12. No. of persons on board &Extent of Injury	: 52 : Nil
13. Phase of Operation	: Landing
14. Type of Incident	: ARC: Abnormal Runway Contact

(All timings are in UTC)

Synopsis

On 16/11/2020 at 1312UTC, M/s Turbo Megha Airways (M/s. Trujet) ATR 72 aircraft Registration VT-TMM, Sector Belgaum - Mysuru (TRJ 543), departed from Belgaum airport with 47 passengers, 04 operating crew and 01 AME onboard. At Mysuru, just above the runway 09 at approx. 30ft RA, before executing go around, crew felt their aircraft touched with ground and simultaneously go around action was performed. Due bad weather at Mysuru, crew diverted the flight to Chennai Airport in coordination with Mysuru ATC as it was their first alternative airport. As crew could not retract the landing gear,

Mysuru to Chennai sector was continued with the Landing Gears in extended condition. Aircraft landed safely at Chennai airport approx. at 1540UTC. But, during the landing roll, crew observed right wing was lower than left wing and hence, the aircraft was stopped on runway itself and requested Chennai ATC for assistance. All the passengers were disembarked normally on runway and aircraft towed to the bay. There was no fire or injury to anyone.

The incident was investigated by an Investigator In-Charge appointed by DGCA, India vide Order No. DGCA-15018(13)/3/2020-DAS dated 23/11/2020 in exercise of power under Rule 13(1) of The Aircraft (Investigation of Accidents and Incidents) Rule 2017.

During investigation, it has been observed that during the final approach, the required speed was maintained but there was no required checks and actions performed by the crew to maintain the flight path angle of the aircraft and the aircraft was constantly below the path which has most probably induce the need for the low level off and then the difficulty to land the aircraft in difficult weather condition.

Failure to manage the aircraft vertical path and improper CRM performance together with the Loss of situational awareness & delayed go around action was the probable cause of the incident.

Prevailed weather condition was a contributory factor.

1. Factual Information

1.1. History of Flight

On 16/11/2020, M/s Trujet ATR 72-500 aircraft VT-TMM was scheduled for flight TRJ543, sector Belgaum - Mysuru with 52 persons onboard. The aircraft departed at 1312UTC with 3400Kg of Fuel onboard. At 1403UTC, the aircraft came in contact with Mysuru Tower at FL150 & 61DME. Tower informed the ETA as 1421UTC and passed 1400Z METAR to the aircraft and to expect VOR DME approach runway 09 along with aerodrome warning of surface wind likely to reach 20Kts from 070°. Further, the aircraft was advised to report on release by Mangalore Control. After the release by Mangalore Control, as advised, the aircraft reported at 1406UTC and at that time its position was 40mile inbound on 322R with FL125. The aircraft was approaching Mysuru airport in coordination with the controller. When TRJ543 aircraft was 25 NM, Alliance air aircraft (which was in No.1 landing sequence), conveyed that on their final approach, experienced heavy rain before 2NM from the Runway and after that light rain. At 1418UTC, when the aircraft was at 3500ft, controller passed the visibility as 3000m with moderate rain.

At 1419UTC, Air Traffic Controller gave landing clearance to TRJ543 with an updated weather information of wind 150°/10Kt which was acknowledged by the aircraft.

When the aircraft was between 40ft to 30ft of RA, the aircraft vertical speed reduced (levelled off) and it rolled approx. 20Deg. (i.e. from -11° to +9.5°) and at the same time 'Bank Angle' aural warning followed with thud sound noticed at 14:20:55UTC.

At 1423UTC, aircraft informed tower that the aircraft is going around and accordingly the aircraft was vectored for going around. At 1425UTC, controller enquired with the aircraft about the reason for going around. Crew reported unstabilised approach with strong rain and winds. As per the crew requests, the aircraft was given climb clearance to 7000ft and later at 1430UTC, cleared for diversion flight to Chennai.

M/s Alliance aircraft (LLR897) which got departed subsequently from Mysuru airport informed Mysuru tower controller that some metal FOD on runway 09/27. On inspection, found an aircraft metallic door (landing gear door) on northern side of RWY edge (on the runway Basic Strip) abeam of DVOR hut.

As per Operational Jeep personnel, they were holding at PDP when TRJ543 went around and observed that it was raining heavily with strong winds at airport.

As crew could not retract the landing gear, Mysuru to Chennai sector was continued with the Landing Gears in extended condition. At approx. 1540UTC, aircraft landed safely at Chennai airport on runway 07. But, during the landing roll, crew observed right wing was lower than left wing and hence, the aircraft was stopped on runway itself and requested Chennai ATC for assistance. All the passengers were disembarked normally on runway and aircraft towed to the bay no 50. There was no fire or injury to anyone.

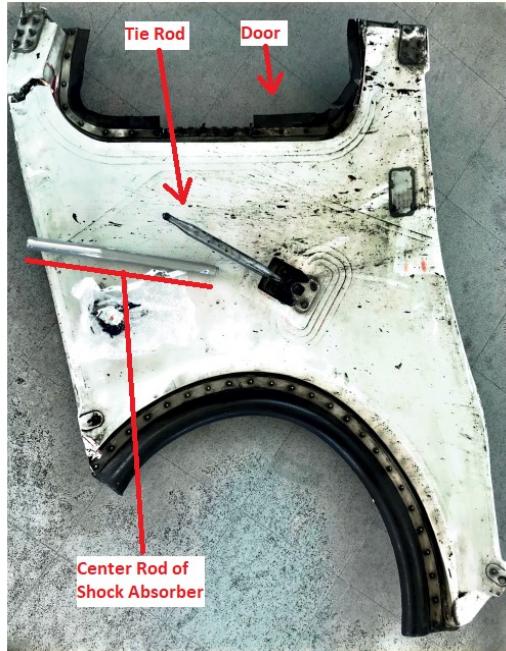
1.2. Injuries to Persons:

INJURIES	Crews	Passengers	Others
Fatal	Nil	Nil	Nil
Serious	Nil	Nil	Nil
Minor/ None	Nil/02+02+01	Nil/47	

1.3. Damage to Aircraft:

Aircraft sustained the following damages;

1. RH MLG (Main Landing Gear) door along with tie rod detached at Mysore.



2. RH MLG shock absorber found sheared at bottom attachment (Trailing arm end) and its internal center rod component detached in Mysore.



3. Scratch markings No # 3 MW tyre.



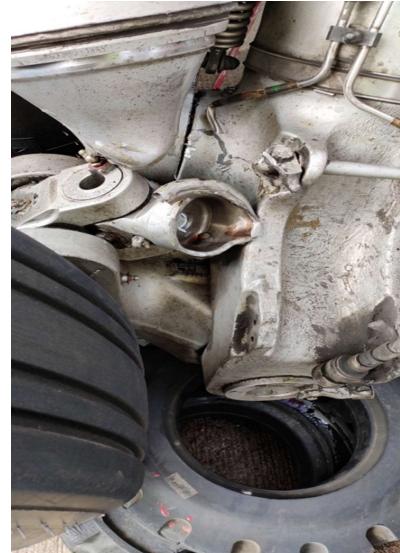
- 4.Damaged AFT fairing structure



5. Trunnion leg and trailing arm found distorted & mechanically touching each other and whole LG assembly leaned forward.



6. Down un lock actuator Hydraulic lines are found crushed and broken



1.4. Other Damages:

Nil

1.5. Personnel Information

1.5.1. Pilot in Command

Age & Gender	: 45 years & Male
License type & Validity	: ATPL, valid till 02/08/2021
Category	: Aero plane
Date of Medical Examination	: 29/09/2020
Medical Examination valid up to	: 28/09/2021
FRTD License Valid up to	: 23/09/2022
Total flying experience	: 4850Hours
Experience on type	: 4610Hours
Experience as PIC on type	: 1324 Hours
Total flying experience during last 01Year	: 672 Hours
Total flying experience during last 06months	: 290 Hours
Total flying experience during last 90 days	: 214 Hours
Total flying experience during last 30 days	: 103 Hours

Total flying experience during last 07 Days	: 25 Hours
Total flying experience during last 24 Hours	: 07Hours
Duty time Last 24Hrs	: 08:35 Hours
Rest Period before the flight	: 14:55Hours

1.5.2. Co-pilot

Age & Gender	: 32 years & Male
License type & Validity	: CPL, valid till 10/03/2024
Category	: Aero plane
Date of Medical Examination	: 09/06/2020
Medical Examination valid up to	: 08/06/2021
FRTD License Valid up to	: 10/03/2024
Total flying experience	: 820Hours
Experience on type	: 553 Hours
Experience as PIC on type	: -Nil -
Total flying experience during last 01Year	: 564 Hours
Total flying experience during last 06months	: 204 Hours
Total flying experience during last 90 days	: 181 Hours
Total flying experience during last 30 days	: 87 Hours
Total flying experience during last 07 Days	: 30 Hours
Total flying experience during last 24 Hours	: 07 Hours
Duty time Last 24Hrs	: 08:35 Hours
Rest Period before the flight	: 14:55Hours

Crew were appropriately qualified and had sufficient rest before undertaking the flight on that day.

1.6 Aircraft Information

- a) Aircraft Model : ATR 72-212A(500)
- b) Aircraft Serial No. : 825
- c) Year of Manufacturer : 2008
- d) C of R Valid till : 17/09/2022
- e) C of A issued on : 30/10/2019
- f) A R C issued on : 27/10/2020
- g) Engine Type LH : P&W 127M

- h) Engine Sl. No. LH : ED0089
- i) Engine Type RH : P&W 127M
- j) Engine Sl. No. RH : ED0114
- k) Total Airframe Hours : 31533Hrs. 57ins.
- l) Total Engine Hours LH (TSN) : 28516Hrs.55Min.
- m) Total Engine Hours RH (TSN) : 25995Hrs.11 Min.
- n) Date of weighment on : 23/09/2019
- o) RH MLG Details:

Description	Part No.	Sl.No	Date of Installation	CSO Current	Cycles Remaining	Remarks
Leg Assy.	D23190000-23	MN442	30/05/'16	8,316	11,684	
Shock absorber	D23188000-5/A,B	MN1101	23/10/'19	1,741	18,259	Serviced on 11/08/'20
Side Brace Assy.	D23220000-5	MN453	30/05/'16	8,316	11,684	

Aircraft is certified in the transport category for day and night operations. As per the weight schedule, the last weighment was carried out on 10/10/2019 and the certified MTOW/MAUW is 22800Kgs. As per the L&T sheet, the sector load (ATOW) was 20936Kgs. As per pax. manifest, there were 47 passengers (46+01 infant), 04 operating crew and 01 AME were onboard.

During post incident in situ inspection, the following observations have been made:

- a. Remaining total fuel onboard was 1710Kgs (LH790Kg and RH-920 Kg).
- b. Oil Reservoir Quantity was above 60%.
- c. Pitch disconnect indication was observed.
- d. G-meter Report of 2.34G noticed.

