



**FINAL REPORT ON SERIOUS INCIDENT TO M/s JET
AIRWAYS BOEING 737-800W AIRCRAFT VT-JFA AT
COCHIN ON 18/08/2015**

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Foreword

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts. The investigation has been carried out in accordance with Annex 13 to the convention on International Civil Aviation and under the Rule 11 of Aircraft (Investigation of Accidents and Incidents), Rules 2012 of India. The investigation is conducted not to apportion blame or to assess individual or collective responsibility. The sole objective is to draw lessons from this incident which may help to prevent such future accidents or incidents.

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FINAL REPORT ON SERIOUS INCIDENT TO M/s JET AIRWAYS
BOEING 737-800W AIRCRAFT VT-JFA AT COCHIN ON
18/08/2015

- | | |
|------------------------------|---|
| 1. Aircraft Type | : Boeing 737-800W |
| Nationality | : INDIAN |
| Registration | : VT - JFA |
| 2. Owner | : M/s Celestial Aviation Trading 71 Limited |
| 3. Operator | : Jet Airways. |
| 4. Pilot – in –Command | : ATPL holder on type |
| Extent of injuries | : Nil |
| 5. First Officer | : CPL Holder qualified on type |
| Extent of injuries | : Nil |
| 6. Place of Incident | : Trivandrum Airport |
| 7. Date & Time of Incident | : 18 th August 2015 0139 UTC |
| 8. Last point of Departure | : Doha, Qatar |
| 9. Point of intended landing | : Cochin |
| 10. Type of operation | : Schedule Operation |
| 11. Crew on Board | : 02 cockpit crew & 06 cabin crew |
| Extent of injuries | : Nil |
| 12. Passengers on Board | : 142 |
| Extent of injuries | : Nil |
| 13. Phase of operation | : During landing |
| 14. Type of incident | : Emergency Landing due low Fuel. |

(ALL TIMINGS IN THE REPORT ARE IN UTC)

SYNOPSIS

On 17/08/2015, M/s Jet Airways, Boeing B737-800 aircraft registration VT-JFA was scheduled to operate sector Doha-Cochin. Both the operating crew were duly qualified on type B737 aircraft to operate the flight. There were 142 passengers and 08 crew members on board the aircraft.

The flight from Doha to Cochin was uneventful, however due to presence of low clouds below decision altitude (DA) in approach path at Cochin, the crew carried out three go-around as visual contact with runway could not be established. While carrying out the third go-around the minimum reserve fuel became less than what was required for Bangalore, the designated alternate destination, hence the crew re-designated the alternate destination as Trivandrum. After the third go-around diverted to Trivandrum. The reported visibility at Trivandrum was 3000 meter. However after 9W-555 came in contact with Trivandrum ATC, the reported visibility was 1500 m. Trivandrum ATC cleared 9W-555 for VOR/DME approach runway 14. The flight crew of 9W-555 could not establish visual contact with the runway at Minimum Decision Altitude (MDA), carried out a go-around and declared "MAY-DAY" due fuel. After declaring "MAY-DAY" the PIC requested ATC for permission to carry out visual approach for runway 14. Thereafter the crew of 9W-555 made two more visual approaches for runway 14 and, however failed to establish visual contact with the runway and carried out go-around. The aircraft finally landed on runway 32 after making total of seven approaches during the flight. After engine shut down fuel on board was 349 Kgs.

The crew carried out refuelling at Trivandrum and again got airborne for Cochin. The aircraft landed safely at Cochin.

There was no damage to the aircraft. There were no fire and no injury to any of the occupants on board the aircraft.

Initially the incident was reported by M/s Jet Airways to DGCA only. Subsequently considering the seriousness of the occurrence, the AAIB classified the occurrence as serious incident and ordered an Inquiry under Aircraft (Investigation

of Accidents and Incidents), Rules 2012 to investigate into the cause of the serious incident vide Ministry of Civil Aviation Order No AV-15029/112/2015-DG dated December 2015.

