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FINAL INVESTIGATION REPORT ON RUNWAY OVERSHOOT BY M/s. SPICEJET PRIVATE LIMITED BOMBARDIER Q 400 AIRCRAFT VT-SUE ON 17.09.2016 AT TIRUPATI AIRPORT, TIRUPATI

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Foreword

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Incidents and Incidents), Rules 2017, the sole objective of the investigation of an Accident shall be the prevention of Incidents and not 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 could lead to erroneous interpretations.

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1.	Aircraft	Type	Bombardier Q 400
		Model	DHC-8-402
		Nationality	Indian
		Registration	VT-SUE
2.	Owner		Maple Leaf Financing Limited, Ireland.
3.	Operator		M/s. SpiceJet Limited
4.	Pilot – in –Command		ALTP Holder
	Extent of injuries		NIL
5.	Co Pilot		CPL Holder
	Extent of injuries		NIL
6.	Date & Time of Incident		17.09.2016, 1445 UTC (2015 IST)
7.	Flight No.		SG-1047
8.	Place of Incident		VOTP (Tirupati Airport), Tirupati
9.	Last point of Departure		VOHS (Rajiv Gandhi International Airport), Hyderabad
10.	Intended landing place		VOTP (Tirupati Airport), Tirupati
11.	No. of Persons on board		62 Passengers + 05 Crew including AME
12.	Type of Operation		Domestic Scheduled Passenger Flight
13.	Phase of Operation		Landing
14.	Type of Incident		Runway Over Shoot
15.	Co-ordinates of Incident Site		13°37’51’’N (Latitude) and 79°31’52’’E (Longitude)

(All timings in the report is in UTC)

SUMMARY

On 17.09.2016, M/s Spice Jet Ltd. Bombardier Q-400 aircraft VT-SUE while operating a scheduled flight SG1047 from Hyderabad to Tirupati was involved in a serious incident of runway overshoot after landing on runway 26 at 1445 UTC at Tirupati Airport. The aircraft was under the command of an ATPL holder pilot and with co-pilot, who was a CPL holder on type. There were 62 passengers, 02 cabin crew and 01 AME on board the aircraft. There was no injury reported to person on board.

The aircraft took off from Hyderabad at 1351 UTC for Tirupati and the en-route flight was uneventful. The PIC was PF and carried out an ILS approach for runway 26 via DME ARC. The Co-Pilot was PM & both crew were monitoring ATIS during descent. During landing, the PIC reconfirmed on RT with Tirupati tower about the runway condition and ATC informed PIC runway condition as Wet. Visibility at the time of landing was 2500 meters with variable winds 170 ° and 06 kts.

Landing at wet Runway 26 in variable winds (varying from 160 ° to 200° and speed 06 kts to 10 kts) resulted aircraft to drift. At 108 ft RA, the pilot increased the power and used rudder resulting the aircraft to float on the runway. The aircraft made a delayed touch down at 3650 feet (Main Wheel) and 5482 feet (Nose Wheel). There was delay in application of manual brakes which were applied at 6236 feet. The max prop reverse thrust was applied at 7253 feet. The landing G load during landing was 1.46 G.

The aircraft crossed the runway 08 RESA and finally stopped in kuccha after completing an arc, with centre of MLG at 725 feet away from RWY08 threshold. The total length of Runway is 7500 feet. The approx. landing Distance required for Q 400 aircraft is 4000 feet.

There was no fire or damage to the aircraft and there was no injury to any occupants on board the aircraft. All passengers were disembarked safely by the Flight crew immediately from the L1 door. However, the Runway was closed till 18.09.2016
The occurrence was classified as Serious Incident by AAIB as per the Aircraft (Investigation of Incidents and Incidents) Rules, 2012 and accordingly, a Committee of Inquiry was appointed by Ministry of Civil Aviation for investigating into the probable cause of incident.

The probable cause of serious incident is “Delayed touchdown of the aircraft during landing at wet runway in variable winds resulting in aircraft to float on runway, followed by late application of Brakes and Propeller Reverse Thrust, resulting in aircraft overshooting the Runway”.

1. FACTUAL INFORMATION

1.1 History of the flight

On 17.09.2016. M/s Spice Jet Ltd. Bombardier Q-400 Aircraft VT-SUE was operating a scheduled flight SG1047 from Hyderabad to Tirupati under the command of an ATPL license holder endorsed on type and CPL holder qualified First Officer on type. The aircraft was involved in an incident of runway overshoot while carrying out landing roll on runway 26 at Tirupati airport.

There were 02 operating crew, 02 cabin crew, 01 AME on board and 62 passengers on board the aircraft, including one infant.

Previous to the incident flight, the aircraft VT-SUE had operated flights Colombo – Madurai, Madurai – Hyderabad with the same set of cockpit crew. The flights were uneventful and there was no snag reported by the PIC on the completion of these flights. Subsequently, the aircraft was scheduled for flight SG 1047, Hyderabad-Tirupati at around 1351UTC. SG 1047, Hyderabad-Tirupati was seventh sector of the day for the same aircraft. Also, this was third sector of the day with the same set of crew.

The aircraft took off from Hyderabad at around 1351 UTC and the visibility reported for Tirupati was 2500 meters. After coming in contact with Chennai ATC, the aircraft was directed to Tirupati.

As the weather was within Company Minima for the conduct of ILS approach Runway 26 at Tirupati, the approach was commenced.

The aircraft landed with 1.46 G load and the MLG touched at 3650 feet from runway 26 threshold. The total available Runway length for Tirupati is 7500 feet. The PIC stated that after touchdown and reducing power to DISC, as the runway was WET, sufficient brake force was not applied. PIC could not see the runway end due to fog patches. He further mentioned that the full reverse was selected on both engines after realizing that the Runway end is approaching near and maximum braking force was also applied. The aircraft overrun the runway and came to its final stop with centre of MLG was 725 feet from the edge of the runway 08. The PIC tried manoeuvring the aircraft and as stated by him in his statement, he did this in order to avoid hitting any light or ground equipment in the nearby area.

During flare just before touch down around 30 ft, aircraft couldn't be aligned to the center line and the same was corrected by PIC by adding power and

manoeuvring towards the center line of Runway. In the process of correcting this, PIC made a delayed touch down.

There was no fire or smoke indication and the aircraft came to final stop. The engines were shut down normally, however both fire handles were found pulled in the cockpit. Normal passenger disembarkation was carried out from L 1 door and there was no injury to any passenger or crew. The ATC was informed about the Runway overshoot and First Officer requested ATC for ground support and firefighting services.

There was no damage to the aircraft. There was no fire or injury to any occupant on board the aircraft. There was no post-incident fire. All passengers were transported to the terminal building in passenger coaches.

Previous METARS at Tirupati reported moderate/heavy rain over the Airfield. As per METAR issued at 1440 UTC, the visibility at the time of incident was reported to be 2500 meters with variable winds of 200 degree 10 Knots and runway surface condition was wet. However, ATC informed crew winds 170 ° and 06 knots.

Removal of disabled aircraft from kuccha started on 18.09.2016 at 0430 UTC and lasted till 1245 UTC using a tow tractor and wooden planks. Two JCB's were also used along with roller for the exercise.

Due to aircraft being stuck on end of runway 26, the runway was not available for operations the Runway was closed on 17.09.2016 from 1445 UTC to 18.09.2016 up to 1315 UTC. Flight operations were affected at Tirupati airport on 17th and 18th of September 2016.

As per PIC's statement there were fog patches on the Runway and it was pitch dark Runway surface with no moon light. The approach to Tirupati was normal and stabilized approach as per Company criteria.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
~~MINOR~~/NONE	4 + 1	62	Nil

1.3 Damage to Aircraft

The aircraft exited the runway and got stuck in the unpaved surface, approximately perpendicular to the Runway. There was no damage to the aircraft.

1.4 Other damages

NIL

1.5 Personnel information

1.5.1 Pilot – in – Command – Pilot Flying (PF)

AGE	28 Yrs
License	6610
Date of License Issue and Valid up to	11-Jan-16/10-Jan-21
Category	ATPL
Endorsements as PIC	DHC 8 402
Date of Joining Company	23-Apr-12
Date of Endorsement as PIC on type	25-May-16
Instrument Rating	29-Mar-16
Date of Med. Exam & validity	11-Apr-16/19-APR-17
Date of Route Check	27-MAY-16
Date of Last Proficiency Check	29-Mar-16
Total flying experience	2871:08 Hrs
Total Experience on type	2583:20 Hrs
Total Experience as PIC on type	367:30 Hrs
Last flown on type	17-Sep-16
Total flying experience during last 01 Year	970:33 Hrs
Total flying experience during last 180 days	484:50 Hrs
Total flying experience during last 90 days	275:37 Hrs
Total flying experience during last 30 days	71:41 Hrs
Total flying experience during last 07 Days	09:30 Hrs
Total flying experience during last 24 Hours	04:20 Hs
Rest period before the flight	22:25:00 Hrs