The aircraft has 72 seats and can be operated with minimum 02 flight crews with the following limitations (as per AFM)

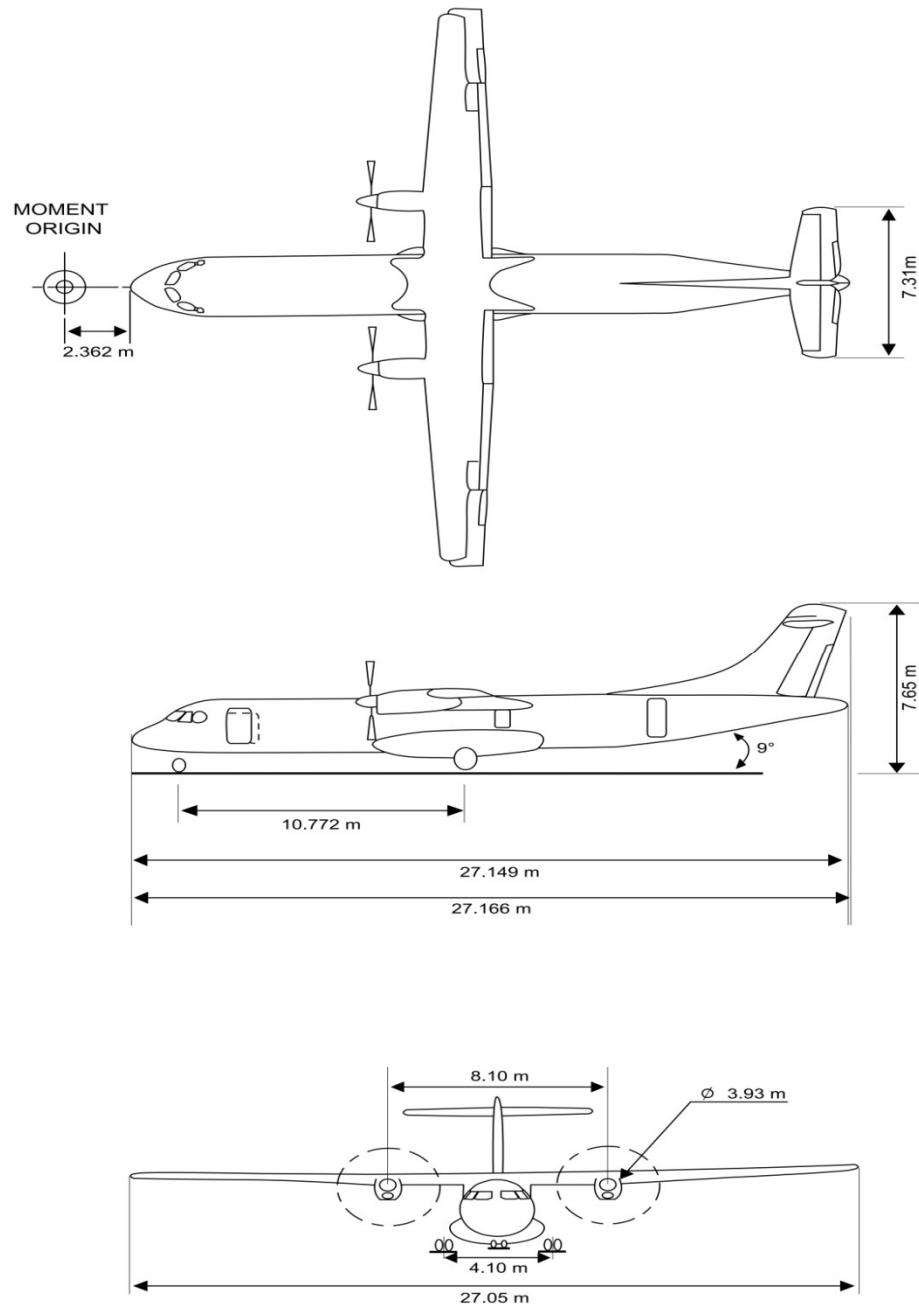
- i. The maximum operating altitude = 25000 ft.
- ii. Maneuvering limit load factors with Gear and flaps retracted = +2.5g to -1g
- iii. Maneuvering limit load factors with Gear and flaps extended= +2g to 0 g
- iv. Tailwind limitation(Takeoff and landing) = 15kt

(Note: *The limitation for tailwinds greater than 10kt reflects the capability of the aircraft as evaluated in terms of airworthiness but does not constitute approval for operations under tailwinds exceeding 10kt in case such operational approval is required by the National Authorities to the Operators.*)

- v. Maximum demonstrated Crosswind = 35Kts for dry runway (Takeoff/Landing Flaps 30)
- vi. Maximum demonstrated Crosswind = 28Kts for Wet runway up to 3mm depth (TO/Landing Flaps 30)
- vii. Maximum Take-off weight = 22800 Kg

- viii. Maximum Landing Weight = 22350 Kg
- ix. Maximum mean runway slope = $\pm 2\%$

M/s Trujet has its own maintenance setup for the maintenance of ATR 72-212A aircraft to maintain airworthy.



1.6.1 Landing Gear:

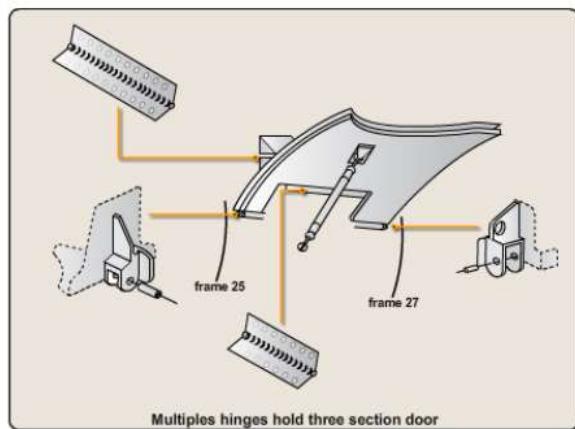
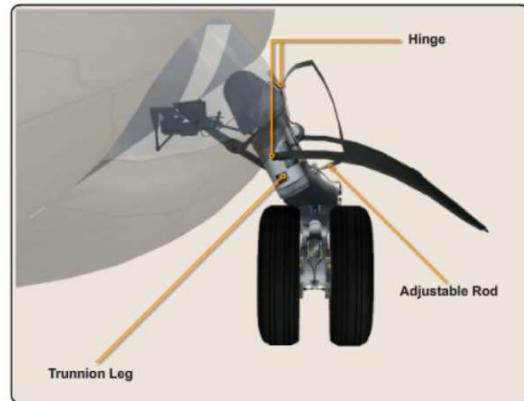
ATR landing gear is a retractable tricycle, fuselage mounted type. It is electrically controlled and hydraulically actuated. In case of power supply failure, the landing gear may be extended by gravity. The Hydraulic system supplies hydraulic pressure to the landing gear system. Green system is used for normal braking system and landing gear operations. Blue system is used for parking/emergency braking and for Nose Wheel steering operations.

Main Landing Gear (MLG) is of lever type inboard retracting, partially below the passenger compartment floor and partially in a specific fairing. Each main gear assembly is equipped with two wheels and an oleo pneumatic shock absorber. Nose Landing Gear (NLG) is forward retracting. It is housed in a wheel well aircraft nose. The two-wheel nose gear assembly includes an oleo pneumatic shock absorber.

The main gear doors are located on the belly fairing between the frames 25 and 27 of the fuselage. The main landing gear supports a three-section door to restore fairing contour when L/G is locked up. The door is hinged on its upper part to the fairing and on its lower one (the largest) to the trunnion leg by an adjustable rod. The main gear trunnion leg actuates, by a rod, the multiple section door which is composed of a main L/G door and two folding doors. These doors allow to close gear wells in flight conditions.



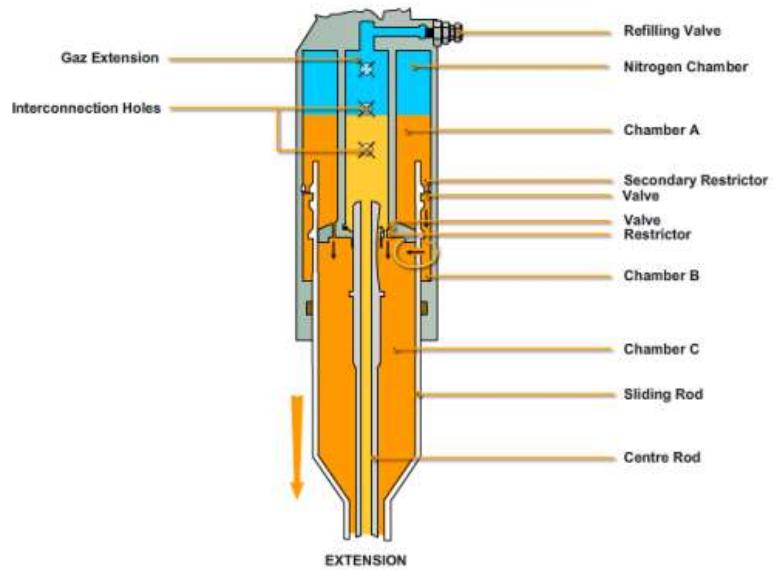
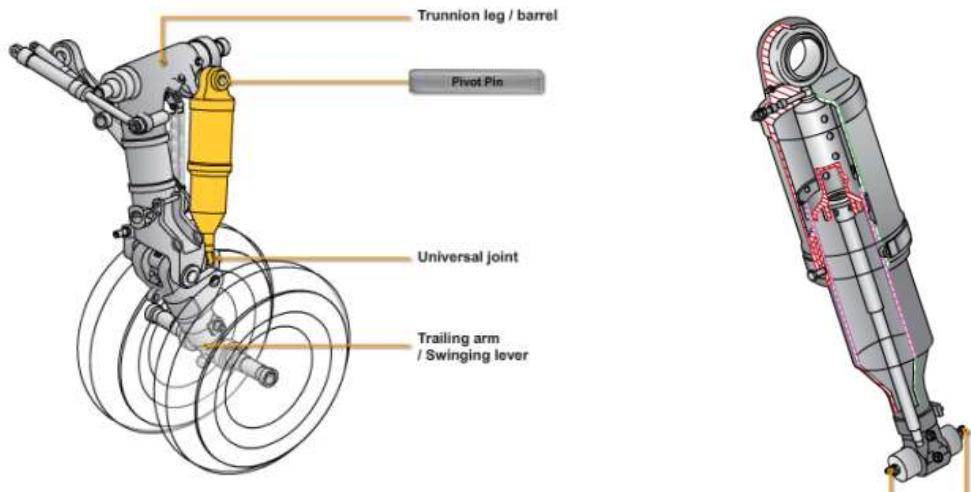
Main Gear Door



Multiples hinges hold three section door

1.6.2. Shock Absorber:

The shock absorber is a part of MLG located in the belly fairing. The left and right MLG shock absorbers are identical and interchangeable. The oleo pneumatic double acting shock absorber absorbs landing energy and provides an elastic suspension when the aircraft taxies. It is pivoted between a pin fitted to the trunnion leg (or barrel) and a universal joint fitted to the trailing arm (or swinging lever). A valve is used for filling and charging the shock absorber (also when installed on the aircraft) through a tube which secures the upper rod in the external cylinder. It allows the servicing of the shock absorber with dry nitrogen and hydraulic fluid. Its sliding rod is fitted with the oil drain plug. Furthermore, there is an oil drain plug and two lubrication fittings on its lower part, and another lubrication fitting on the top of the shock absorber.



1.6.3. Flight Control Pitch Disconnection:

Each control column mechanically drives the associated elevator and through a pitch coupling mechanism, the other elevator and the opposite control column.