The Sole objective of this investigation is not to blame or apportion liability on anyone and it is only to prevent the recurrence.

1. FACTUAL INFORMATION

1.1 History of the flight

On 17/08/2015, M/s Jet Airways, Boeing 737-800 aircraft VT-JFA was scheduled to operate flight 9W-555 (Doha-Cochin). The flight was under the command of PIC holding current Air Transport Pilot License (ATPL) along with First Officer (F/O) holding current Commercial Pilot License (CPL) respectively. Both the operating crew were duly qualified on type Boeing 737- NG aircraft to operate the flight. There were 142 passengers and 08 crew members on board the aircraft.

The crew had operated Cochin-Doha (COC-DOH) sector on the previous flight, the flight was uneventful. The crew were scheduled to operate flight DOH - COK on 17/8/2015 after the required rest. The flight departed Doha at 1940 UTC and was uneventful until top of descent into Cochin. The aircraft came in contact with Cochin ATC at time 2300 UTC and the weather reported by ATC was visibility 3500 meter haze, few clouds at 1500 ft and scattered clouds at 8000 ft. The 9W-555 arrived overhead Cochin at time 2348 UTC with 4844 Kgs of fuel on board. ATC cleared 9W-555 for ILS approach Runway (Rwy) 27. The visibility requirement was RVR 650m and the DA was 320 feet. During approach, the flight crew was not able to make visual contact with the runway due to low clouds and initiated a go-around at 256 feet by pressing TOGA at around 2358 UTC.

After the 1st go around, fuel on board was 4699 Kgs and the Minimum Diversion Fuel (MDF) for designated alternate destination Bangalore was 3306 Kgs. Thereafter the PIC followed the missed approach procedure and joined the holding

pattern overhead Cochin. ATC cleared 9W-555 to proceed outbound for the second approach ILS Rwy 27 during which the crew discussed the alternate fuel requirements for Coimbatore and Trivandrum also. The F/O advised the Captain that at Trivandrum only VOR Approach is available as ILS is not available. The Captain responded that Trivandrum reported visibility is 3000 meter and is adequate to carry out the VOR Approach in Trivandrum.

While 9W-555 was heading overhead Cochin to proceed outbound on the second approach, Air India Express B737 aircraft operating flight 474 which was ahead of 9W-555 carried out go-around on R/W 27. ATC informed Air India Express flight 474 that an aircraft which was ahead of them had landed and reported sighting the runway at 1400 feet and reported moving clouds.

Subsequently, Cochin ATC advised 9W-555 that aircraft ahead of them (i.e. Air India Express flight 474) had executed a go-around and had reported low clouds at 600 feet and broadcasted that the visibility has dropped to 2500 meters. 9W-555 continued for 2nd approach and again on reaching DA did not sight the Runway and executed the 2nd go-around at 0017 UTC. The fuel on board after 2nd go-around was 3919 Kgs, and the MDF for Bangalore was 3306 Kgs.

After following the missed approach procedure, 9W-555 joined the holding pattern overhead Cochin again and the crew discussed to re-designate Trivandrum as the alternate destination in order to gain more holding time over Cochin. The F/O expressed concern about the possibility of visibility dropping further due Haze. The Captain responded that in case of emergency they can ask for Coimbatore as it is a closer airport to Cochin. However the Coimbatore weather details was not obtained by the crew of 9W-555.

ATC was advised by 9W-555 about re-designating of Trivandrum as the alternate destination Aerodrome. Thereafter ATC instructed 9W-555 to join the holding pattern over Cochin. As 9W-555 entered holding pattern, another aircraft, Kuwait 329 executed a go-around on ILS approach Rwy 27 Cochin due being unable to sight the runway.

Subsequent to Kuwait 329 go-around, ATC broadcasted latest visibility of 2000 m, with low clouds reported scattered at 400 feet. Air India Express flight 474 informed ATC that reported visibility at Trivandrum is 3000 m and requested Cochin ATC to confirm with Trivandrum ATC if there were any reports of low mist, haze, or go-arounds at Trivandrum. Thereafter Cochin ATC broadcasted to all stations "Trivandrum visibility is 3000 m and clouds at 1500 feet".