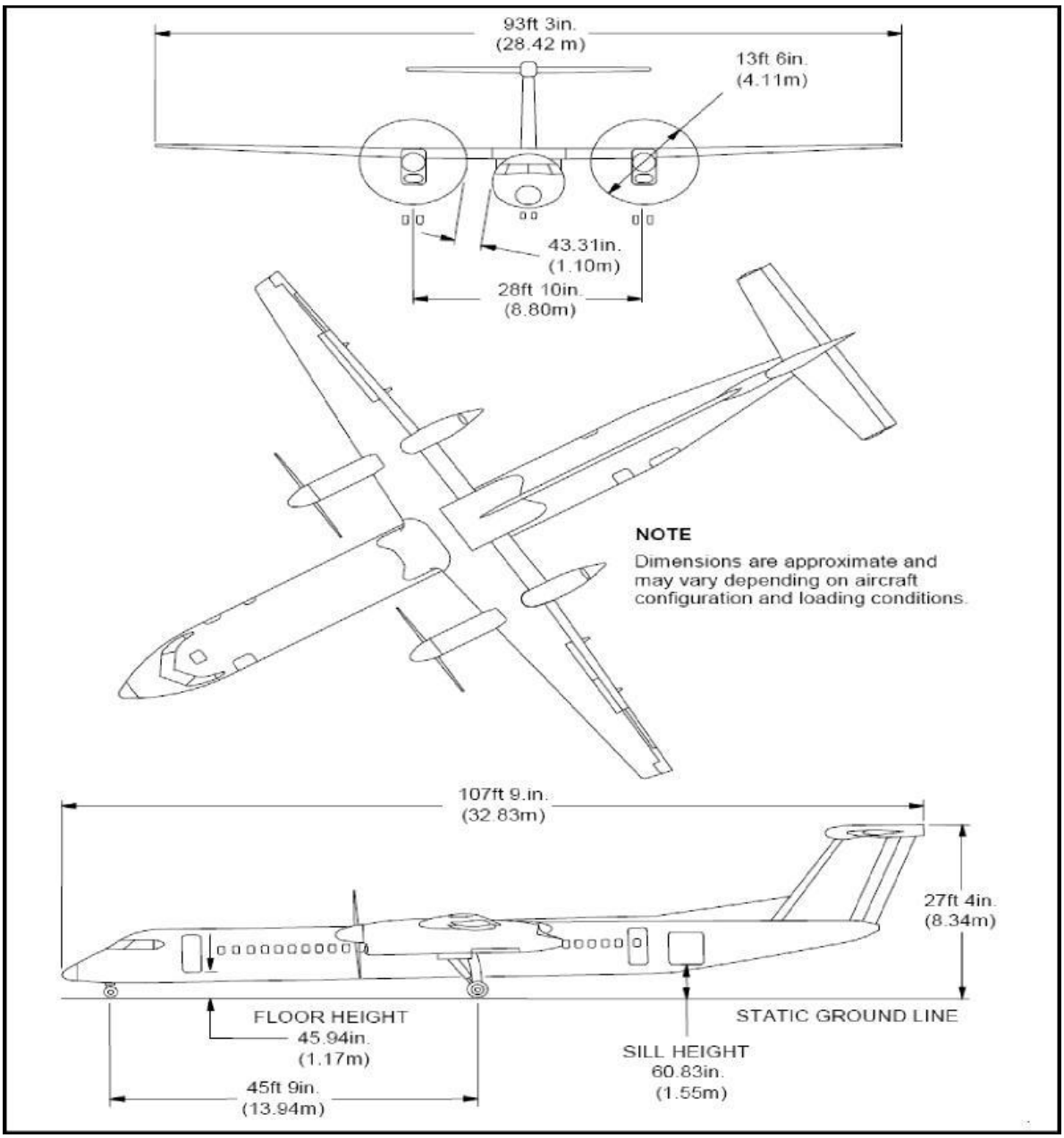
1.5.2 Co-Pilot - First Officer – Pilot Monitoring (PM)

AGE	47 Yrs
License	5337
Date of License Issue and Valid up to	25-Mar-13/24-Mar-17
Category	ATPL
Class	A
Endorsements as PIC	C-152A,172,310,,P-68 C,PA 23-250
Date of Joining Company	15-Jul-15
Date of Endorsement as PIC on type	C-152A,172,310,,P-68 C,PA 23-250
Instrument Rating	06-Jul-16
Date of Med. Exam & validity	02-Jun-16/14-Jun-17
Date of Route Check	16-Jul-16
Date of Last Proficiency Check	06-Jul-16
Total flying experience	3510:50 Hrs
Total Experience on type	454:50 Hrs(In the company, earlier experience not available
Total Experience as PIC on type	nil
Last flown on type	17-Sep-16
Total flying experience during last 01 Year	454:50 Hrs
Total flying experience during last 180 days	191:31 Hrs
Total flying experience during last 90 days	191:31 Hrs
Total flying experience during last 30 days	101:40 Hrs
Total flying experience during last 07 Days	25:44 Hrs
Total flying experience during last 24 Hours	04:20 Hrs
Rest period before the flight	22:25:00 Hrs

Both operating crew were not involved in any serious incident/ Incident in the past. Both operating crew had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating this flight. Both Pilots had carried out landings at Tirupati Airport earlier also.

1.6 Aircraft Information:

The aircraft is a high winged monoplane with fully cantilever wings, horizontal stabilizer surfaces, a semi−monocoque fuselage and a fully retractable tricycle landing gear. A large portion of the skin panels are bonded assemblies consisting of skin, stringers and doublers, or skin sandwich with a honeycomb core.



LANDING GEAR CONSTRUCTION

The landing gear is electrically controlled and hydraulically operated. The tricycle gear is a retractable dual wheel installation. The main gears retract aft into the nacelles and the nose gear retracts forward into the nose section. Doors completely enclose the landing gear when it is retracted and partially enclose the gear when it is down.

The Main Landing Gear includes the following components:-

− Yoke

− Shock Strut

− Stabilizer Brace

− Drag Strut

− Uplock Assembly

− Downlock Release Actuator

− Retraction Actuator

− Auxiliary Extension Actuator

Each MLG assembly is installed on the airframe structure in the wheel well of the respective engine nacelle. Each MLG has two wheel and tire assemblies and retracts rearwards into the aft section of the wheel well.

A retraction actuator is attached to the yoke and to the shock strut to extend and retract the MLG. A lock actuator on the stabilizer brace locks the MLG in the down position. An auxiliary extension actuator is attached to the airframe structure in the aft section of the wheel well and to the arm of the yoke. The auxiliary extension actuator extends the MLG during an alternate extension sequence. An uplock assembly is attached to the top of the aft section of the wheel well and locks the MLG in the retracted position.

The yoke is attached to the top of the aft section of the wheel well. The shock strut is attached to the bottom of the yoke. A stabilizer brace keeps the yoke in position in the wheel well. The stabilizer brace is attached to the front of the yoke and to the forward frame of the forward section of the wheel well. The shock strut is held in position, in the wheel well, by the drag strut. The drag strut is attached to the bottom of the shock strut cylinder and to the forward frame of the forward

section of the wheel well. The shock strut has provision for the wheels, brake units, and anti-skid devices to attach to the axles.

Landing gear control Panel

The landing gear is controlled and monitored from the landing gear control panel, located on the right side of the engine display on the forward instrument panel in the flight deck. The panel has a landing gear selector lever, a lock-release selector lever, landing gear and landing gear door advisory lights, and a landing gear warning horn/mute test switch. The landing gear is commanded to the up or down position with the landing gear selector lever. An amber light in the landing gear selector lever is illuminated when the landing gear position does not agree with the landing gear selector handle position or when any of the landing gear doors are not closed.

Aircraft VT-SUE (MSN 4379) was manufactured in 2011 and was registered with DGCA under the ownership of M/S Maple Leaf Financing Limited. The aircraft is registered under Category 'A' and the Certificate of Registration No. is 4253.

The Certificate of Airworthiness Number 6362 under "Normal category" subdivision Passenger / Mail / Goods was issued by DGCA on 23.09.2011. The specified minimum operating crew is two and the maximum all up weight is 29,257 Kgs. At the time of incident, the Certificate of Airworthiness was current with unlimited validity.

The Aircraft was holding a valid Aero Mobile License No. A-010/037/RLO at the time of incident. This Aircraft was operated under Scheduled Operator's Permit No S-16 which is valid up to 16.05.2023. As on 17/09/2016, the aircraft had logged 13797:58 Airframe Hours and 13199 cycles.

Accordingly, the last major inspection Base Check-2 (6000 FH check) was carried out at 11336 cycles on 16/02/2016. Subsequently, all lower inspections (Pre-flight checks, 50 FH Inspections) were carried out as and when due before the incident.

The aircraft was last weighed on 30th July, 2016 at GATL, HYD INDIA and the weight schedule was prepared and duly approved by the office of Deputy Director General, DGCA, Delhi. As per the approved weight schedule, the Empty weight of the aircraft is 17638.18 Kgs. Maximum usable fuel Quantity is 5318 Kgs. Maximum payload with fuel tanks full is 5723 Kgs. Empty weight CG is 10.01 meters aft of datum. As there has not been any major modification affecting weight & balance since last weighing, hence, the next weighing is due on 29th

July 2021. Prior to this flight, the weight and balance of the aircraft was well within the operating limits.

All concerned Airworthiness Directives, Mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engines have been complied with as on date of event.

Transit Inspections were carried out as per approved Transit Inspection schedules. Higher inspection schedules include checks 1 inspection as per the manufacturer's guidelines as specified in Maintenance Program and are approved by the Continuing Airworthiness Manager (Post Holder for Continuous Airworthiness).

The last fuel microbiological test was done through Fuel stat test kit on 5th July, 2016 at Delhi by Spice Jet Certifying staff and the microbiological growth was negligible.

The left Engine S/N PCE-FA0835 had logged 12522:43 Hrs and 11717 cycles and the right Engine S/N PCE-FA0884 had logged 9530:39 Hrs and 9182 cycles. There was no defect report on the engine on the previous flight.

It is concluded that aircraft and its maintenance are not a contributory factor for the incident since aircraft operated from Colombo to Madurai to Hyderabad and finally from Hyderabad to Tirupati sector.

1.7 Meteorological information

The incident occurred at 1445 UTC and the METAR of 1440 UTC was valid at the time of incident. As per the METAR, following meteorological conditions existed.

Time (UTC)	1400UTC
Wind	200°/10 knots
Visibility	2500 Meters
Temp	27
Dew Point	23
QNH	1006
Clouds	Scattered at 2000 feet
Weather	Thunder Storm/Rain

No significant trend was reported by ATC. CVR tape transcript revealed that the weather information was also passed by the Tirupati ATC to the aircraft while giving the landing clearance.