The aircraft must be controlled from one control column only. Dual input in opposite direction may result in a pitch disconnect.

In case of jamming, pitch control will be recovered by applying on both control columns a differential force (520 N/114lb) disengaging the pitch coupling system. The non-affected channel enables the aircraft to be operated safely. System recoupling has to be performed on ground and dedicated maintenance inspection needs to be performed.

Pitch uncoupling generates Master Warning red alert and red message PITCH DISCONNECT on CAP.

1.6.4. Control Column Uncoupling:

To uncouple elevators and override jam, both pilots accomplish one by one a firm action on own column in the way required by the flight condition.

1.7 Meteorological Information:

Time & Type of Report (UTC)	Visibility (Meter)	Precipi-tation	Cloud Description	Current Temp./ Dew Point Temp. (°C)	Surface Wind Speed/ Direction (Kts / Deg.)
1400 METAR	4000	Rain	Overcast Cloud Cover at 8000 Ft Scattered Cloud at 1200 Ft Few Cloud at 800 Ft	23/22	09 / 80
1415 SPECI	3000	Rain	Overcast Cloud Cover at 8000 Ft Scattered Cloud at 1200 Ft Scattered Cloud at 800 Ft	23/22	07 / 150
1430 METAR	4000	Rain	Overcast Cloud Cover at 8000 Ft Scattered Cloud at 1200 Ft Few Cloud at 800 Ft	23/22	08 / 140

1. Mysuru Airport has issued Aerodrome Warning at 1330 UTC for WIND SPEED 20 Kt from 070°degree valid from 1345UTC to 1745 UTC.

2. In addition, Mysuru had issued SPECI at 1415 UTC containing the following significant changes;

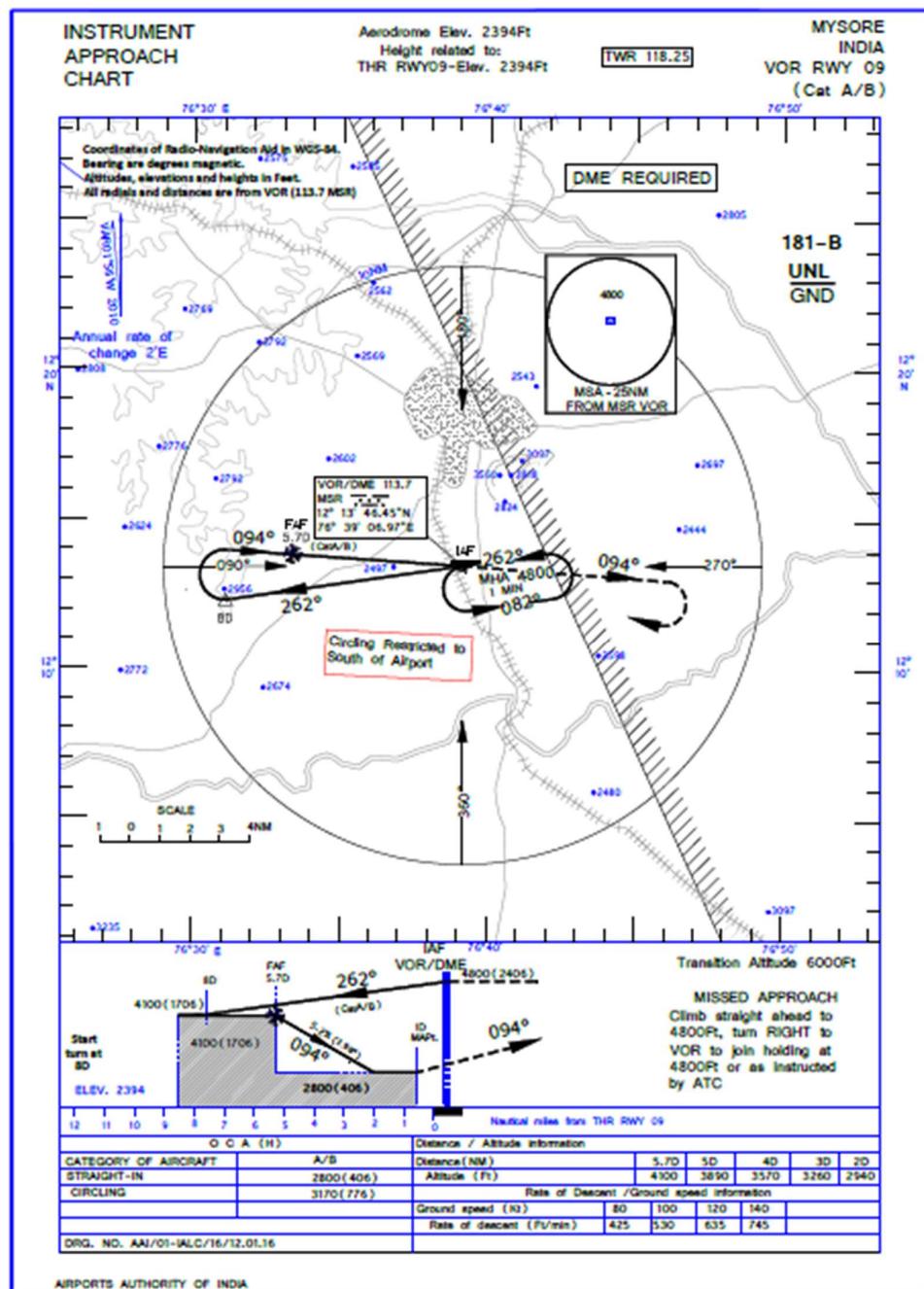
- a. Increase in cloud cover from few to scattered at 800 ft with Rain
- b. Reduction in visibility from 4000m to 3000m
- c. Change in direction of Wind from 80° to 150°degree.

At 1418 UTC, before Final Approach Fix (FAF) point of RWY 09, the ATC tower provided the latest weather observation as Visibility 3000m with Moderate Rain and at 1419 UTC, ATC had given clearance to land with Wind 150°/10Kts. The incident occurred at time 142055 UTC.

1.8 Aids to Navigation:

AIP
India

AD 2 VOMY 2-201
01 JUL 2019



Airports Authority of India

AMDT 02/2019

The navigational aids VOR-DME and PAPI were available.

1.9 Communications:

There was always two-way communication established between the Air Traffic Controller and the aircraft.

1.10 Aerodrome Information:

Mysore Airport has a single runway 09/27 at an elevation of 2394 ft, with dimensions 1,740 x 30 meters (5,709 ft x 98 ft) and the ability to service ATR 72 turboprop and similar aircraft. The apron has three parking stands and is connected to the runway by a single perpendicular taxiway. The ATS, MET and ARFF services are available. Air Traffic Services are provided by Airport Authority of India.

The runway 09/27 has;

1. Short Approach Lighting System (SALS)
2. Visual Slope Indicator PAPI on left of both sides of runway with MEHT 30 Ft
3. RWY 09 has Slope of 01.00% negative

	Marking	Lighting
Runway 09/27	Designation THR TDZ Centre line Edge Aiming point	THR Edge END Turning Point
Taxiway	Centre line Edge Taxi holding Position (TWY A)	Edge (TWY A)

1.11 Flight Recorders:

Flight recorders raw data were downloaded from the units. CVR raw Data converted in to the readable format at the operator's facility, Hyderabad and DFDR raw Data sent to M/s. ATR facility for conversion and analysis.

1.11.1 Cockpit Voice Recorder: -

Aircraft was fitted with Fairchild CVR unit (FA2100) with Part No.2100-1220-02 & Sl.No. 001142471.

From the CVR recording, followings have been observed;

- a. PIC was carrying out Pilot Flying (PF) duties and First Officer was carrying out Pilot Monitoring (PM) activities.
- b. At 140800Hrs, descent checklist and at 141213Hrs. Approach checklist was carried out by the crew.

- c. At 141713Hrs, when the aircraft was descending to 4900ft to establish on final approach track, Alliance air (No.1 in landing sequence) conveyed that on their Final approach, they experienced heavy rain before 2NM from runway and after that light rain over threshold.
- d. At 141745Hrs, aircraft establishing final approach Rwy09. Controller passed the latest visibility as 3000m with moderate rain which was acknowledged by the aircraft.
- e. At 141756Hrs, Runway 09 clear to land was granted by tower.
- f. At 141808Hrs, before landing checklist were performed by the crew.
- g. At 141817Hrs, PF called for 5Miles height check and Pilot Monitoring (PM) replied 5Miles, 3890, 4Miles, 3570.
- h. At 141852Hrs, PF called for 4Miles height check and PM replied 3570 and 3Miles 3260.
- i. At 141901Hrs, PF called out - Are we on Profile 4Miles? and PM replied as Yes sir. PF called again for 4Miles height check and PM replied 3570.
- j. At 141926Hrs, around 3Miles, on height check called by PF, PM replied that 3260 and 100 below profile, for which PF said Ok.. Correcting.
- k. At 141939Hrs, Runway insight & wipers full on PM side call was made by PF and PM replied wipers full on.
- l. At 142008Hrs, the aircraft was at 500ft (RA -auto call). But there was no Stabilised/ Not stabilised call out by PM.
- m. Between 500ft RA and 300ft RA auto call, Wipers with varying mode (i.e. Slow to Fast) was used.
- n. At 142029Hrs, auto call of 200ft came on followed with winds 07kts from right was announced by the PM.
- o. At 142047Hrs, When the aircraft was between 40Ft to 30ft of RA, Bank angle aural warning came on.
- p. At 142055Hrs, 10ft RA call out followed with a thud sound and then Master Warning & Continuous Repetitive Chime heard.
- q. At 142056Hrs, Go Around call was made by the PF and Go Around checklist actions were carried out.
- r. While going around with flap 15° and on positive rate, PM informed pitch disconnect and gear not getting up at 142109Hrs.
- s. While performing pitch disconnect checklist, at 142447Hrs, PF confirmed that his control column is free and continued the PF activity from his side.
- t. There was no call out & response found available in the CVR with reference to vertical flight path management by the crew.

1.11.2. Flight Data Recorder:

The aircraft was fitted with Fairchild (FA2100) Flight Data Recorder bearing Part No. 2100-4043-00 & SI.No.000603289. From the DFDR data and the analysis report by ATR, the following have been observed:

There were several sharp variations and peaks in the Indicated Air Speed and Angle of Attack (IAS & AOA) values indicate the presence of turbulent weather when the aircraft was over Mysuru Airport.

1.11.2.a. APPROACH:-

At 2200ft RA, aircraft was aligned with the runway and with Flaps 15°, aircraft descended. At 1800ft RA, Landing Gear selected down and Flaps were deployed from 15° to 33° and IAS started to decrease gradually from 150Kt. The aircraft was under Auto pilot (AP) till 550ft RA. IAS varied between 116k and 107kt (calculated V_{APP} was 106kt). The final approach met the stabilization criteria in respect of speed but the aircraft was constantly below the path which has most probably induce the need for the low level off and then the difficulty to land the aircraft in difficult weather condition. Hence, it is observed that the final approach did not meet the stabilisation criteria.

At 141817UTC, (when PF called for 5miles check), the aircraft pressure altitude was 3616ft. Similarly, at 141852UTC, (4mile check), the aircraft was at 3292ft and at 141926UTC (3mile check), it was at 2971ft.