Cochin ATC informed 9W-555 that trend is reducing visibility and requested for their intentions. 9W-555 intimated ATC that they would like to make another attempt and if unsuccessful, they will divert to Trivandrum. ATC gave 9W-555 the option of trying an approach for R/W 09, the PIC asked for the visibility or RVR value for R/W 09. ATC intimated them that no RVR was available for R/W 09, so the PIC decided to continue for an ILS Approach R/W 27. Further ATC gave a weather updates to 9W-555 that "tempo visibility reducing to 1500 m in mist and low clouds now at 400 feet" and advised 9W-555 that in case of missed approach "turn left to intercept 180 radial Cochin and climb to 4000 feet".

After 33 minutes of 2nd go around, 9W-555 made third approach on Rwy 27, as the Runway was not sighted at DA the 3rd go-around was initiated by PIC at 0050 UTC. The fuel after the 3rd go-around was 2644 Kgs and the MDF for Trivandrum was 2614 Kgs.

After the third go around, the crew set course and diverted to Trivandrum. While diverting from Cochin to Trivandrum 9W-555 climbed to FL 210. At 0102 UTC aircraft came in contact with Trivandrum ATC. The weather reported by Trivandrum ATC at 0100 UTC was visibility 1500 meter haze, winds 290/3 kts, scattered cloud at 1500 ft and at 2500 ft. Around 25 nm short of Trivandrum VOR, the PIC realised he was high and requested ATC for a right 360 orbit to reduce the height.

ATC cleared the aircraft 9W-555 for VOR approach and landing on Rwy 14. The crew of 9W-555 contacted Trivandrum ATC to check for the availability of high

intensity lighting system (HILS) on runway 14 as they would like to use CMV to land on runway 14. ATC Trivandrum informed that HILS is not available on runway 14 and only Simple intensity lighting system with high intensity is available for runway 14. The Visibility requirement was RVR 2100 m for runway 14. The crew had informed ATC about minimum fuel conditions. ATC cleared 9W-555 for landing on runway 14 with visibility 2000 m. During approach and landing, the crew was unable to sight the runway and initiated the 1st go – around at Trivandrum (4th go-round of the flight) at 0119 UTC. The fuel on board after the 4th go-around was 1324 Kgs.

About 40 seconds after the Go-Around, as the fuel on board was below 1300 Kgs, 9W-555 Declared "MAY DAY due Fuel". Thereafter Captain informed ATC of his intention for right hand visual circuit for Rwy 14. As the crew of 9W-555 had declared fuel emergency, the ATC cleared 9W-555 for visual approach runway 14. On the 2nd visual approach circuit the crew was not in visual contact with the runway and sighted the runway very late and at time 0126 UTC crew initiated the 2nd go-around at Trivandrum (5th go-around of the flight) as the crew also realized that aircraft was not aligned with the runway. The fuel on board after go-around was 898 Kgs.

The PIC again requested ATC for circling visual approach for Rwy 14, however he was not in visual contact with the runway and once again crew was late in sighting the runway, too high on approach and was not able to align the aircraft on the runway and carried the 3rd go around (6th go round of the flight) at 0132 UTC. The fuel on board after the go-around was 662 Kgs.

After carrying out the 6th go-around at 700 feet AGL, the PIC requested ATC to take left 180° turn and self-position for landing for inbound runway 32. This manoeuvre activated EGPWS caution "TERRAIN TERRIAN" followed by EGPWS warning "TERRAIN TERRAIN PULL UP". The First officer selected Ground proximity Terrain Inhibit switch to TERR INHIBIT and at around 50 feet radio altitude, the EGPWS bank angle alert also got activated. The PIC continued the approach with all warnings and with no visual contact with the runway and finally landed on runway

32 on the 7th attempt at 0139 UTC. After landing, the total fuel on board was 349 Kgs. There was no damage to the aircraft. There were no fire and no injury to any of the occupants on board the aircraft. The occurrence was reported to DGCA by M/s Jet Airways. The aircraft was refuelled at Trivandrum and crew flew back to Cochin and landed safely.