The METAR indicated visibility of more than 2500 meter at 1400UTC. The winds were consistent, with bearing 200 and velocity 10 kts. There were scattered clouds at 2000 feet.

1.8 Aids to navigation

There is one single runway available at Tirupati Airport which has the orientation 26/08. For landing runway 26/08 VORDME approach is available. PAPI is available for both sides of the runway. NDB is also available at Tirupati Airport for approach and landing. The ATC is controlled and manned by Airports Authority of India.

Tirupati airport is equipped with following Radio Navigation and Landing Aids.

Type of aid CAT of ILS/MLS (For VOR/ILS/	ID	Frequency	Site of transmitting antenna coordinates	Elevation of DME transmitting antenna	Remarks
DVOR	TTP	115.7MHz	133805.9N 0793348.8E	107.3M	Relocated along extended centerline RWY26.
DME	TTP	1191/1128MHz	133805.9N 0793348.8E	107.3M	Collocated with DVOR CH104X
LLZ	ITPY	111.3 MHZ	133750.6N 0793150.0E	107.3M	
GP	ITPY	332.3MHZ	133805.3N 0793303.6E	107.3M	GP DME Tx- 1074 Mhz Rx-1011 Mhz

1.9 Communications

At the time of incident, the aircraft was in contact with Tirupati ATC on frequency 119 MHz. From the CVR transcript it was apparent that there was no communication issue between the Flight Crew & ATC. Aircraft maintained positive communication with the ATC throughout the flight.

1.9.1 Salient Tape Transcript of Aircraft with Tower on 119.0 MHz. Frequency from 1431 to 1458 UTC is as follows:

Time	From	Text
14:31	SEJ1047	Released by Chennai sir. Passing level 117, descending to 95
	Tower	Continue descend to 6000' transition level 96, QNH 1006
	Tower	Cleared for ILS approach Rwy26 via 15 DME arc, report commencing arc
	SEJ1047	Cleared ILS Rwy26 via 15 DME arc, call you commencing arc
14:33	SEJ1047	Commencing 15 DME arc
	Tower	Roger, descend as per procedure, report crossing lead radial
14:37	SEJ1047	Confirm runway condition
	Tower	Runway conditions wet sir
	SEJ1047	Runway condition wet confirm
	SEJ1047	Confirm drizzling over the field
	Tower	Negative sir
	Tower	SEJ1047 QNH 1007 latest
14:40	SEJ1047	Established on localizer SEJ1047 for ILS Rwy26
	Tower	Roger, report fully established on ILS
	SEJ1047	Fully established on ILS sir 10 DME
	Tower	Roger, clear to land, winds 160degrees 06 Knots
	SEJ1047	Rwy26, clear to land, request wind sir
	Tower	170degrees 06 Knots
	SEJ1047	Copied
14:45	Tower	SEJ1047 backtrack Rwy26 vacate via Txy – 'B'
	SEJ1047	Backtracking sir, Spicejet we have overshot the Rwy. Request tow facility sir
	Tower	SEJ hold, confirm unable to make 180
	SEJ1047	Unable sir
14:45	Tower	Roger hold position
	SEJ1047	Request tow bar facility request sir as soon as possible
	Tower	Roger ma'am we have only Air India and Trujet having Tow bar presently both are i think they have closed the watch hours
	SEJ1047	We are evacuating the sir..{noise}
	Tower	Other than this we don't have any tow bar facility madam, just we are coordinating
	SEJ1047	Ok sir, copied sir then we have commenced evacuation
	Tower	Say again
	SEJ1047	We are evacuating the aircraft. We have commenced evacuation sir, from the present position passengers are disembarking

14:48	Tower	Confirm disembarking
	SEJ1047	Affirm sir
	Tower	Confirm any other assistance required
	SEJ1047	We need assistance of may be the coaches sir
	SEJ1047	We need assistance to take these passenger back to .. {noise}
	Tower	Roger ma'am, we will advise
	SEJ1047	And we request fire truck also to be ready just in case
	Tower	SEJ1047 say again last transmission
	SEJ1047	Request any other facility like fire truck
	Tower	Roger ma'am, we are trying our best
	SEJ1047	Yes sir
14:51	SEJ1047	Tower
	Tower	Go ahead SEJ1047 tower
	SEJ1047	Tower how do you read sir
	Tower	Readability 5, go ahead ma'am
	SEJ1047	Request passenger coaches sir because passengers are still seated in aircraft and we need to evacuate them from the aircraft
	Tower	They are on the way, ETA another 03 minutes
	SEJ1047	Copied sir, can you please expedite the help the assistance
	Tower	We have advised your operator madam. They are providing even tow bar and coaches are approaching another 03 minutes
14:55	Tower	SEJ1047
	SEJ1047	Go ahead
	Tower	Confirm do you need any ambulance help madam
	SEJ1047	Request ambulance, fire truck as well as passenger coaches urgently sir because there is no fire as of now but we do not all the passengers is struck in aircraft and we have opened the doors for them to exit for safe evacuation. Request passenger coaches as soon as possible and ambulance as well as truck also sir.
	SEJ1047	Sir we have commenced evacuation sir, passengers are getting down the aircraft and there will be i hope the coaches have arrived sir
	Tower	Affirm madam, affirm everything has been arranged
	SEJ1047	Thank you sir
`14:58	Tower	Standby for Tow tractor, we have advised your operator. They are approaching shortly with your tow tractor also.

1.10 Aerodrome information

Tirupati Airport is operated by AAI. The Tirupati runway 26 is equipped with an ICAO complaint RESA. In locations where this is not possible, ICAO recommends that airports consider reducing some of the declared distances. The airport was licensed by DGCA at the time of Incident.

Tirupati Airport has a single runway (26/08) operation and general information about the airport is as follows:-

City/Country	Tirupati/India
IATA/ICAO Code	TPT/VOTP
Latitude	13°37'59''N
Longitude	79°31'52''E
Elevation	339'
Runway Available	26/08
Type of traffic permitted	IFR/VFR

1.11 Flight recorders

The aircraft was fitted with Solid State CVR & DFDR as per the table given below. The recorders showed no signs of damage. Data from both CVR & DFDR were downloaded and analysed after the serious incident.

Unit	**Manufacturer**	**Part Number**	**Serial Number**	**Total Duration of available Recording**
CVR	UNIVERSAL AVIONICS SYSTEMS CORPORATION	1606-00-01	381	02 Hrs 02 min 45 sec
DFDR		1607-00-00	265	25 Hrs.

1.11.1 Cockpit Voice Recorder

04 Audio channels with duration of 02 hrs 02 min 45 sec were found in CVR. The channels are:-

- P1 Microphone recordings
- P2 Microphone recordings
- Passenger Address Microphone recordings
- Cockpit Microphone recordings

Following are the salient observations:-

UTC Timing	VT-SUE involved in an incident of RWY excursion on 17th Sep 2016	
14:37:05	P1	Confirm runway condition SG1047
	P1	Runway condition sir
	ATC	Runway condition wet sir
	P1	RWY condition wet confirm
14:37:22	P1	Confirm drizzling over the field
	ATC	Negative sir…SG-1047 QNH 1007 latest
14:38:10	P1	Approaching lead radial
	P2	Checked…passing lead radial SG1047
	ATC	SG1047 roger report established on ILS RWY 26
	P2	Call u established on ILS RWY 26, SG1047
	P2	Established on LOC SG 1047 for RWY 26
14:39:56	ATC	Roger…report fully established on ILS
14:40:24	P1	Established on ILS 10 DME inbound.
	P2	TIR tower SG1047 fully established on ILS sir, 10DME sir
	ATC	SG1047 roger RWY 26 clear to land wind 160º 06kts
	P2	RWY 26 clear to land SG1047 request wind sir
	ATC	170º 06kts
	P2	Copied SG1047
	P2	Pumps are On speed is checked flaps 5 set
	P1	Check…select flap 15
	P2	Speed is checked
14:41:32	**Landing checklist carried out as per SOP**	
14:41:37	**Sync call 2500**	
14:43:23	P1	1000ft stable…RWY insight…disengage autopilot…decision landing
	Auto pilot disengage horn annunciated	
14:43:40	P2	Winds 198º 08kts
	P1	Checked
	P2	Quarterly head wind
	P1	Understood…
	P2	From the left
14:44:05	**Sync call 500**	
	P1	Visual contact…decision landing
	P2	Checked