1.11.2.b. FROM 550ft to 100ft:-

At 550ft RA, AP was disconnected & IAS was 113kt ($V_{APP}+7$ kt). Below 550ft to till 532ft RA, for approx. 06 seconds, IAS was exceeding $V_{APP}+10$ Kts and attained maximum magnitude of 119Kts (ie. $V_{APP}+13$ Kts) for one second.

Below 532ft to 100ft RA, V_{APP} was maintained within V_{APP} and $V_{APP} +10$ Kts & roll was between -4° to +7°. Heading variation between 091° and 101° indicates that the track was in consistence with the runway and the negative drift angle (approx. -5°), is in consistent with a right cross wind. Aircraft vertical speed (based on ALT derivative) varied gradually between -200ft/min and -650ft/min for a VS target at -500ft/min.

On the longitudinal axis the pitch angle varied between +1° and -2°.

1.11.2.c. BELOW 100ft:-

a. ON LONGITUDINAL AXIS:-

At 100ft RA, IAS was 108kt, Pitch angle was less than +1° & Roll was around 4°. The Rate of Descent (ROD) increases from -200ft/min towards -540ft/min and then gradually decreased to zero till 32feet.

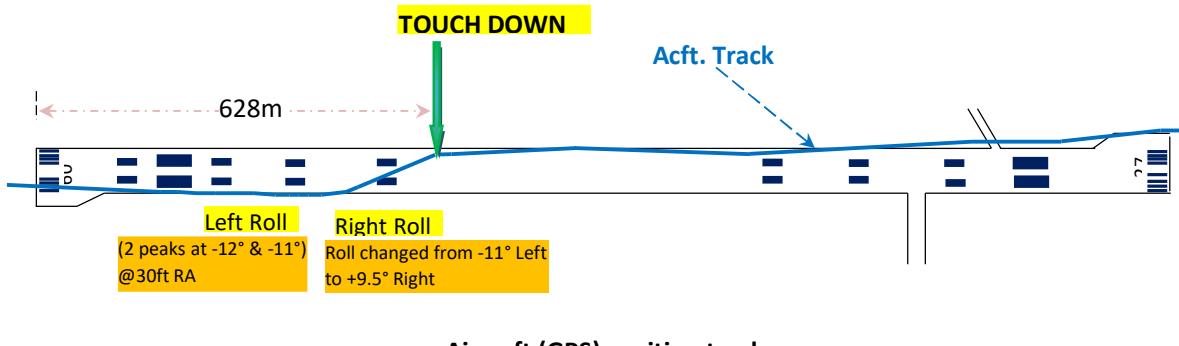
At around 32ft RA, the aircraft levelled off with increasing pitch towards +4°. IAS was around V_{APP} and power levers were slightly increased. While pitch angle was +4°, a nose down input was applied followed by a nose up order effort applied by PF (CM1). Pitch angle decreased to 0° and re-increased to +1.1° with a radio height at 30ft RA. While pitch angle was stabilized at +1.1°, another nose down elevator deflection was found recorded (effort <10daN). The pitch angle decreased towards -4.5° (reached around 10ft). In a first approximation, based on accelerometers values, the vertical speed reached -1000ft/min before the ground contact. At 15ft RA (one second before the ground contact), while pitch angle was reaching -4.5°, a nose up order was recorded and elevator deflection reached -11° at ground contact.

Just before the ground contact, Power levers were moved forward, from 52° to 62° and momentarily it was reduced to 57° and then again started to increase. Based on accelerometer value*, the vertical speed reached approx.1000ft/min before the ground contact and IAS was around 105kt (V_{APP} -2kt).

(Note:-As per ATR - * *The vertical speed is not recorded in the data frame. Hence, a recomputed ROD derived from pressure ALT. At lower height, estimation of the vertical speed is based on the integration of accelerometers was used to describe the landing phase of the aircraft.*)

b. ON LATERAL AXIS:-

On the lateral axis, the drift angle was recorded around -5° until 40ft RA. At 40ft RA, a left rudder pedal input at +5° (de-crab) was recorded and progressively released. When this rudder deflection was initiated, aircraft was banking at approx. 5° right. The manoeuvre was accompanied by a left bank order. From 40ft RA to 30ft RA, the roll angle changed from +5° right and reached -12.0° left. From 30ft RA to 20ft RA, a right bank order was applied, the roll angle reduced at -4° then another peak was recorded at -11° while a left order was recorded. This left roll was maintained while the aircraft position was recorded at the right edge of the runway and could correspond to a trajectory correction. Heading changes from 097° to 090° (left turn) and the lateral acceleration was positive (towards the left). When the aircraft started to go from the left to the right of the centerline, a right roll order was recorded and the roll angle changed from -11° left to +9.5° right (7°/sec) at touchdown.



Aircraft (GPS) position track

Based on the aircraft GPS positions data, observed that the when the aircraft was on the Rwy 09, it was on the right side of the runway axis and the aircraft moved from right to left and made contact with the ground after crossed the touchdown zone.

1.11.2.d. TOUCHDOWN:-

The aircraft touched down at 14:20:55 UTC with a load factor recorded value of +5.2G and pitch angle was around -2°. The ROD was observed as -1000feet/min at the time of touchdown. As per the GPS recorded position the aircraft made contact with the ground after crossed the touchdown zone and on the left side of the runway centreline. Power lever continued to be increased and were around 60° at the time of the contact and IAS was 114kt (just one second prior it was 105 kt).

On the lateral axis, Heading was 089° (QFU 090°), the roll angle was +9.5°.

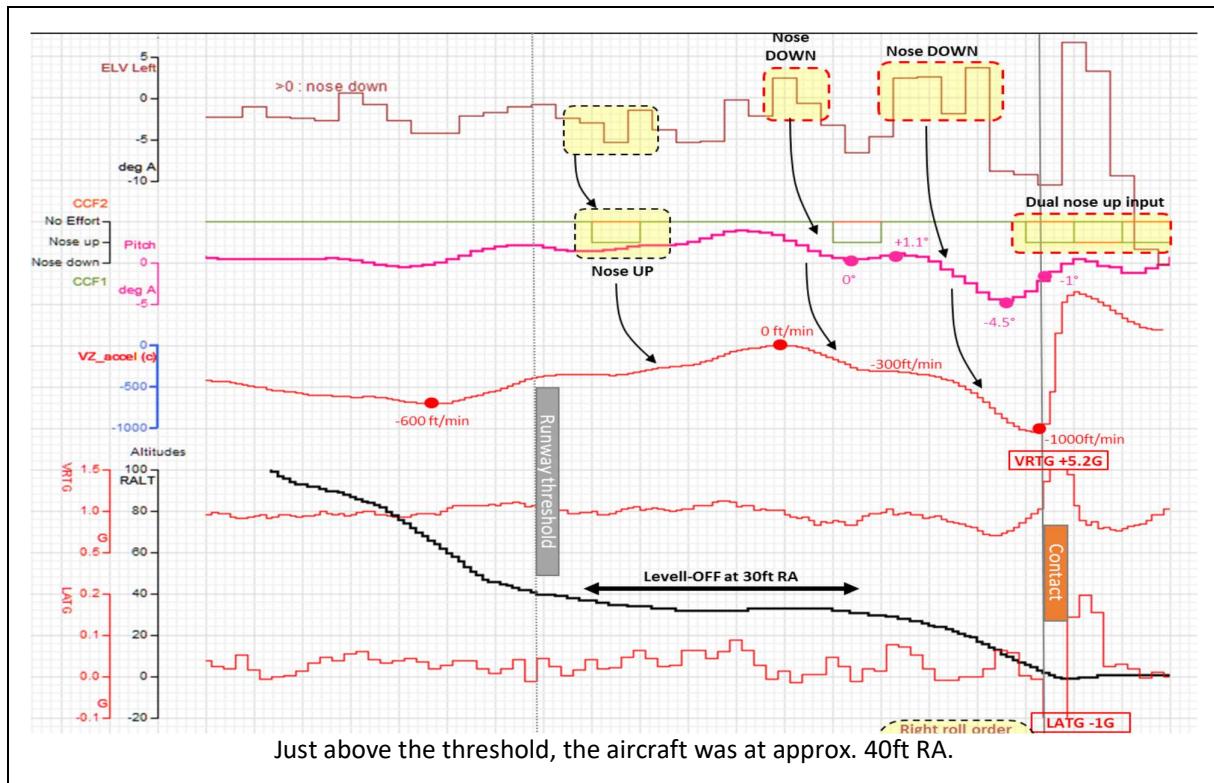
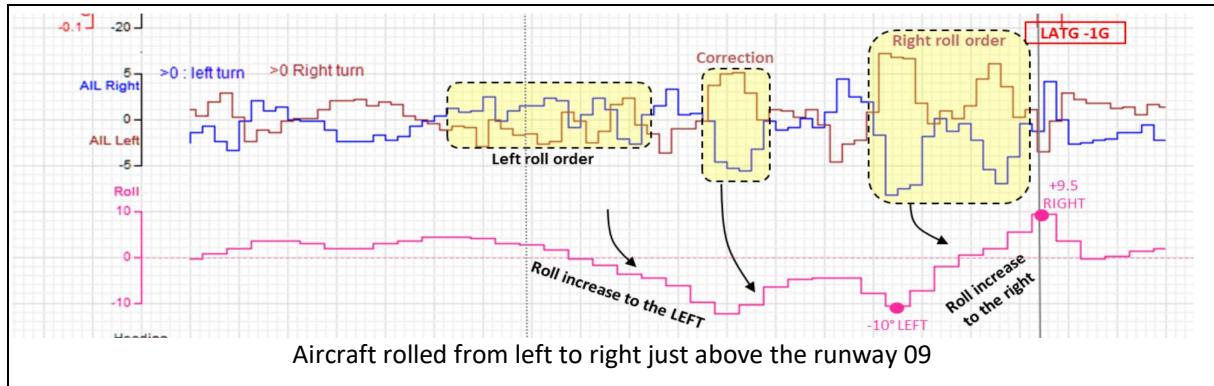
After touchdown, power levers were increased to the Notch. A nose up elevator deflection was recorded by PIC while a nose down effort of more than 10daN was applied by Co-pilot (CM2) indicating brief Dual Input from Co-pilot noticed. Less than one second later, a master warning triggered due to FLAPS at 33° under Go-around pushbutton (PB) mode. The aircraft was on ground (zero ft) for 3 seconds before getting into air again.

MLGs (Main Landing Gear) mode & All LGs (Landing Gears) compressed mode were shown as 'AIR' throughout the maneuvers at Mysuru. This is due to the reason that only one LG might have compressed at a time when the aircraft contacted with Runway.