1.2 Injuries to persons

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil

1.3 Damage to Aircraft : NIL

1.4 Other damage: NIL

1.5 Personnel information

1.5.1 Pilot – in – Command

AGE : 40 years

License : ALTP Holder

Category : Aeroplane Class I

Endorsements as PIC : B 737-800 (NG)

Date of Med. Exam. : 26.08.2015

Med. Exam valid upto : 25.02.2016

FRT0 License Validity : 20.09.2016

Total flying experience : 6699.18 hours

Experience on type : 6289.09 hours

Experience as PIC on type : 2924:19 hours
Total flying experience during last 180 days : 369:23 hours
Total flying experience during last 90 days : 197:45 hours
Total flying experience during last 30 days : 71:29 hours
Total flying experience during last 07 Days : 22:39 hours
Total flying experience during last 24 Hours : 05:34 hours

1.5.2 Co-Pilot

AGE : 25 years
License : CPLHolder
Category : Aeroplane Class I
Endorsements as PIC : N/A
Endorsements as F/O : B 737-NG
Date of Med. Exam : 16.03.2015
Med. Exam valid upto : 15.03.2016
Total flying experience : 1465:24 hours
Experience on type : 580:24 hours
Experience as PIC on type : Nil
Total flying experience during last 180 days : 331:27 hours
Total flying experience during last 90 days : 176:43 hours
Total flying experience during last 30 days : 84:48 hours
Total flying experience during last 07 Days : 22:54 hours
Total flying experience during last 24 Hours : 05:34 hours

Both the operating crew were not involved in any serious incident/ accident in past. Both the operating crew were current in all training and had adequate rest as per the Flight Duty Time Limitations (FDTL) requirement prior to operating the incident flight.

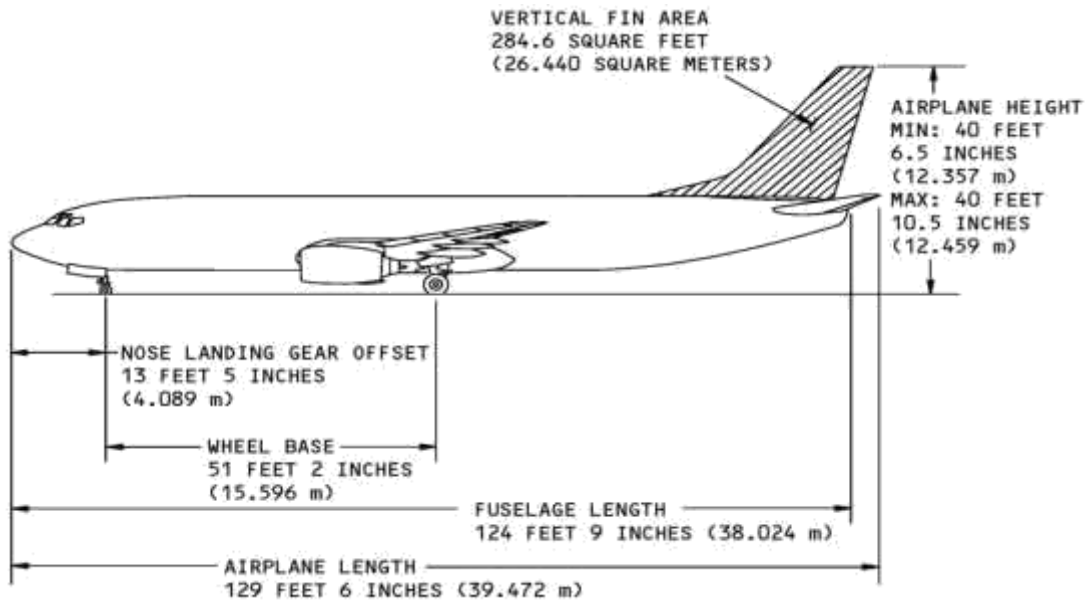
The Crew of 9W 555 were operating within the Flight and Duty Time Limitations contained in Chapter 2 of Operations Manual Part A, revision 10. The flight Crew had started their flight from Doha after a layover of 24hr. The following is a summary of the accumulated times compared to the various limitations.