14:44:21	P2	Minimums
	P1	Visual landing…
14:44:35	**Sync calls 100**	
14:44:37	**Sync calls 50**	
14:44:39	**Sync calls 40**	
14:44:40	**Sync calls 30**	
14:44:41	**Sync calls 20**	
14:44:43	**Sync calls 10**	
14:44:46	P2	Right ko ja raha he
	P2	Go to the left
	P1	No problem
14:44:50	Touch down sound	
	P1	Correcting…sorry for that
	P2	No problem
14:44:52	P1	Wow that was a lot of drift
	P2	Drift na….okay check..
14:44:59	P1	Like anything
	P2	Apply brakes…brakes….
14:45:02	P2	Reverse…
	P1	No problem…not required…
14:45:13	P2	reverse ….reverse….reversers..
	Loud sound (Aircraft enters kachaa)	
	P1	Sorry for that
14:45:27	ATC	SG1047 backtrack RWY26 and vacate via taxi ‘B’
14:45:33	P2	This is SG1047 we have overshot the RWY, SG1047….request tow facility sir…
14:45:43	ATC	Roger…confirm unable to make 180??
14:45:47	P1	Unable
14:45:49	P2	Unable sir
	ATC	SG hold position
14:45:52		
14:46:06	SCC	Yes Capt.
	P1	Can u send the engineer inside
	SCC	Sorry
	P1	Engineer inside please
	SCC	Alright sir
	P1	Sir overshoot hogaya…sir overshoot hogaya
	Engineer	Cut karona engine…kahan jana he…bandh karona engine…
	P1	Emergency evacuation karenga na???
	Engineer	Aapka jo procedure he you just follow that….
	P1	I guess I have to do emergency evacuation.
14:47:20	P1	This is your Capt. controlled evacuation to the left hand side. I

		say again controlled evacuation to the left hands side
14:47:31	P2	How can you evacuate
14:47:33		
	Engineer	Shall I open the door??
	P1	Yes….
14:47:52	P2	SG 1047, request tow bar facility as soon as possible…
	ATC	Roger ma'am, we have only Air India & True Jet having the tow bar here… presently both are… I think they have closed their watch hour….
14:48:07	P2	We are evacuating sir from the present position
14:48:13	ATC	Other than this we don't tow bar facility madam …just we are coordinating…
14:48:18	P2	Copied sir…we have commenced evacuation….copied
14:48:23	ATC	Say again…
14:48:25	P2	We are evacuating…we have commenced evacuation sir from the present position…passengers are disembarking….(PIC enters the cockpit)
14:48:37	ATC	Confirm disembarking??
	P2	Affirm sir…
	ATC	Do you need any other assistance madam???
	P2	We need assistance of may be the coaches sir….we need assistance to take this passenger back to the ramp
14:48:52	ATC	Roger ma'am will advice….
	P2	And request fire truck also to be ready….just in case…
	ATC	SG1047, kindly say the last transmission
14:49:11	P2	Request any other facilities like fire truck sir…
	ATC	Roger ma'am…we are trying our best…
	P2	Ya

1.11.2 Digital Flight Data Recorder

The DFDR readout from UTC 14:24:58 to UTC 14:46:31 was analysed and following are the salient observations:-

Time (UTC)	Sequence of Events
14:24:58	Aircrafts starts descend from FL 210
14:32:19	Eng #1 & #2 bleed switch ON and control selector valve Max
14:40:31	Landing Gear Down and Locked Alt: 3130 ft (baro)
14:40:47	Flap 15 selected Alt: 2852 ft (baro)
14:41:15	Eng #1 & #2 bleed switch ON and control selector valve Min
14:42:50	Alt: 995 ft (radio) Torque Eng #1: 15 Eng #2: 15 ROD: -690 fpm CAS: 135.5 kts Heading: 261 deg
14:42:51	Eng #1 & #2 bleed switch Off
14:43:23	Alt: 500 ft (radio) Torque Eng #1: 15 Eng #2: 14.5 ROD: -750 fpm CAS: 134.5 kts Heading: 259.1 deg
14:43:52	Alt: 108 ft (radio) Torque Eng #1: 18 Eng #2: 16 ROD: -810 fpm CAS: 137 kts Heading: 258.8 deg
14:43:56	Alt: 49 ft (radio) Torque Eng #1: 18 Eng #2: 16.5 ROD: -540 fpm CAS: 137 kts Heading: 259.8 deg
14:44:10	Rudder position R 9.2
14:44:12	**Aircraft touchdown (Main Wheel Contact)** CAS: 121.5 kts Heading: 256 deg Landing g: 1.469 g Rudder position R 3.1
14:44:17	**Idle Reverser** PLA Eng #1: 34.7 #2: 34.1
14:44:20	**Nose Wheel Contact**
14:44:28	**Brakes applied** Brake pressure Left: 396.5 psi Right: 494.1 psi Heading: 262.6 deg
14:44:32	**Max Reverser applied** PLA #1: -0.3 #2: 0.4
14:44:35	**Aircraft starts turning Right leaving the RESA.**

	Max brake pressure left 3043 psi Max brake pressure right 3058 psi Heading: 276.2 deg
14:44:43	**Aircraft starts turning left in the arc** Heading: 253 deg
14:44:47	Master Caution for 24 sec Rudder position R 14.3 Ground speed: 5 kts.
14:45:09	**Aircraft stopped** Heading: 196.4 deg
14:46:31	**Both Engine Cut-off**

1.12 Wreckage and impact information

The aircraft carried out landing on Rwy 26 at Tirupati airport and decelerated after the thrust reversers were applied. Subsequently, parking brakes were also applied but aircraft overshot from the right of the runway end 08 and came to a halt on the unpaved surface, perpendicular to Runway.

There was no damage to the Aircraft. The wheel assembly, main landing gears and tyres were found okay. The Aircraft was put in service after the necessary inspections, which were found satisfactory.

Following are the distance measured with the help of DFDR.

1. Distance of aircraft touch down on Rwy from threshold :- 3860 feet
2. Distance of aircraft Main Landing from end of runway 08 in soft ground - 725.4 feet
3. Distance of aircraft Nose Landing from end of runway 08 in soft ground - 711 feet.

1.13 Medical and pathological Information

Prior to operating the flight, both cockpit crew & cabin crew had undergone pre-flight medical / Breath Analyser test at Madurai (Post Flight first Landing from Colombo-Madurai flight) and were found negative. There after aircraft landed at Hyderabad. After landing at Tirupati, the Airport operator/Airline did not carry out the post flight BA test for crew members.

The Medical Examination requirement as laid down in Airline Flight safety manual is attached as **Annexure – I**

The Medical Examination requirement as laid down in Aerodrome Emergency Plan of Tirupati Aerodrome Operator is attached as **Annexure – II**

1.14 Fire

There was no pre or post impact fire. Fire Handles for Engine 1, & 2 were pulled by during engine shut down check list.

1.15 Survival aspects

The incident was survivable. After the incident, Controlled evacuation was carried out from L1 side. There was no deployment of escape chutes.

1.16 Tests & Research

Eighteen Components were removed and send to shop for investigation. No fault was observed in any of the following components during the inspection in the shop.

SR. NO.	NAME OF COMPONENT	PART NO	SR. NO.
01	DFDR	P/N OFF	1607-00-00
		P/N ON	1607-00-00
		S/N OFF	265
		S/N ON	475
02	CVR	P/N OFF	1606-00-01
		P/N ON	1606-00-01
		S/N OFF	430
		S/N ON	381
03	#1 Nose Wheel Assembly (Overhauled)	P/N OFF	415-118
		P/N ON	415-118
		S/N OFF	1845
		S/N ON	1460
04	#2 Nose Wheel Assembly (Overhauled)	P/N OFF	415-118
		P/N ON	415-118
		S/N OFF	1562
		S/N ON	1443
05	#1 Main Wheel Assembly (Overhauled)	P/N OFF	415-117-1
		P/N ON	415-117-1
		S/N OFF	2732
		S/N ON	2721
06	#2 Main Wheel Assembly (Overhauled)	P/N OFF	415-117-1
		P/N ON	415-117-1
		S/N OFF	2635

		S/N ON	2940
07	#3 Main Wheel Assembly (Overhauled)	P/N OFF	415-117-1
		P/N ON	415-117-1
		S/N OFF	3708
		S/N ON	1741
08	#4 Main Wheel Assembly (Overhauled)	P/N OFF	415-117-1
		P/N ON	415-117-1
		S/N OFF	2347
		S/N ON	2365
09	#1 Brake Assembly (Overhauled)	P/N OFF	2-1605-2
		P/N ON	2-1605-2
		S/N OFF	1918
		S/N ON	2246
10	#2 Brake Assembly (Overhauled)	P/N OFF	2-1605-2
		P/N ON	2-1605-2
		S/N OFF	1899
		S/N ON	0708P
11	#3 Brake Assembly(Overhauled)	P/N OFF	2-1605-2
		P/N ON	2-1605-2
		S/N OFF	1909
		S/N ON	1874
12	#4 Brake Assembly (Overhauled)	P/N OFF	2-1605-2
		P/N ON	2-1605-2
		S/N OFF	2021
		S/N ON	1872
13	Nose landing gear dressed shock strut assembly	P/N OFF	47200-25
		P/N ON	47200-25
		S/N OFF	MA0417
		S/N ON	MA0426
14	Solenoid Sequence Valve	P/N OFF	48302-5
		P/N ON	48302-5
		S/N OFF	FAH1361
		S/N ON	FAH1451
15	#1 ENG scavenge oil filter	P/N	3047107-02
16	#2 ENG scavenge oil filter	P/N	3047107-02
17	#1 ENG main oil filter	P/N	3122427-02
18	#2 ENG main oil filter	P/N	3122427-02

1.17 Organisation and Management information:

M/s. Spicejet Ltd is a low cost model airline with its head office at Gurgaon and registered office at Indira Gandhi International Airport, Terminal 1 D, New Delhi-110037.

The airline has 42 aircraft in its fleet which include 02 Boeing 737-700, 22 Boeing 737–800, 04 Boeing 737-900ER and 14 Dash-8 Q400. The airline has a scheduled operator permit number S-16 issued in Pax/Cargo Category which was re-issued on 02.02.2016 and is valid till 16.05.2018. Dash-8 Q400 aircraft were inducted in Spicejet fleet in Sept 2011, and are used as a feeder/ regional service with high connectivity. Spicejet commenced International operations in 2010.

The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA. The Chief of Safety is senior management official who reports directly to the CEO.

M/s Spice jet has a full established Operations training facility for the pilots. The training facility for both Boeing pilots and Bombardier Q-400 pilots is at Delhi. The training facilities are headed by the senior vice president Operations who reports to Chairman directly. The Engineering training facility is established at Delhi for B737 aircraft and at Hyderabad for Q-400 aircrafts respectively.

1.18 Additional Information

1.18.1 Main landing gear brake system

The brakes convert energy necessary to bring the aircraft to a stop. Two brake units are installed on each axle of the main landing gear.

The three systems that control the brakes are as follows:-

− Normal brake system

− Parking/emergency brake system

− Anti−skid system.