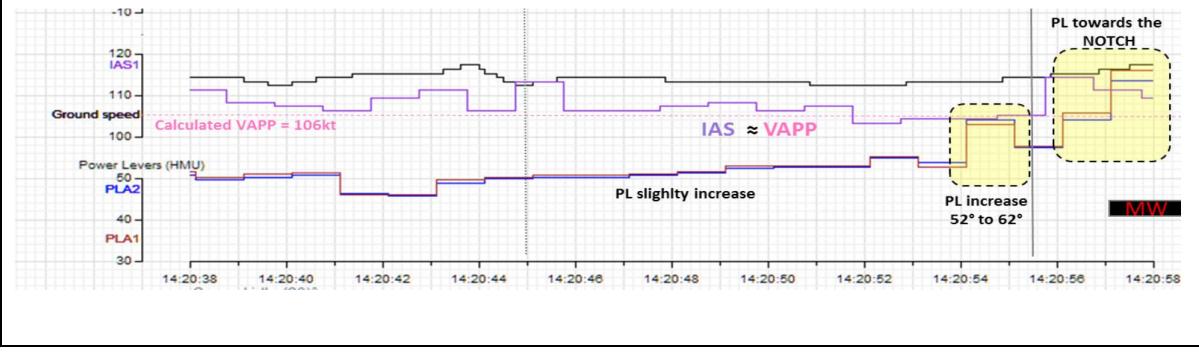
1.11.2.e. GO-AROUND AND DIVERSION TO CHENNAI

GO-AROUND mode was engaged. Power lever (PL) were gradually moved up to the RAMP, the total duration of the PL transition was around 15 seconds. Torque and NP increased to 100% and pitch

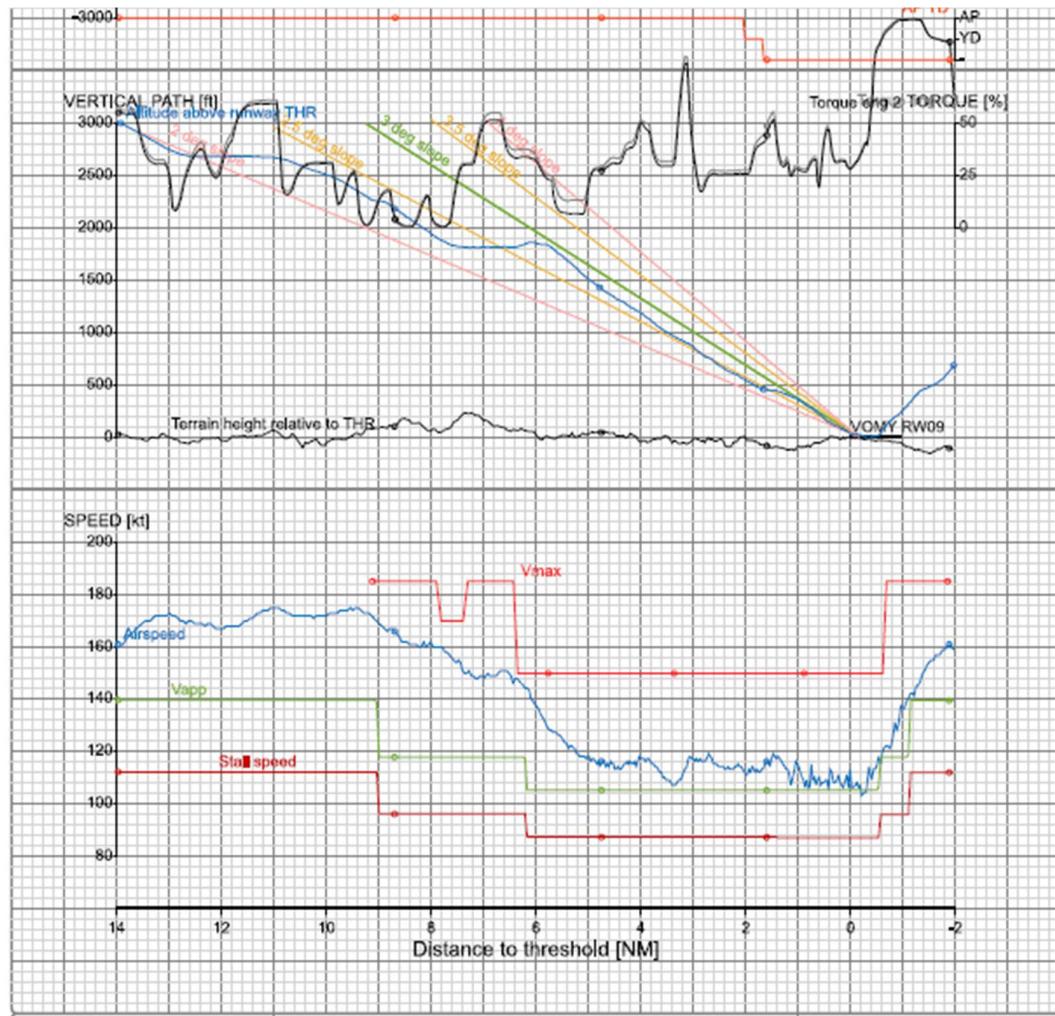
angle reached + 9° before being stabilized around +8°. FLAPS remained in 33° & landing gear lever was recorded in DOWN position during the whole diversion flight. Cruise altitude maintained in the diversion sector was 11000ft. Average IAS was 160kt (Max 170kt) which was Higher than VmLBO (133kt), Lower than both VLE (185kt) and the MAX IAS requested in the PITCH DISCONNECT procedure (180kt). No significant event noticed in the diversion flight.



PL increased from 52° to 62° just prior to Touchdown and after touchdown PL increased to NOTCH.



Graphical representation of few important Parameters (50ft RA till Touch Down) at Mysuru Airport



Approach Plot

Speed and Vertical Path followed by the aircraft.

Final approach speed was within the stabilisation criteria, the aircraft was consistently below the nominal 3° flight path.

DFDR DATA from 100ft RA till Touch down at Mysuru Airport

GMT	RA in Ft.	HDG. in Deg.	IAS in Kt.	PLA (Deg.)		Pitch ATTD (Deg.)				Roll1 Deg.		Rudder Posn. (Deg.)		Left ELE POSN (Deg.)		DRIFT ANGLE (Deg)	Vert. G
				1	2	1	2	3	4	1	2	1	2	1	2		
14:20:39	108.52	94.22	108	50.62	49.92	0.44	0.44	0.44	0.44	2.11	3.87	-0.35	0.05	-0.88	-2.11	-4.39	0.96
14:20:40	93.67	94.92	107	50.98	50.27	0.44	0.44	0.44	0.62	3.87	3.16	-0.01	-0.01	-2.28	-2.55	---	1.00
14:20:41	89.38	93.87	106	45.70	46.05	0.53	0.35	0.09	-0.18	2.11	2.11	-0.12	-0.53	0.70	-0.61	-4.22	0.99
14:20:42	80.39	94.22	109	45.70	45.35	-0.33	-0.42	-0.35	-0.18	3.16	3.87	-0.06	-0.18	-2.64	-4.13	---	0.97
14:20:43	63.98	95.27	111	49.22	48.52	0.09	0.53	0.97	1.41	4.57	4.57	0.00	-0.12	-4.13	-2.02	---	1.06
14:20:44	47.19	95.98	106	49.92	49.57	1.76	2.02	2.20	2.20	4.22	3.16	1.22	1.63	-1.58	-0.88	---	1.11
14:20:45	40.94	96.68	113	50.27	49.92	2.11	1.85	1.58	1.49	2.81	1.76	4.74	4.27	-0.61	-2.28	-2.64	1.06
14:20:46	37.42	95.98	106	50.27	49.92	1.41	1.49	1.58	1.76	0	-1.41	3.80	3.68	-2.90	-5.18	---	0.99
14:20:47	34.30	94.22	106	50.62	50.27	2.02	2.11	2.11	2.11	-3.52	-4.22	2.81	2.28	-1.32	-3.69	---	1.05
14:20:48	32.34	92.46	107	51.33	50.98	2.29	2.64	2.99	3.43	-5.98	-9.49	1.93	1.46	-5.27	-5.01	---	1.11
14:20:49	31.95	92.11	108	52.73	52.03	3.78	3.96	3.87	3.69	-11.95	-10.20	1.81	0.52	0.00	-2.02	-0.18	1.12
14:20:50	33.12	92.11	106	52.73	52.38	3.34	2.72	2.11	1.49	-6.33	-4.57	0.75	0.58	2.55	-0.53	---	1.01
14:20:51	33.12	91.41	107	52.73	52.38	0.97	0.62	0.35	0.44	-4.22	-4.22	0.99	0.81	-3.16	-6.41	---	0.89
14:20:52	30.39	90.00	103	54.84	54.49	0.62	0.88	1.14	0.97	-7.73	-10.55	0.70	0.34	-4.48	2.55	---	1.02
14:20:53	26.88	89.65	104	52.38	53.44	0.70	0.18	-0.70	-1.58	-7.03	-1.76	-0.53	-0.47	2.72	-1.76	-2.99	0.95
14:20:54	20.23	89.65	104	62.58	63.63	-2.44	-3.50	-4.31	-4.48	0.70	2.11	-0.23	-0.94	3.87	-8.61	---	0.85
14:20:55	8.12	88.59	105	57.30	56.95	-4.11	-3.41	-2.20	-1.05	5.62	9.49	-0.82	-0.76	-9.14	-10.37	---	2.35
14:20:56	-1.25	88.95	114	65.39	63.63	0.00	0.53	0.26	-0.35	3.87	0.00	-0.47	-1.11	6.94	3.43	---	5.20
14:20:57	1.48	90.35	111	75.59	73.12	-0.51	-1.21	-1.23	-0.62	0.35	1.41	-0.70	0.23	-9.23	-18.10	0.00	0.88
14:20:58	0.70	91.76	109	74.88	71.02	-0.16	0.62	1.49	2.46	2.11	2.81	0.70	0.87	-19.95	-20.21	---	1.21
14:20:59	1.88	92.11	113	70.31	70.66	3.16	3.78	4.13	4.39	3.52	3.52	0.40	0.00	-13.97	-13.18	---	1.20

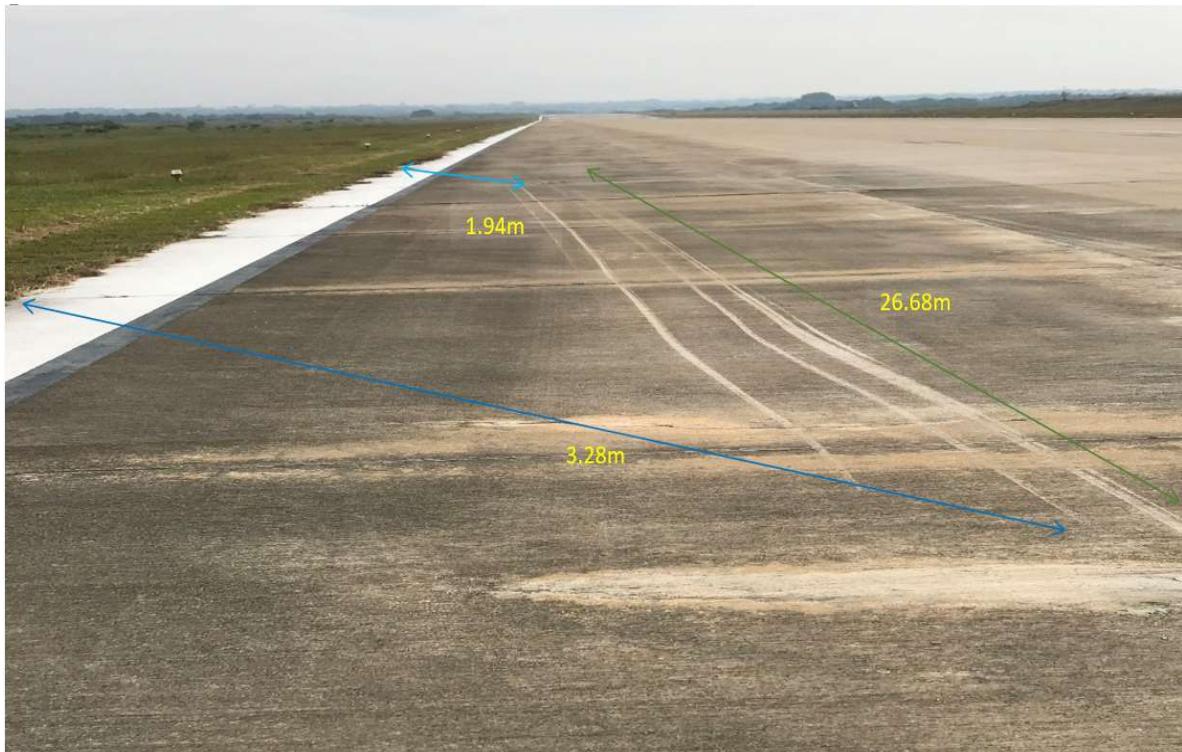
Convention: RUDDER POSITION (>0 TURN LEFT) ;LEFT ELEVATOR POSITION (>0 NOSE DOWN); PITCH ANGLE (>0 NOSE UP);LEFT AILERON POSITION (>0 TURN RIGHT); ROLL ATTITUDE 1 (>0 RH WING DOWN)

GMT	RA in Ft.	Flap in Deg.	Right AIL POSN. (Deg.)				Left AIL POSN. (Deg.)				Wind		Ldg Gear		GA CAP MODE	Control Column		MWrng
			1	2	3	4	1	2	3	4	Dir. Deg.	Spd Kts.	Ma in	All		Capt	FO	
14:20:39	108.52	---	-3.23	-0.049	2.14	1.10	2.94	0.30	-2.30	-1.10	168.78	6	AIR	AIR	inactive	No Effort	No Effort	----
14:20:40	93.67	30.80	1.42	0.090	-0.074	-0.12	-1.38	0.00	0.17	0.17	---	5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:41	89.38	---	-1.10	-2.25	-2.23	-2.33	1.16	2.15	2.15	2.26	---	8	AIR	AIR	inactive	No Effort	No Effort	----
14:20:42	80.39	30.80	-1.63	-2.10	-1.78	-0.63	1.56	1.94	1.72	0.55	196.91	6	AIR	AIR	inactive	No Effort	No Effort	----
14:20:43	63.98	---	-0.10	0.47	1.37	0.95	0.10	-0.40	-1.03	-0.65	---	3.5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:44	47.19	30.80	0.99	2.63	-0.07	1.06	-0.75	-2.88	0.05	-0.85	---	11	AIR	AIR	inactive	No Effort	No Effort	----
14:20:45	40.94	---	1.62	1.62	2.43	2.09	-1.55	-1.48	-2.58	-2.28	---	-1	AIR	AIR	inactive	No Effort	No Effort	----
14:20:46	37.42	30.80	-0.78	0.61	2.41	1.19	0.86	-0.08	-2.40	-1.18	173.71	8	AIR	AIR	inactive	Nose Up	No Effort	----
14:20:47	34.30	---	-1.98	-2.56	0.68	1.64	1.67	2.46	-0.45	-1.48	---	7.5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:48	32.34	30.80	3.38	0.63	0.72	-0.049	-3.51	-0.88	-0.90	-0.03	---	6.5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:49	31.95	---	-4.48	-5.26	-5.54	-3.08	3.84	5.01	5.25	3.05	---	5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:50	33.12	30.80	-0.05	-1.03	-0.75	0.27	0.05	1.18	1.02	0.37	201.84	7	AIR	AIR	inactive	No Effort	No Effort	----
14:20:51	33.12	---	-0.78	0.95	4.50	2.59	1.13	-0.50	-4.51	-2.60	---	5.5	AIR	AIR	inactive	Nose Up	No Effort	----
14:20:52	30.39	30.80	2.00	-1.60	-8.14	-7.41	-2.15	0.89	7.32	6.85	---	9.5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:53	26.88	---	-7.04	-1.73	0.25	-1.15	6.69	1.85	-0.35	1.07	---	8.5	AIR	AIR	inactive	No Effort	No Effort	----
14:20:54	20.23	30.80	-0.30	-2.20	-5.33	-6.89	0.21	1.58	4.58	6.18	201.13	9	AIR	AIR	inactive	No Effort	No Effort	----
14:20:55	8.12	---	-4.01	-0.38	-1.23	4.21	3.70	0.32	1.18	-3.46	---	8.5	AIR	AIR	inactive	Nose Up	No Effort	----
14:20:56	-1.25	30.80	0.05	-2.50	-2.48	-2.15	0.00	3.00	2.28	1.85	---	0.5	AIR	AIR	inactive	No Effort	Nose Up	----
14:20:57	1.48	---	-2.03	-1.33	-1.38	-0.50	1.83	1.38	1.43	0.57	---	4.5	AIR	AIR	inactive	Nose Up	No Effort	WARNING
14:20:58	0.70	30.80	-2.13	-1.70	-2.08	-1.00	1.74	1.49	1.79	0.77	197.62	8	AIR	AIR	active	Nose Up	No Effort	WARNING
14:20:59	1.88	---	-1.05	-0.88	-0.68	-0.43	3.16	3.78	4.13	4.39	---	4	AIR	AIR	active	Nose Up	No Effort	WARNING
14:21:10	222.97	15.00	0.72	0.41	0.36	1.62	0.46	0.59	0.68	0.73	161.75		AIR	AIR	active	No Effort	No Effort	

Note: Wind Speed parameters are derived from the available data.

1.12 Wreckage and Impact Information:

Aircraft RH Main landing gear door and the RHMLGs shock absorber's metering pin got detached at Mysuru. Crew diverted the flight to Chennai and carried out safe landing.



Ground Markings at Mysuru

At Mysuru airport, from the ground markings and damage of the aircraft, it can be deduced that the right main landing gear (RH MLG) had impacted with runway surface around 628m from the RWY09 threshold & 12.5m to the left of centerline (3.28m from the edge of the runway) and due to the impact the RH MLG shock absorber broken at the bottom side nearby its pivot joint with the trailing arm containing the wheel. The RH MLG door detached along with tie rod. The center rod, which is the internal component of shock absorber also detached in Mysuru airport. The ground marks were seen for 26.68m and there were no other ground markings witnessed.

Landing Gear was not able to retract due to damage of hydraulic line. The crew flew the aircraft with landing gear down configuration to Chennai. With the broken RHMLG's shock absorber and the trunnion leg, trailing arm found distorted and leaning forward condition, during the landing roll could have resulted in #03 tyre rubbing and denting the AFT fairing structure.

1.13 Medical and Pathological Information

The flight crew undergone preflight & post incident Breathalyzer test and found negative.

1.14 Fire

There was no fire or fumes.

1.15 Survival Aspects

The incident was survivable.

1.16 Tests and Research

The failed RHMLG shock absorber, the detached RHMLG door and metering pin sent to DGCA, AED lab, New Delhi for failure analysis.

Analysis report states that the presence of slant, fibrous and distortion features available on the fracture surface of the RH-MLG's piston rod, door's tie rod, door attachment lugs, centre rod and retaining bolt at shock absorber upper attachment end are indicative of overload failure of the components. The presence of dimple features seen on the fracture surfaces of the mentioned components under Scanning Electron Microscope (SEM) examination confirms that the components have failed in overload condition.

1.17 Organizational and Management Information

M/s Turbo Megha Airways Pvt. Ltd. (M/s. Trujet), Hyderabad has its initial Air Operator Certificate in 15/05/2017 valid up to 11/05/2025 has total of 07 passenger aircrafts. Out of 07, 05 aircraft are of ATR 72-500 and 02 aircraft are ATR72-600.

1.18 Additional Information

As per the crew, Pilot- in – Command (PIC) was the Pilot Flying (PF) and during final approach at Mysuru all the way up to 100ft, runway was very much in sight and when close to the ground, intensity of the rain picked up. At approx. 50ft, they were on the threshold of the RWY 09 with moderate rain and at approx. 20-30ft, hit an unexpected heavy down pour of rain like hitting of wall and strong gust. The depth of perception reduced and the aircraft banked to the right and nose down. Concentrated in recovering the aircraft and decided to go around. During the process, Landing Gear (LG) made ground

contact. During go around maneuver, LG lever was selected UP. Whereas, LG lever was not going up. Carried out appropriate checklists. Due to the bad weather condition as it was not safe to land at Mysuru with landing gear being unsafe and as endurance was more than 4 hours, diversion flight to first alternative aerodrome, Chennai was decided. Lower level and lower speed was maintained and the aircraft flown to Chennai with landing gear down configuration. At Chennai, safe landing was performed on runway 07 and maintained center line. During landing roll, felt right wing slightly low and suspected tyre burst or deflation, the aircraft was stopped on the runway and with adequate briefing to the crew and passengers, engines were switched off and passengers were deplaned normally on the runway.

1.18.1. Landing – FCOM Normal Procedure:-

ATR TRJ / 75 FCOM	PROCEDURES NORMAL OPERATIONS NORMAL PROCEDURES	PRO.NOP Page n°41
------------------------------------	---	--------------------------

NOR.22 Landing		REV	4.3
		ALL	
PF	PM		
At DH or MDA +100 ft	► HUNDRED ABOVE ANNOUNCE		
At DH or MDA	► MINIMUM ANNOUNCE		
■ If visual references acquired ► VISUAL REF ANNOUNCE ► APPROACH CONTINUE			
■ If visual references not acquired ► 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			
	► YD DISENGAGE & ANNOUNCE ► AFCS YD ALARM CLEAR ► RUD TRIM CHECK CENTERED		
At 50 ft AAL	► 50 FT AAL ANNOUNCE		
At 20 ft AAL	► 20 FT AAL ANNOUNCE		
► PL 1+2 FI ► FLARE PERFORM			

FCOM Normal Procedure requires PF to reduce Power Lever (PL) 1+2 to Flight Idle (FI) at 20ft and FLARE to be performed.

1.18.2. Standard Procedure for Go-Around Action: The Pilot flying and Pilot Monitoring has to perform the following for Go Around actions.

ATR	PROCEDURES	PRO.NOP
TRJ / 75 FCOM	NORMAL OPERATIONS NORMAL PROCEDURES	Page n°42

NOR.23 Go-Around

e883463b-12c2-4516-a524-6a9c3b5b91b4	REV	6.2
		ALL

PF	PM
Go-Around <ul style="list-style-type: none"> ▶ GO-AROUND ORDER & INITIATE <i>Announce "Go-around, set power, flaps one notch".</i> • Simultaneously <ul style="list-style-type: none"> ▶ GA pb PRESS 	

PF	PM
<ul style="list-style-type: none"> ▶ PL 1+2 ADVANCE TO RAMP ▶ PITCH ROTATE TO GA PITCH <i>Follow FD bars and accelerate to GA speed.</i> ▶ ADU CHECK <i>Check Go-around mode engaged.</i> ▶ CAVALRY CHARGE CANCEL 	<ul style="list-style-type: none"> ▶ FLAPS RETRACT ONE NOTCH CAUTION <ul style="list-style-type: none"> ▶ Adjust go-around torque and avoid overtorque. ▶ PL 1+2 CHECK <i>Check GA TQ and NP at 100 %.</i> ▶ FLAPS ANNOUNCE POSITION ▶ ADU CHECK <i>Check Go-around mode engaged.</i>

As per the above procedure, Go around, set power, flaps one notch to be announced and simultaneously GA push button to be pressed. PL1+2 to be advanced to Ramp and Pitch to rotate to GA pitch. Meanwhile PM to retract Flaps to one notch and adjust go around torque and avoid over torque and PL1+2 to check.