The normal brake system decreases the speed of the aircraft during ground operations. The normal brake system is controlled by the pilot’s and copilot’s brake pedals and is operated hydraulically from the No.1 hydraulic system.

The parking/emergency brake system is used to keep hydraulic pressure applied to the main wheel brake units when the aircraft is parked. The parking/emergency brake system can also be used to stop the aircraft when the

normal brake system is not available. It is powered by the No. 2 hydraulic system, and or the parking brake accumulator.

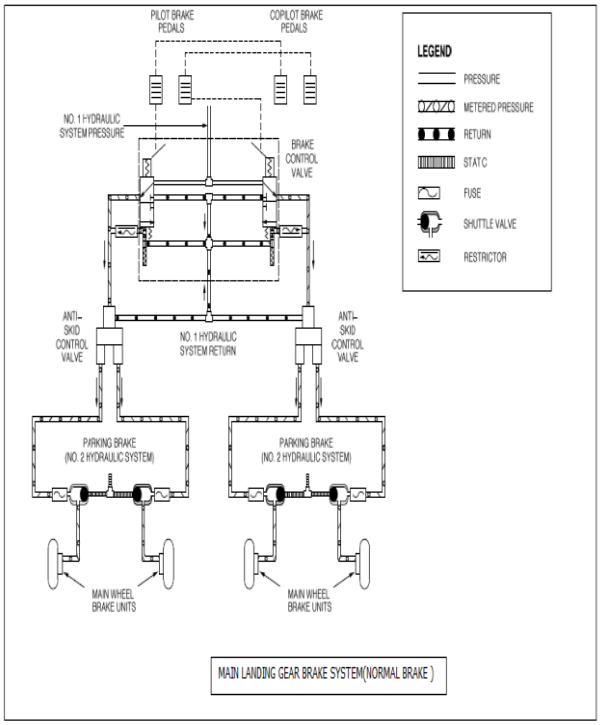
The anti−skid system controls hydraulic pressure to the four main wheel brake units to supply individual wheel anti−skid protection.

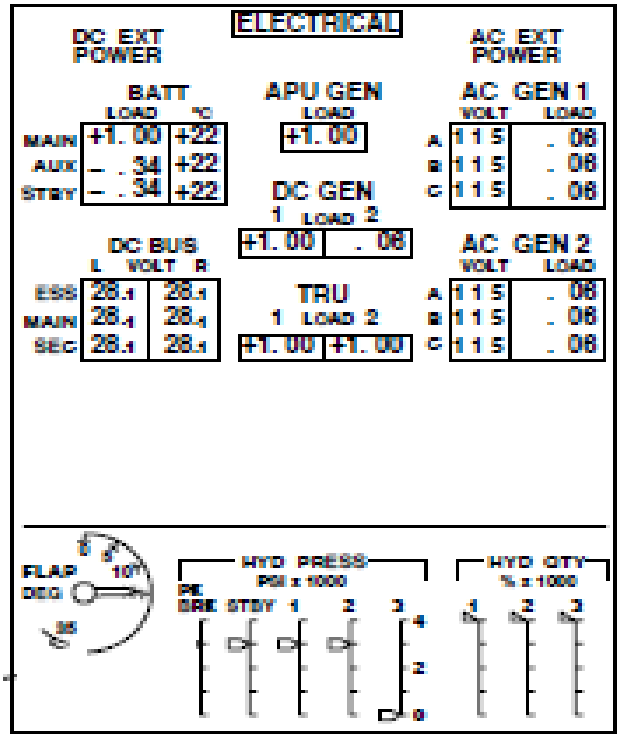
Normal Brake system

The MLG brake system is controlled by the pilot's and copilot's brake pedals. The brake system has the following components:-

- Main wheel brake units
- Brake control valve
− Fuse/shuttle valves
− Pilots' brake pedals
− Brake control cables

The pilot's and co-pilot's brake pedals are installed in the flight compartment and are connected together through interconnect cables in such a way that movement of the pilot's brake pedals do not operate the co-pilot's but movement of the co-pilot's brake pedals move the pilot's brake pedals. Brake pedal mechanism below the flight compartment floor connects pilot's & co-pilot's left and pilot's & co-pilot's right brake pedals together for independent application of inboard and outboard brakes. The interconnected brake pedals of left and right side are linked through cable respectively to left and right brake lever of the brake control valve installed in the left wing root . The brake control valve has two internal metering sections in a common housing and each section progressively moves by separately actuated brake lever. Hydraulic pressure and return lines connect the brake control valve to the No.1 hydraulic system. Each metering section of brake control valve supplies hydraulic pressure in proportion to the amount of brake pedal travel. Metered hydraulic pressure from brake control unit transferred to applicable MLG brake units through anti -skid control valve & fuse/shuttle valves which are connected together by hydraulic rigid and flexible lines. These anti-skid and fuse/shuttle valves are installed on the left wall of the left and the right nacelle. The fuse component of the fuse/shuttle valve closes the hydraulic line to the brake unit, if the fluid flow is more than a specified





Quantity and the shuttle component of the fuse/shuttle valve allows either normal brake pressure or parking/emergency brake pressure to be used to actuate the brake units. On the command from Anti-skid control unit (ASCU) the anti−skid valves control hydraulic pressure to individual wheel to protect it from skid at high speed. When the brake pedal is released, the lever springs of pilot brake pedal return the brake pedal to the off position. A spring in the brake control valve returns the valve to the off position and consequently brake pressure is released to return line in the brake control unit.

When the MLG brake unit is actuated, pressurized hydraulic fluid entered in axle mounted carbon brake unit .The hydraulic pressure inside brake unit uniformly moves the pistons to push the pressure plate assembly which in turn pushes three rotor disks, the stator disks, and the end plate together to create resistance needed to slow down the aircraft wheels to bring the aircraft to stop.

Ant-Skid System

The anti−skid system controls the quantity of hydraulic pressure supplied to the main wheel brake units during the use of the normal brake system. Maximum brake pedal input will not cause the main wheels to skid when the anti−skid system is in operation. The anti−skid system is controlled by an ON/OFF/TEST switch located on the co-pilot's instrument panel. The anti−skid system operates with the normal brake system only and is not available with the Parking/emergency brake system. System consists with two separate valves in one common Manifold which release the necessary brake pressure to the return line in accordance with electric command received from anti-skid control unit (ASCU). The ASCU responses on output from individual axle mounted transducers. Anti-skid system can be terminated or tested by selecting ANTI−SKID switch which is located on the co-pilot's glareshield panel.

1.18.2 Aircraft Recovery

1. The aircraft was recovered as per the instructions of manufacturer and ARM (Aircraft Recovery Manual) procedures.
2. The MLGs were cleaned of all debris in accordance with AMM landing gear cleaning procedures.
3. The NLG wheels, tyre assemblies & NLG axle sleeves were removed and fully cleaned to remove all debris and then visually inspected for any signs of damage.
4. The MLG wheel, tyre assemblies & Brake assemblies were cleaned to remove all debris and then visually inspected for any signs of damage.
5. The brake assemblies were inspected and found statisfactory.
6. A visual inspection of the tachometers and their assembly (drive shafts bent or damaged, mechanical interface between debris guard and driveshaft, mechanical interface between drive shaft and tachometer) was performed.
7. A wiring test of the servo valves was performed.

8. Engines were inspected for Bird Strike, Foreign object or slush ingestion inspection.
9. After necessary inspections and satisfactory landing gear retraction test at Tirupati, ferry flight was carried out from Tirupati to Delhi to position the aircraft for full Inspections as per manufacturer's instructions and AMM.

1.18.3 Approach and Landing

The Airline SOP for each phase of flight as laid down in Operations Manual PART-A is attached as **Annexure – III**

1.18.4 Landings at wet Runway

The Airline SOP for Landings at wet Runway conditions as laid down in Para 4.4 of Chapter 4 of AOM is attached as **Annexure – IV**

1.19 Useful or effective investigation techniques:

NIL

2. ANALYSIS

2.1 Serviceability of the aircraft.

The aircraft had a valid Certificate of Airworthiness and a valid Certificate of Registration on the day of serious incident. Scrutiny of Log books reveal that all inspection schedules were carried out satisfactorily in time. The aircraft and its engines were maintained as per the maintenance program consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance program approved by DGCA.

Scrutiny of the snag register revealed that there was no snag reported on the aircraft prior to the incident flight. Prior to incident flight, the aircraft weight & balance was well within the operating limits.

After incident, Controlled evacuation was carried out from L1 Door. There was no deployment of escape chutes.

All four Brake assemblies were inspected at shop, but no damage or fault was found during shop investigation.

2.2 Weather

As per METAR issued at 1440 UTC, the visibility was 2500 meters with winds 200 ° and 10 kts. However as per CVR, ATC informed winds 170 ° and 06. Co-Pilot during landing informed PIC that winds were 198 ° and 08 kts. The runway surface condition was wet.

2.3 Handling of Evacuation procedure

Controlled evacuation was carried out as per the procedure defined in airline operations manual. However, the Evacuation checklist was carried out after the evacuation. The crew carried out evacuation of passengers immediately after landing on the advice of PIC. Passengers were evacuated from the port side using LI door. PIC had left the cockpit and went out of the aircraft to assess both sides of the aircraft for safety. There was no injury reported to any of passengers. The evacuation was uneventful.