1.18.3. Bank Angle Aural Warning: GPWS Mode 6 - Excessive Bank Angle and Altitude Callouts

This mode monitors the following parameters:

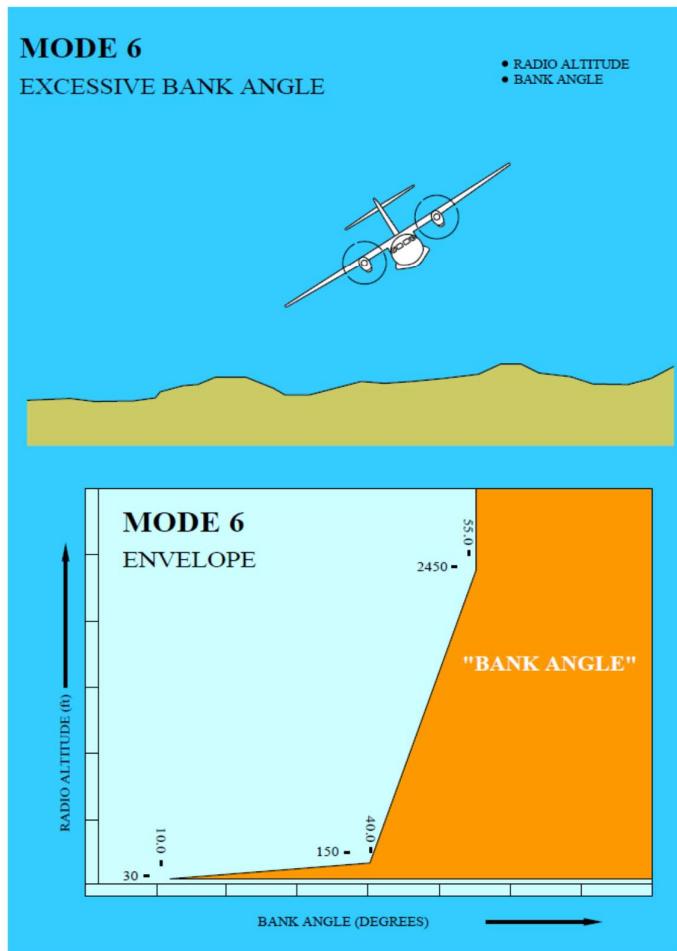
- Radio altitude,
- Decision Height (DH) &
- Bank angle.

ATR TRJ / 75 FCOM	DESCRIPTION NAVIGATION TAWS	DSC.34.13 Page n°13
--	--	----------------------------

cont'd... >>>

1) Excessive Bank Angle Callout

The system monitors the radio altitude and bank angle, and generates an aural annunciator (BANK ANGLE) when the aircraft bank angle exceeds a bank angle limit.
The bank angle limit depends on the radio altitude.



1.18.4 Operation Manual (Stabilisation Criteria):-

	Turbo Megha Airways Pvt Ltd	TMAPL 01.A
	Operations Manual Part A	Issue 01 Rev 00
	Stabilised Approach	Mar 2015
		Chapter 25

Chapter 25

Stabilised Approach

25.1 Required Elements of a Stabilised Approach

A Stabilised approach is one of the key features of safe approaches and landings especially those involving transport category airplanes. A Stabilised approach is characterized by a constant-angle, constant-rate of descent approach profile ending near the touchdown point, where the landing maneuver begins. A Stabilised approach is the safest profile in all but special cases, in which another profile may be required by unusual conditions.

All appropriate briefings and checklists should be accomplished before 1000' height above threshold (HAT) in instrument meteorological conditions (IMC), and before 500' HAT in visual meteorological conditions (VMC). An approach that becomes un-Stabilised below the altitudes shown here requires an immediate go-around.

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

- a) The aircraft is on the correct lateral and vertical flight path.
- b) Only minor changes in heading/pitch are required to maintain the correct flight path after glide path intercept or after Final Approach Fix.
- c) Aircraft speed should not be lower than VAPP nor be greater than VAPP + 10. **Only** as a consequence of particular speed instructions by ATC, a deviation from the Stabilised **Speed** criteria including the associated Power setting is permitted **below 1000 feet AFE down to 500 feet AFE**. In this case, the Stabilised **Speed** criteria and the associated Power setting must be reached by **500 feet AFE** latest. At 500 feet AFE, the PM shall call-out "STABILISED" / "NOT STABILISED";
- d) The aircraft is in the correct landing configuration. (Flap configuration shall not be changes below stabilisation gate)
- e) All briefings and checklists have been completed.

A-25-3

1.18.5. Trujet Operations Manual Part A /DGCA Operation Circular 01/2013

	Turbo Megha Airways Pvt Ltd	TMAPL 01.A
	Operations Manual Part A	Issue 01 Rev 00
	Stabilised Approach	Mar 2015 Chapter 25

25.2 Minimum Altitude and Limit Altitude

Stabilization during any straight-in approach shall be achieved before passing 1,000 ft. AAL in the approach.

A later stabilization in speed is only acceptable if higher than normal approach speeds are required by ATC procedures; in this case, the airplane must be configured by the standard 1000 feet AAL, but the speed and thrust criteria may be achieved by 500 ft. AAL.

For visual approaches and approaches, where the visual references are visible and identifiable already above 1,000 ft. AAL until touchdown, stabilization shall be achieved not later than 500 ft. AAL.

25.3 The Decision Making Process Leading To a Go-Around (Operations Circular 1 of 2013)

Flight Crew, for any reason, it is judged that an approach cannot be continued to a safe, successful landing, a missed approach or go around is flown. Some of the reasons for discontinuing an approach include the following:

- a) The 'required visual reference' has not been established by the Decision Altitude/Height (DA/H) or Minimum Descent Altitude/Height (MDA/H) or is acquired but is subsequently lost;
- b) The approach has become Un Stabilised;
- c) The aircraft is not positioned so as to allow a controlled touch down within the designated runway touchdown zone with a consequent risk of aircraft damage with or without a Runway Excursion if the attempt is continued;
- d) The runway is obstructed;
- e) Landing clearance has not been received or is issued and later cancelled;

1.18.6: SOP for Altitude Vs Distance and altitude deviation above or below the desired one.

ATR 72-500/600 	STANDARD OPERATING PROCEDURES SECTION II - NORMAL PROCEDURES	SOP.NOR
--	---	----------------

Flight Events	PM	PF
1000 FT AFE IMC	Announce : "XXXX ft, Stabilized" Winds _____	Announce : "Continue"
1000 FT AFE IMC	Announce : "XXXX ft, Unstabilised"	Order : "Go-around"
Reaching MDA + 500 ft	Announce : "Five Hundred Above" Winds _____	Announce : "Check"
Reaching MDA + 100 ft	Announce : "One Hundred Above MDA"	Announce : "Check"
MDA	Announce : "Minimum"	Announce : "Continuing" then "Land" or "Go-

Note 1: PM announces altitude versus distance, and altitude deviation above or below the desired one. PF corrects by adjusting VS.

Note 2: When RWY in-sight, PF announces 'LAND'. No more minima announcement done by PM.

Note 3: Go-around may be initiated before MAPT, according to the Company policy.

Note 4: On a non-precision approach (non-CDFA) without DME, ALL ENGINES OPERATING – if there is a level segment (MDA) after FAF, the flight must continue as published till Missed Approach Point (MAP) and landing can be made provided visual references are available as per the company policy established.

Note 5: On a non-precision approach (non-CDFA) without DME, in case of SINGLE ENGINE OPERATION – during a level segment after FAF an immediate Go-around shall be initiated upon reaching MDA as aircraft performance in a level flight with one engine operating in landing configuration is limiting.

Note 6: It is not permissible to descend below the MDA unless the required visual reference is established. It must be understood that if a go-around is initiated at MDA while descending, the aircraft will go below the MDA (H) during the missed approach maneuver, which is not allowed. To compensate for this, a margin of 50 ft must be added to the MDA to establish Derived Decision Altitude (Height) (DDA), so that executing a missed approach at the DDA(H) will not cause the aircraft to descend below the MDA. In such cases, there is no need to increase the RVR or visibility requirements for the approach and published AOM on Jeppesen pages can be followed.

1.18.7: ATR CLARIFICATIONS:-

With reference to the DFDR report, following significant observations have been observed and taken up with ATR and the clarifications received from ATR are;



Aircraft G-Meter Report

Difference between G-meter Report of 2.34G and DFDR data of 5.2G was clarified by ATR that the limits of the G-meter reported is +/-5G via the MCDU and the system will not display a value above the +/-5G. In this case, it took the previous value recorded that was 2.34G.

For the Nose down effort made by the First Officer (as per DFDR) for one second duration at the time of contact on ground at Mysuru, ATR has clarified that it is technically possible that during a hard landing the control column could move forward simultaneously with its own weight during impact and resulted in pitch disconnect, indicating that there was no input by the PM and pitch disconnect was due to the impact.

Also, with reference to the Right roll order recorded in the DFDR (just prior to the RWY contact), it stated that the right roll output is in consistent with right roll input given by the PF.

1.19 Useful or Effective Investigation Techniques

Nil

2. ANALYSIS

2.1 Pilot handling the aircraft:

Pilot in-Command was carrying out the Pilot Flying duties and First Officer was carrying out Pilot Monitoring duties.

On final approach, controller updated Mysuru weather as 3000m visibility with moderate rain. As per the CVR, PF made height check call outs at 5NM, 4NM & 3NM and PM replied 3890ft, 3570ft & for 3NM 3260ft (AIP Instrument Approach Chart values). Only for 3NM, PM announced the deviation of 100ft below profile for which PF acknowledged by saying Ok correcting. Whereas as per the DFDR, at 5NM, 4NM and 3NM, the (pressure) altitudes were 3616ft, 3292ft, 2971ft respectively indicating that the aircraft was consistently below the nominal 3° flight path and only approach speed was maintained as per the stabilisation criteria. Further, the 2NM height check was not carried out by the crew. Aircraft was under Auto Pilot till 550ft RA and when AP was disconnected the IAS was +7Kt above V_{app} of 106Kts. Below 550ft to till 532ft RA, for approx. 06 seconds, IAS was exceeding V_{app} +10Kts and maximum magnitude was recorded for one second was 119Kts (ie. $V_{app}+13$ Kts). But the speed was corrected immediately and from 528ft to 100ft RA , V_{app} was maintained within V_{app} +10Kts & roll was maintained between -4Deg. to +7Deg. Heading between 091° and 101° indicating that the track was in consistence with the runway and the negative drift angle (approx. -5°) is in consistent with a right cross wind. Aircraft vertical speed varied gradually between -200ft/min and -650ft/min for a VS target at -500ft/min. On the longitudinal axis the pitch angle varied between +1° and -2°.

The aircraft was below the profile. At the time of clear to land, right crosswind of 11Kts was prevailed which is within the aircraft limit. Below 100feet, the Rate of Descent (ROD) was increased from -200ft/min to -540ft/min and then gradually decreased to zero at approx. 33ft RA.