2.4 CVR & DFDR Readout

The CVR and DFDR Correlation was carried out and the following are the salient findings:-

a) As per CVR, PIC was carrying out landing and co-pilot was PM.

b) The Runway surface was wet and winds at the time of landing were 170°, 06 Kts which changed to 198 °, 08 kts.

c) PIC while trying to bring the aircraft to touchdown, increased power at 108 Feet RA to align with center line of Runway.

d) The aircraft floated on the Runway and the Main Landing Gear touched Runway at 144412 UTC at a distance of 3640 feet from threshold at GS 121.5 kts. Hence, the actual Touch down of the Aircraft was much after the touch down zone.

e) The Nose Landing Gear touched runway at 5482 feet.

f) Vertical G at the time of touchdown was 1.469g.

g) There was delay in applying Brakes as the same were applied at 144428 UTC (8 sec after Nose wheel touchdown) at 6236 feet.

h) The Max Reverser thrust was applied late after crossing 7253 feet of Runway at 144432 (12 sec after Nose wheel touchdown).

i) At 144435 UTC, aircraft went off the RESA turning left in Arc.

j) At 144509 UTC, aircraft stopped with centre of MLG at 725 feet from the threshold.

k) At 144631, The Engines were shut off.

l) There was normal evacuation after engine cut off, but the engine shut down checklist was carried out after evacuation.

2.5 Landing SOP

Final assessment of the cross wind as required as per operations manual was not carried out to ensure that the cross wind does not exceed the limit or other predetermined value prudent for the particular runway and the conditions.

Correction factor for calculating available landing distance (LDA) was not applied for WET Runway, as mentioned in Chapter 4 of Airlines AOM.

During landing at any point if PF feels that it is unsafe to land (due to drift or any other reason), GO-AROUND, must be initiated.

Both crew were meeting the requirements and are qualified to operate at Tirupati airport.

2. 6 Circumstances leading to the Incident:

The PIC was PF and carried out an ILS approach for runway 26 via DME ARC. The Co-Pilot was PM & both crew were monitoring ATIS during its descent. Visibility at the time of landing was 2500 meters with variable winds 170 ° and 06 kts and runway condition wet.

Landing at wet Runway 26 in variable winds (varies 160 ° to 200° and speed 06 kts to 10 kts) resulted the aircraft to drift. At 108 ft RA, the pilot increased the power and used rudder resulting the aircraft to float on the runway. The aircraft made a delayed touch down at 3860 feet (Main Wheel) and 5482 feet (Nose Wheel). There was a delay in application of manual brakes and brakes were applied at 6236 feet. The max prop reverse thrust was applied at 7253 feet. After landing, Co-Pilot had asked PIC to apply Brakes and Reverse Thrust, but there was a delayed action from PIC in this regard.

However, the aircraft crossed the runway 08 RESA and finally stopped in kuccha after completing an arc, with centre of MLG at 725 feet away from RWY08 threshold. The total length of Runway is 7500 feet. The approx. landing Distance required for Q 400 aircraft is 4000 feet. The crew could not assess the crosswind component properly to perform a stabilised landing.

There was no fire or damage to the aircraft and there was no injury to any occupants on board the aircraft. All passengers were disembarked safely by the Flight crew immediately from the L1 door. However, the Runway was closed till 18.09.2016

3. CONCLUSIONS

3.1 Findings

1. The Certificate of Airworthiness, Certificate of Registration and Certificate of Flight Release of the aircraft was current/ valid on the date of incident.
2. Previous to the incident flight, the same aircraft had operated Colombo – Madurai, Madurai – Hyderabad with the same set of cockpit crew and there was no snag reported after completion of the flight.
3. Both pilots were qualified on type to operate the flight and were meeting the competency requirements to operate at Tirupati Airport.
4. After coming in contact with Chennai ATC, Aircraft was cleared by Chennai ATC direct to Tirupati.
5. The landing was carried out by PIC and Co-pilot was PM for the flight.
6. The aircraft was cleared for landing runway 26 by ATC.
7. The Runway conditions were “Wet”.
8. As per the MET report, the weather at the time of incident was visibility 2500 meters with winds 200/10, thunderstorm and rain, with scattered cloud at 2000Ft., Temp 27 Degree Celsius & dew point 23 Degree Celsius.
9. The aircraft carried out an ILS approach for runway 26 under IFR condition and the approach was stabilized.
10. During flare just before touch down around 30 ft, aircraft couldn’t align to the center line and the same was corrected by PIC by adding power and maneuvering toward the center line of Runway. In the process of correcting this, PIC made a delayed touch down.
11. The main wheels touched runway at 3860 feet near to intersection ”A” & Nose wheel touched at 5482 feet from end of runway 26.
12. Total Length of Tirupati Runway is 7500 feet.
13. After landing, Co-Pilot had asked PIC to apply Brakes and Reverse Thrust, but there was a delayed action by PIC in this regard.
14. The max prop reverse thrust was applied at 7253 feet.

15. The aircraft exited the runway on the right side on Kutcha and came to the final stop at perpendicular to Runway center line with centre of MLG at 725 feet from end of runway 26.
16. There was no damage to Aircraft or any of its components.
17. There was no injury to any passenger.
18. All Passengers were evacuated normally from L1 door.
19. There was neither fire nor any fire extinguishing material used by Crash Fire Tenders. However, Fire handle were pulled to stop engines and it was not a part of normal shut down procedure.
20. The runway was closed after the incident as aircraft became disabled on the runway as the Airline didn't had a tow bar at Tirupati station
21. The Spice Jet airways aircraft was removed from runway 18-09-2016 and airport opened for normal operation thereafter.
22. Post flight medical Examination of Cockpit Crew & Cabin Crew was not carried out after the Incident by Airline or by the Airport operator. Also, the Airport operator at Tirupati is not aware of this regulation.
23. Crew did not carry out the final assessment of the cross wind as needed as per operations manual to ensure that the cross wind does not exceed the limit or other predetermined value prudent for the particular runway and the conditions.
24. Crew did not apply the correction factor to calculate the available landing distance (LDA) for WET Runway, as mentioned in Chapter 4 of AOM.
25. Brake assemblies of the aircraft were inspected at shop and Nil faults were found during shop investigation.

3.2 Probable cause of the Serious Incident

"Delayed touchdown of the aircraft during landing at wet runway in variable winds resulting in aircraft to float on runway, followed by late application of Brakes and Propeller Reverse Thrust, resulting in aircraft overshooting the Runway".

4. Safety Recommendations

1. The Airline's SOP for Approach and Landing mentioned in their Operations Manual and AOM, may be reiterated with respect to this incident.
2. The procedure for conducting the medical examination of the cockpit crew, post Serious Incident as per Airline approved Flight Safety Manual may be reviewed for implementation.
3. The procedure for conducting the medical examination of the cockpit crew, post Serious Incident as per Airport operator's Aerodrome Emergency plan may be reviewed for implementation.

(Dr. Jitendra Loura)
Member
Deputy Director
AAIB

(Raje Bhatnagar)
Chairman
Assistant Director
AAIB

Date: 28-06-2019
Place:- New Delhi

5.10 MEDICAL EXAMINATION AFTER ACCIDENT

In the event of an accident at an airport or in its near vicinity, the Officer Incharge of the airport shall ensure that the crew members are immediately subjected to medical check-up for consumption of alcohol. The doctor conducting such checkup shall take samples of blood, urine, etc. required for detailed chemical analysis. Such examination and collection of samples shall be done at the Airport Medical Centre, wherever available.

In case where medical centers are not available at the airports or when the condition of crew members requires immediate hospitalisation, Aerodrome Officer Incharge shall ensure that the sample of the blood, urine, etc. is taken at the nearest hospital. These checks should be expeditiously carried out without any loss of time.

In case where accident is at a location far away from the airport and the police authorities are able to reach the site before the aerodrome authorities and the crew members are alive, the procedure for collection of blood/urine samples shall be performed by the police at the nearest hospital. Such samples shall be properly preserved. For the purpose of chemical analysis, the sample may be forwarded to local forensic laboratory giving the details of tests to be conducted, names of flight/cabin crew, etc.

NOTE: For details refer CIVIL AVIATION REQUIREMENTS SECTION 5 - AIR SAFETY SERIES F, PART III, ISSUE III, Date 4TH AUGUST 2015.

5.11 CLEARANCE FOR PILOTS UPGRADATION

Prior to up gradation of Captains (PIC upgradation), Flight Operations department shall obtain clearance from Chief of Flight Safety / Dy. Chief of Flight Safety. Based on the past five years records available with respect to the Captain's involvement in an accident/incident, Critical Exceedances and pre flight medical for alcohol, the Chief of Flight Safety shall give clearance for up gradation of the Captain.

If in previous 5 years a captain is found blameworthy in an accident/incident or Critical exceedances or had tested BA positive, Chief

13. MEDICAL EXAMINATION OF FLIGHT CREW, HANDLING OF DEAD AND MEDIA MANAGEMENT

a) Medical Examination of Flight Crew

i. The flight crew must be segregated from the rest of casualties.

ii. If the Pilot and co-Pilot are Priority I casualties, they will, after stabilization, be immediately transferred to **Hospital** from the triage area. For this purpose, an **ADVISORY CARD** indicating the biochemical and toxicological examinations to be carried out shall be attached to the casualties prior to their transfer to the hospital.

iii. If the Pilot and Co-Pilot are Priority II / Priority III or uninjured casualties, the medical examinations and collection of blood and urine samples shall be carried out by the MEDICAL OFFICER at the Emergency Medical Center.

iv. The samples of blood and urine collected must be handed over to Director (Air Safety), DGCA or his representatives.

b) Handling of Dead

i. The obvious dead will be left at the crash site for investigation purposes. Upon clearance by the Director (Air Safety), DGCA, the bodies will be handed over to the Police. The police will take charge of the **Body Holding Area**, which is a part of the **Casualty Clearance Centre** set up. All the dead bodies including those who do not survive their injuries at the care holding areas will be brought to the Body Holding Area. At, the Body Holding Area, forensic team and other relevant specialists may conduct body identification and determination of cause of death.

ii. The Police will liaise with the hospitals for mortuary arrangements and in coordination with Mobile Command Post, arrange for the transportation of bodies and parts to the mortuaries as soon as possible.

altitude descent rates of 300fpm.