2.1.1. Role of Pilot Flying (PF):-

During the whole approach phase, the aircraft was below the required path. As per the CVR, for the 3NM height check PM has informed that the aircraft is 100ft below profile and PF replied correcting. However as per DFDR, it was observed that no corrective action was taken by PF, further when the aircraft was at 2NM, PF did not make height check call out.

PIC increased the pitch to 3.96° made the aircraft started to level off around 32ft RA for 04 seconds most probably to correct the aircraft flight path angle. Simultaneously, the aircraft reached the right edge of runway at the same altitude of 30ft which was not noticed by the crew due rain. Without

realising the aircraft position, two left roll peaks magnitudes of -12.0° (at 31.95ft) and -11° (at 30.39 ft), was applied by the PIC. During the second peak roll input, “Bank Angle” aural warning was generated.

With 04 seconds to impact, the aircraft started moving from right to left edge of the runway. With reduction in altitude from 30ft to 08ft and the inappropriate application of Roll from -11° to $+9.5^{\circ}$ by the PIC has made the aircraft RH wing to go down in close proximity with ground. At 08ft of RA With nose down input (pitch -4.49°) and with increased power from 52to 62PLA resulted the aircraft’s RH MLG to impact on runway with maximum of +5.2G.

It is also observed that at around 20ft RA, the power lever was increased from 52.38° to 62.58° , instead of bringing the power lever to Flight Idle and to flare the aircraft at 20ft. It is most probable that the PL were increased to reduce the vertical speed before touchdown. Master Warning was generated after one second of the impact, followed with Go around Pushbutton was activated by the Pilot Flying and carried out the subsequent actions. The Master Warning was generated due to PITCH DISCONNECT alert and TO CONFIG warning due to FLAPS at 33° under Go-around pushbutton (PB) mode. During the go around action, Power levers were gradually moved up to the RAMP and the total duration of the PL transition was around 15 seconds indicates that the Go around action was delayed.

As per the PIC, below 100ft RA when close to the ground, intensity of the rain picked up and at approx. 50ft they were on the threshold of the RWY 09 and on the right side of centerline. At approx. 20-30ft, hit an unexpected heavy down pour of rain like hitting of wall and strong gust. The depth of perception reduced. Further, crew stated that they decided to go around and during the process, Landing Gear (LG) made ground contact. However, as per the DFDR, the required Go-around actions were performed only after the aircraft made a ground contact.

DFDR (GPS data) indicates that the aircraft moved from right to left on the runway and Ground markings on the runway 09 at Mysuru confirms the aircraft RH MLG touched around 628m from the threshold (i.e. after touchdown zone) and 12.5m to the left of centerline (3.28m from the edge of the runway). This was not noticed by the PIC.

Based on the aircraft GPS positions data, observed that when the aircraft was on the Runway 09, it was on the right side of the runway axis and the aircraft moved from right to left and made contact with the ground after crossed the touchdown zone.

It can be seen that when the aircraft was just below 50ft, aircraft was on the RH side of the runway 09 centreline and moved further towards the RH side of the runway. Crew failed to notice the drifting of the aircraft to the right side of the runway. Also when they were just 40ft to 30ft, due rain, they lost their visual cues and position. Without realizing it, PIC carried out inappropriate maneuvers in roll and pitch just before touchdown and delayed go around action led the aircraft RHMLG to touch on the runway heavily. One of the main contributory factor of the hard landing is the crew nose down input just before the right MLG touchdown. This Pitch action combined with the roll movement lead to the hard landing on the RHMLG.

During go around maneuver, LG lever was selected UP. Whereas, LG lever was not going up and hence the aircraft flew from Mysuru to Chennai with landing gear down configuration. At Chennai, safe landing was performed on runway 07 at approx. 1540UTC and during landing roll, crew felt right wing slightly low and suspected tyre burst or deflation. The aircraft was stopped on the runway and engines were switched off. All the Passengers were deplaned normally on the runway and aircraft towed to the bay no 50. There was no fire or injury to anyone.

2.1.2. Role of Pilot Monitoring (PM):-

As per the SOP, PM has to announce altitude versus distance and altitude deviation above or below the desired one and PF corrects by adjusting VS. From the DFDR, it could be seen that during the whole approach phase, the aircraft was below the vertical flight path and also as per CVR data, there was no correct altitude deviation announcement made by PM from the desired one in order to correct the deviation by PF.

Also when the aircraft was at approx. 550ft to 432ft RA, V_{app} was more than $V_{app}+10$ for 06seconds. This was not monitored by the PM. Also, there was no call out of 'Stabilised/ Not Stabilised' by the PM in line with their company OMs stabilization criteria. Further, from 30ft to go around phase, the track deviation from the centerline and excessive rolls (more than $\pm 10^\circ$) etc., were not monitored by the PM.

2.1.3. Crew Resource Management (CRM)

It may be observed that though it is the responsibility of both the crew that the navigation performance of the airplane is continuously monitored and the present position is verified at regular intervals, crew have failed to utilize Crew Resource Management (CRM) techniques to work together during the approach and landing phases at Mysuru in the following areas;

- a. **Monitoring and Communication:** When the height checks call outs were made at 5NM, 4NM by PF, Pilot Monitoring (PM) failed to monitor and announce correct altitude (Vs distance) deviation from the desired one which could have allowed the PF (PIC) to correct the deviations in a timely manner. Further, at 3NM height check, PM informed the 100ft below altitude deviation but no corrective action was carried out by PF to nullify the deviation. Also, PF did not give call out at 2NM as per the Instrument approach chart to ensure the correct flight path management. Additionally, there was no call out of 'Stabilised/ Not Stabilised' made out by the PM in line with their company's stabilization criteria.
- b. **Situational awareness:** The crew failed to notice the aircraft's flight path deviation till threshold and over threshold, the aircraft drifted to the right. Simultaneously, crew encountered heavy rain and lost visual cues at an altitude of between 40ft to 30ft of RA. However, without recognizing the potential threats of close proximity to the runway, PF inappropriately manipulated the controls has resulted the aircraft to move to the left side of the runway and finally RHMLG's of the aircraft touched down heavily beyond the touchdown zone.
- c. **Decision-making:** Go-around action was performed by PF after the aircraft hit with the runway indicating that the PIC (PF) delayed in the decision-making for go around. Pilot Monitoring also did not advise/ suggest PF, well in advance, for the safe and efficient conduct of the flight.
- d. **Teamwork:** Both the PF and PM failed to evaluate perceptions of threats in the operating environment and not exhibited the team work for proper flight path management and to carry out safe landing.

From the above it is evident that the improper vertical path management, lack of CRM and the non-application of go around action when the visibility decreased were factors of the incident.

Hence, aircraft handling by the crew was a factor of the incident.

2.2 Serviceability of the Aircraft

The aircraft was fully serviceable and there was no snag reported or encountered any problem during the time of flying.

The failed RHMLG shock absorber, the detached RHMLG door and metering pin sent to DGCA, AED lab, New Delhi for failure analysis and the lab report concluded that the components have failed in over load condition.

Hence aircraft serviceability was not a factor.

2.3 Weather Factor

The Mysuru Airport has issued Aerodrome Warning at 1330 UTC for wind speed 20 Kt from 070°degree valid till 1345 UTC/ 1745UTC.

From DFDR (wind parameters) data, IAS as well as the AoA values showed several sharp variations and peaks indicate presence of turbulent weather from 800ft RA to 100ft RA.

As per CVR information, below 500ft RA, wipers with varying mode (i.e. Slow to Fast) was used by the crew indicate presence of rain with varying intensity. When the aircraft was cleared for landing, visibility was 3000m (approach minima is 2800m), Wind was 150°/ 10Kt with moderate rain was reported by ATC. Visibility and wind parameters are within the operational limits.

At approx. 50ft RA, aircraft was on threshold of runway 09 with moderate rain as reported by ATC. At approx. 20-30ft RA, crew experienced unexpected heavy down pour of rain like hitting of wall and strong gust.

Operational Personnel at PDP also witnessed that when TRJ543 went around it was raining heavily with strong winds at airport.

Hence, weather was a factor.

3 CONCLUSION

3.1 Findings

1. Crew were appropriately qualified to fly the aircraft.
2. Aircraft was released with adequate fuel and in airworthy condition.
3. As per the recorded IAS and AOA parameters shows the existence of turbulence weather during the approach and landing phase of the aircraft into Mysuru airport.
4. There was no correct announcement made by PM for altitude Vs Distance call outs made by PF.

5. PF did not give call out at 2NM even though he was aware of altitude deviation at 3NM.
6. During the whole approach phase, the aircraft was below the vertical path and the approach was not stabilized as the vertical path management was not consistent with vertical flight path angle.
7. When the aircraft was at 500ft RA, there was no Stabilised/ Not stabilised call out by PM.
8. Below 500ft RA, wipers with varying mode (i.e. Slow to Fast) was used by the crew indicate presence of rain with varying intensity.
9. When the aircraft was just below 50ft (RWY09 threshold), it was on the RH side of the RWY09 centerline and moved further towards the RH side of the runway.
10. When the aircraft was just 40ft to 30ft, PIC lost his position due heavy rain.
11. The aircraft moved from right to left and at around 20ft RA, the power lever was increased from 52.38° to 62.58° instead of bringing the power lever to Flight Idle and to flare the aircraft at 20Ft.
12. At altitude of 8.12ft RA, aircraft experienced maximum roll of +9.49° which has resulted the RH wing to go down associated with Pitch of -4.5° input, made the aircraft to impact the ground with maximum of 5.2G.
13. MLGs (Main Landing Gear) mode and All LGs (Landing Gears) compressed mode were shown as 'AIR' due to only RHMLG had contacted the ground and the sub consequent damages.
14. RH MLG's shock absorber bottom side nearby pivot joint got damaged. The center rod of the shock absorber and the RH MLG door found detached along with tie rod and found at the Mysuru airport touch down area. RHMLG components have failed in overload condition.
15. Aircraft's RH MLG touched after the touch down zone around 628m from the threshold and 12.5m to the left of centerline (3.28m from the edge of the runway) and dragged over a longitudinal distance of 26.68m.
16. Crew did not utilize proper CRM techniques during approach and landing attempt at Mysuru airport.
17. At Mysuru airport, the decision to carry out go around action was delayed by the crew.
18. Difference between G-meter Report of 2.34G and DFDR data of 5.2G was due to MCDU system limitations.
19. Operational Personnel at PDP witnessed that when TRJ543 went around it was raining heavily with strong winds at airport.
20. As crew could not retract the landing gear, Mysuru to Chennai sector was continued with the Landing Gears in extended condition and the aircraft landed safely at Chennai airport on Runway 07 at approx.1540UTC.
21. During landing roll at Chennai, crew observed as right wing was lower than left wing, aircraft was stopped on runway. All the passengers were disembarked normally on runway and aircraft towed to the bay number 50.
22. There were no injuries to the occupants or any third party and there was no fire or smoke.

3.2 Probable Cause

Failure to manage the aircraft vertical path and improper CRM performance together with the loss of situational awareness & delayed go around action was the probable cause of the incident.

Prevailed weather condition was a contributory factor.

4 SAFETY RECOMMENDATION

Appropriate action as deemed fit by DGCA may be taken.

20/01/2023
Chennai.


(R Rajendran)
Investigator In-Charge