(e) Pilots should be conscious of terrain under the descent path and aware of safety heights/altitudes along the arrival route and for the approach. Pilots must not descend below the minimum safe altitude for the route or the MSA for the approach facility until they have positively identified and cross checked their position.

(f) Pilots shall not descend below the MSA to the minimum procedural altitude until the aircraft has passed over the approach fix or unless specific descent instructions are given in the Jeppesen approach chart. The extended ILS glide path is not approved as an en-route descent aid.

(g) Where the aircraft is being vectored by airport approach radar and has been positively identified, the approach radar controller is responsible for ensuring proper terrain clearance. In these circumstances clearance and descent to the cleared altitude below the MSA is authorized. However pilots must continue to assess the aircraft's position using the radio aids available. If doubt exists, the MSA must be maintained and if radar contact is lost the aircraft should climb to the MSA without further delay.

(h) The Descent and Approach Briefing should be completed as an SOP prior to commencement of the descent.

A17.3.0.4.2 **Descent and Approach Briefing**

Refer OM Part-A Ch 23

A17.3.0.5 **Descent**

(a) Descent shall be planned in such a way that enables a Pilot to arrive at the initial approach fix/clearance limit at or above the initial approach altitude or as cleared by the ATC. The Co-Pilot will carry out the descent check list and advise the Commander when descending through 1,000 ft. above the assigned altitude, reaching FL 100 and transition level. The Co-Pilot shall also obtain destination weather. When weather conditions or ATC procedures are likely to entail prolonged holding or a possible diversion, the weather of the nearest suitable alternate should also be obtained.

(b) The PF will carry out an approach briefing.

(c) ECON Descent speed as predicted by the FMS shall be flown in the managed or open mode.

(d) The briefing must include the procedure to be adopted after any GPWS warning so that CFIT accident is avoided.

(e) Fasten Seat Belt sign shall be switched ON when descending through 20,000' unless for a particular route or airfield there are airline limitations.

(f) Below transition level appropriate external lights will be switched ON till after landing.

(g) The altitude alert system will be used during descent.

(h) The approach check list shall be completed on reaching transition level. Upon leaving transition level the altimeter shall he set to the QNH of the destination airport and cross checked.

A17.3.0.6 **Approach and Landing**

(a) Landing Conditions

Refer OM Part-A Ch 28, Para A.28.1.1

(b) Conduct of Approach

Refer OM Part-A Ch 28.

(c) Stabilized Approach

Refer OM Part-A Ch 25.

(d) Visual Approaches

Refer OM Part-A Ch 28 Para A.28.1.8

(e) Circling Approach

Refer OM Part-A Ch 28 Para A.28.2

(f) Go-Around

Refer OM Part-A Ch 28 Para A.28.3

(g) Landing

Procedures to ensure an aeroplane being used to conduct 3D instrument approach operations crosses the threshold by a safe margin, with the aeroplane in the landing configuration and attitude are as follows:

i. The standard prerequisites for a safe landing require the runway threshold to be crossed at the correct height and airspeed, and to land on the centreline within the prescribed touchdown area.

i. A stabilized approach is the means by which this effected.

ii. A final assessment of the cross wind is needed as the aircraft crosses the threshold to ensure that the cross wind does not exceed the limit or other predetermined value prudent for the particular runway and the conditions.

iii. Excess threshold height, speed and touchdown float will significantly increase landing/ stopping distance. Specifically:

1. The target threshold height for all aircraft is 50 ft;
2. The maximum allowable airspeed over the threshold is Vref + 20kts. The approach speed which contains increments for wind speed and gust should be flown accurately on the final approach and the additional speed increments reduced as the threshold is crossed to within the maximum tolerance. Conditions dictate what the cushion ought to be and in a tail wind it should be minimal.
3. With a 3° approach glide path and a target runway threshold height of 50 ft the touchdown aiming point is 1,000 ft. This point can be identified from the standard runway markings.

iv. The touchdown area should be within the range of 750' to 1,250' from the runway threshold and never outside the range of 500' to 1,500'.

v. When determining the target touchdown point, consider that visual and Electronic glide slopes may intersect the runway surface beyond the 1000' point and some runways may have a displaced threshold

vi. A shallower approach path of less than 3° and a down slope on the runway make an accurate touchdown progressively more difficult.

vii. If for any reason the approach path is not maintained and it is likely that the touchdown will occur too short or too far beyond the touchdown area, or the threshold speed is excessive then a go-around must be

initiated.

viii. The computed landing crosswind component should be determined using the steady wind velocity and based on this component the cross wind limit must not be exceeded. Specifically:

1. The tolerance to any greater crosswind component caused by wind gusts is a matter of judgment which should take into account the frequency and strength of the gusts, the wind direction, the particular runway surface, width and length, and the runway conditions at the time of landing;
2. The acceptable crosswind component must be reduced for runways less than 150 ft wide, for short runways which are landing weight restricted, and for contaminated runway surface conditions; and
3. The largest aerodynamic side forces generated by the cross wind when tracking down the centreline occur at the highest airspeed and therefore exposure to the risk of lateral drift off the centreline towards the side of the runway occurs during the early part of the landing roll. Touchdown should be made with minimal lateral drift to avoid aggravating this tendency and increasing the crosswind exposure.

ix. SpiceJet has developed safe operating procedures to land at any airport with minimal use of thrust reverser. Such procedures have been developed for compliance without compromising with the safety of aircraft and its occupants as well as without compromising the runway capacity. The flight crew shall have the final authority to decide on use of thrust reverser on case to case basis.

x. If the runway is short, all stopping devices must be used to the fullest potential allowed by directional control considerations.

xi. If the runway is long, the levels of braking action and reverse thrusts used should be governed by good judgment and consideration of turn-off taxi-way, brake and tyre wear, fuel economy, and passenger comfort. Specifically:

1. While recognizing that maximum reverse thrust can and shall be used in an emergency stopping situation down to a standstill, normally reverse thrust shall be used within the restrictions specified for protecting the engine against surge and F.O.D. ingestion damage;
2. Pilots should be aware that the aircraft stopping capability usually far exceeds that routinely used for deceleration, and that reverse thrust is most effective at the highest speeds while the wheel braking force increases as speed decreases. This is particularly the case on wet runways; and
3. Also that, the deceleration characteristic of distance-against-speed is such that most of the landing roll is spent at the higher speeds, and hence by implication, a need to initiate the stopping procedures without delay after touchdown.

xii. Runway turn-offs are built to different designs. Pilots should be prudent

about aircraft turn-off speed until they are familiar with the turn-offs on specific runways:

1. Turn-offs at high speed can generate high side loads on the landing gear and increase tyre wear.
2. Turning forces on the aircraft are higher than experienced on the runway and special care needs to be taken where there is a possibility of ice or frost on the turn-offs and taxi-ways even though none exists on the runway.
3. Where ice or frost is present on runways, turn-offs or taxi-ways the aircraft should be brought to a virtual standstill on the runway before turning-off to allow careful assessment of the surface conditions (e.g. at Srinagar).

xiii. An all engine go-round can be executed at any time until after touchdown. However, once either the spoilers or reverse thrust have been selected a go-around off the runway must not be attempted:

1. If the engine power/thrust has been reduced to idle during the flare for landing then a longer spool-up will be needed to generate the necessary go-around thrust. The aircraft may touchdown if it has not already done so.
2. The normal go-round drill should be adhered to and the go-round attitude maintained for lift-off and initial climb out until the gear has been retracted.
3. Pilots should be conscious of obstacle clearance following such a go-round off the runway or from low altitude.

xiv. **180 degree turns on runways**

To prevent confusion and to ensure compliance with instruction on 10-9/Airport pages, crews are directed to do 180 degree turns at the end of all runways unless they request and obtain approval from tower to do "180 at present position".

A17.3.0.7 Taxi-In

(a) Upon arrival, standard ICAO hand signals only shall be used from ground to cockpit.

(b) After arrival at the ramp parking position, parking brakes shall not be released until:

i. All engines have been shut down; and
ii. Chocks have been inserted; and
iii. The aircraft is not moving.

A17.3.0.8 Arrival Procedure

(a) Marshalling

i. Aircraft shall be marshalled away from the ramp stand on departure as well as on to a stand on arrival. Marshalling signals are standard and used universally throughout the industry. For reference they are detailed in the Jeppesen Airway Manual – 'Air Traffic Control' Section.
ii. Airport ground traffic control procedures and guidance systems may be specific to particular airports and are set out for each airport with

4.4 LANDING

4.4.1 General

JAR-OPS 1 requirements differentiate between "dispatch requirements" and the "actual landing requirements".

For the dispatch requirements the regulations for propeller driven airplanes state that the actual (= unfactored) Landing Distance shall not exceed 70% of the available landing distance (LDA).

Using a factor, this means that the unfactored Landing Distance shall be factored with **1.43** (= 100 / 70) to obtain the required landing field length.

For Wet Runways an additional factor of **1.15** shall be used.

4.4.2 Dispatch Requirements

As mentioned under *Sub-Chapter 4.4.1* the unfactored landing distance (= distance from 50 ft above threshold to full stop) shall not exceed 70% of the available LDA - in case of a Dry Runway.

When computing the Maximum Mass for landing for a given LDA, regulations do only require to consider

- the aerodrome Altitude,
- the Wind, and
- the Slope - **if greater than ± 2%**.

The Dash 8-Q400 is restricted to a maximum Slope of 2%.

From that it follows that the slope **could** be disregarded.

However the AFM also provides correction factors for the slope and it is company standard also to consider the slope.

4.4.2.1 Maximum Mass for Landing / Dispatch

The presentation under this *Sub-Chapter* is made out to show the maximum mass for landing for a given runway length (considering the 70% rule).

The LDA (Landing Distance Available) as shown in the AIP (Aeronautical Information Publication) must first be corrected for the Wind and the Slope (see Tables 1, 1a and 1b).

With this corrected distance, Tables 2, 2a and 2b may be entered to obtain the maximum allowed landing mass.

Needless to say, in case of a zero Slope and a zero Wind, Tables 2, 2a and 2b may be used right away without Tables 1, 1a and 1b.

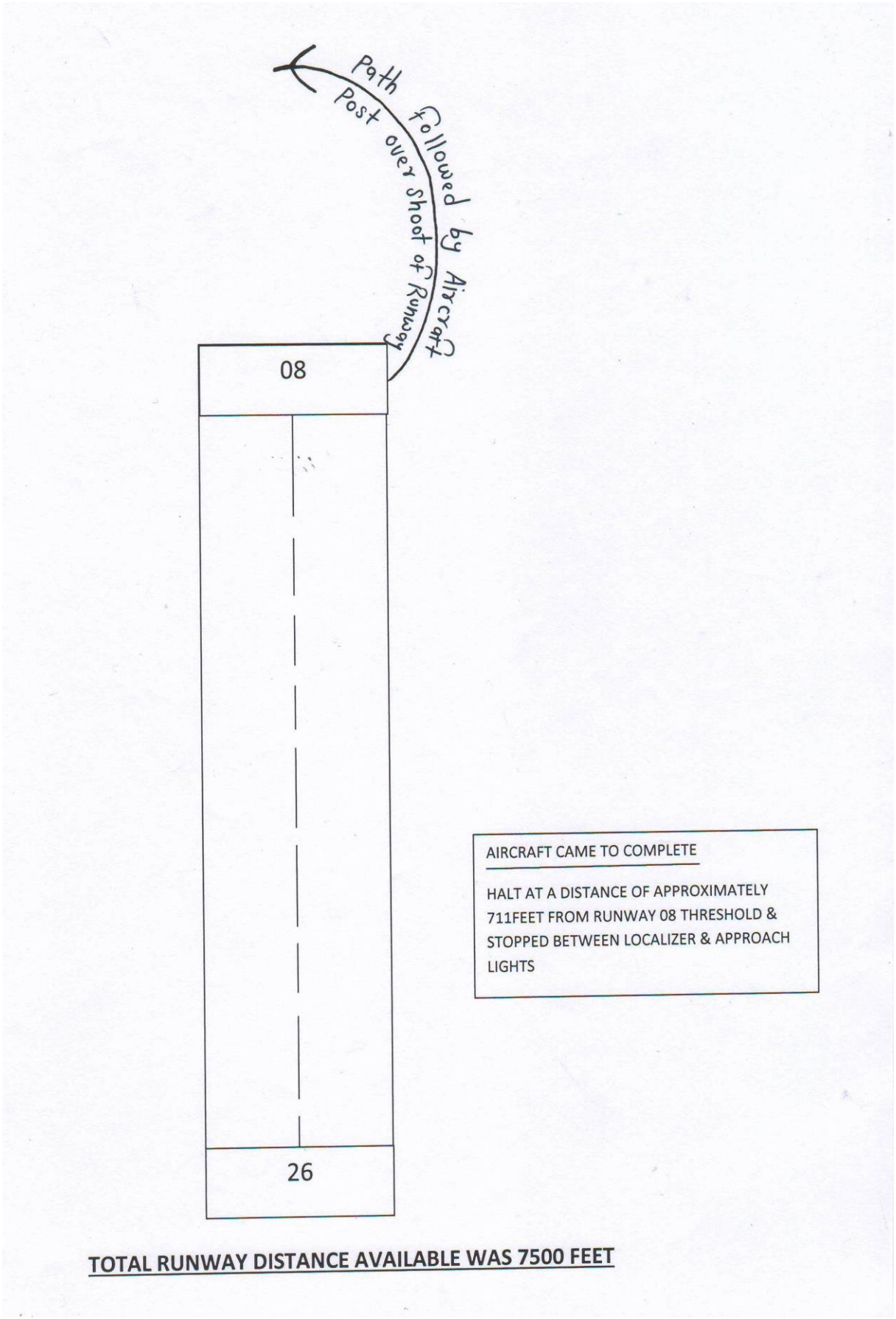
In case of a wet runway the LDA must however first be corrected by multiplying the (dry) LDA with the Wet Runway factor of **0.87** to obtain the LDA corrected for the wet runway.

Therefore, an LDA of 1400 m (for example) converts into a LDA of only 1218 m in the case of a wet runway.

Table 1 - LDA [m] corrected for Wind and Slope - 10° Flaps
Table 1a - LDA [m] corrected for Wind and Slope - 15° Flaps
Table 1b - LDA [m] corrected for Wind and Slope - 35° Flaps

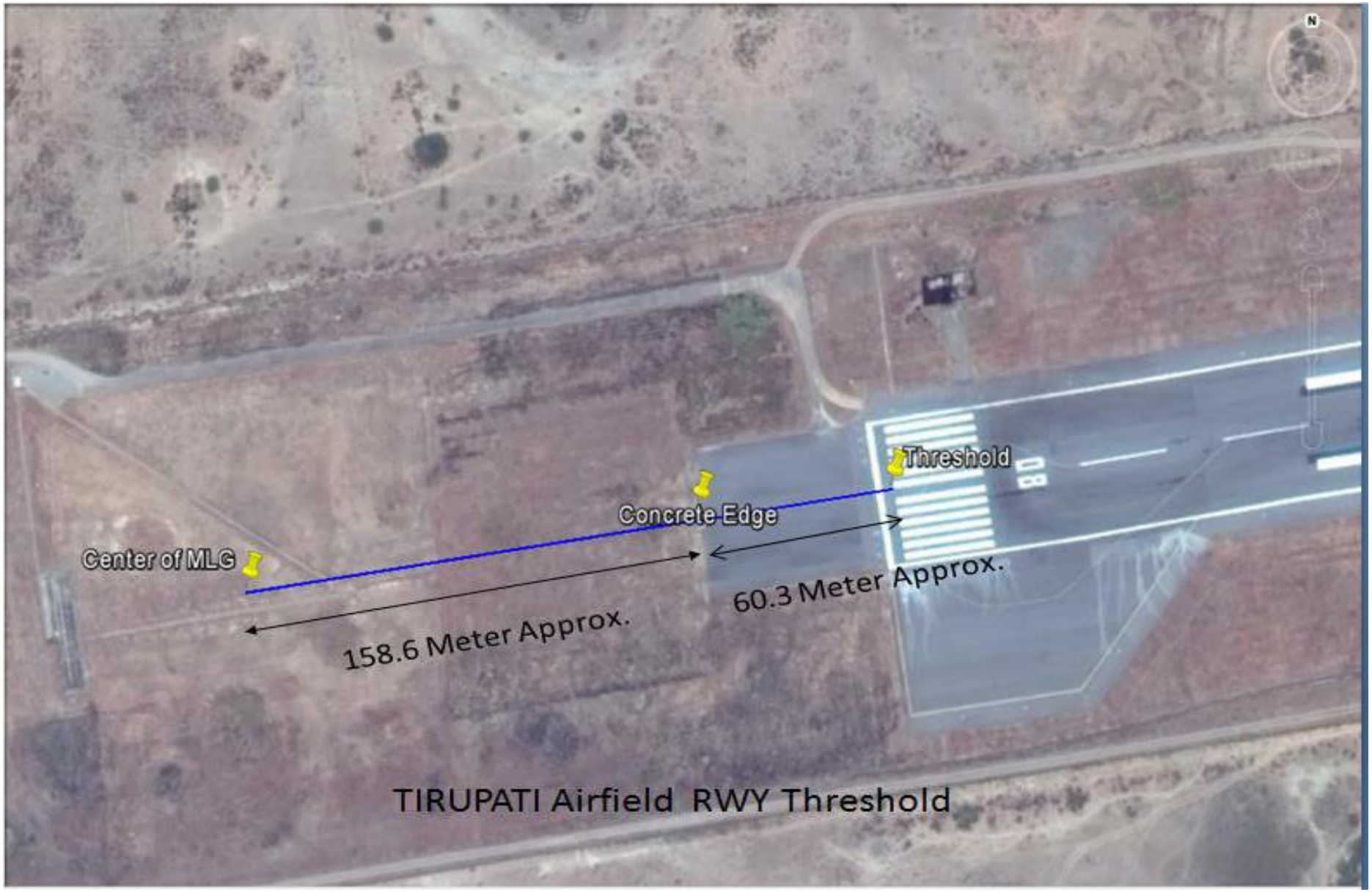
Table 2 - Maximum Landing Mass [kg] for Landing Distance Available - Dispatch - 10° Flaps
Table 2a - Maximum Landing Mass [kg] for Landing Distance Available - Dispatch - 15° Flaps
Table 2b - Maximum Landing Mass [kg] for Landing Distance Available - Dispatch - 35° Flaps

PHOTOGRAPHS




Main Wheel Contact 3860 ft
Idle Reverser 4864 ft
Nose Wheel Contact 5482 ft
Brakes Applied 6236 ft
Max Reverser 7253 ft
Aircraft Exit RNWY 7638 ft
Aircraft Stopped 711 ft from RNWY 08
Google Earth
Image © 2019 DigitalGlobe
Imagery Date: 3/7/2018 13°37'55.42" N 79°32'32.91" E elev 343 ft eye alt 7451 ft


Max Reverser
148 ft
Aircraft Exit RNWY
563 ft
Aircraft Stopped
Google Earth
Image © 2019 DigitalGlobe
Imagery Date: 3/7/2018 13°37'51.78" N 79°31'57.78" E elev 351 ft eye alt 1881 ft
2001


Threshold
Concrete Edge
Center of MLG
158.6 Meter Approx.
60.3 Meter Approx.
TIRUPATI Airfield RWY Threshold