	Block hours last		Duty time last	
	30 days	7 days	28 days	7 days
Max .Hrs	125:00	35:00	190:00	60:00
Capt.	71:29	22:39	139:14	45:15
F/O	84:48	22:54	114:40	31:53

The block times and hours achieved by the crew did not exceed the limitations.

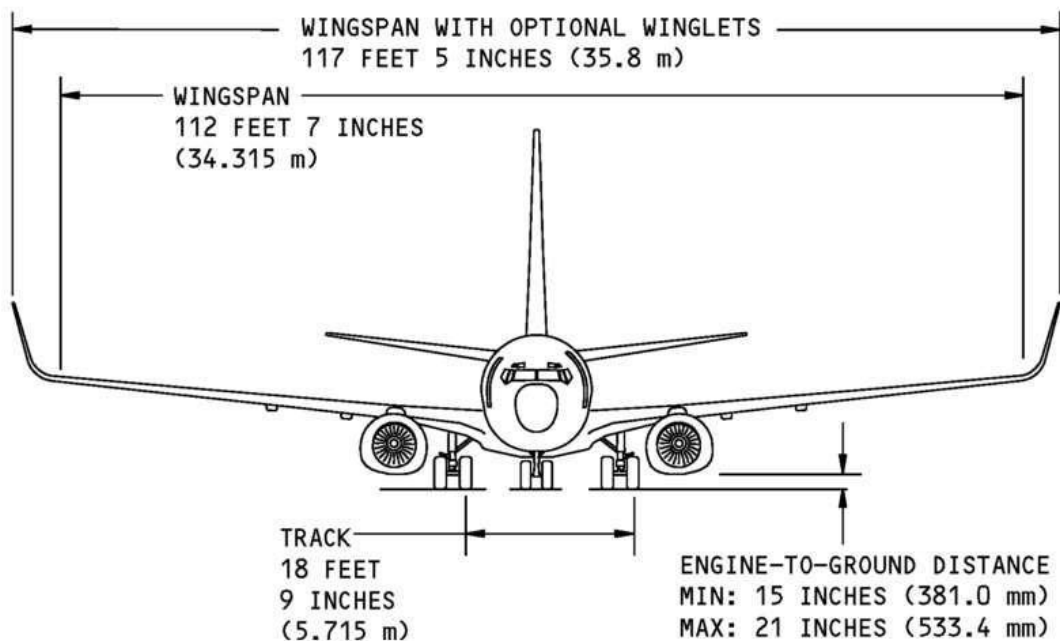
1.6 Aircraft Information:

Boeing 737-800 is a Twin engine aircraft fitted with CFM 56-7B Engine and is manufactured by CFM. This aircraft is certified in Normal category, for day and night operation under VFR & IFR. The maximum operating altitude is 41000 feet and maximum takeoff weight is 79,015 Kgs. Aircraft length is 39.472meters, wingspan is 35.8 meters and height of this aircraft is 12.459meters. This airplane is certificated in the Transport Category, FAR Part 25 and Part 36.



Construction:

The airframe structure is fabricated, in general, of high-strength aluminium alloys. Steel, titanium, and other FAA approved materials are also used where required. Magnesium alloy is not used in primary or secondary structural application. 7079 Aluminium alloy is not used in any structural applications. Aluminium alloy sheet stock are clad for gages less than 0.063 inch thick.



The fuselage has three sections:

Flight compartment

Passenger compartment

Aft fuselage, which supports the stabilizers

The wing centre section is enclosed by the main fuselage section and is permanently attached to it.

The fuselage is a semi-monocoque structure with zee-type frames and skin stiffened with hat-type stiffeners. The fuselage skin panels are made of longitudinal stiffeners mechanically fastened to sheets or plates. Circumferential tear straps and doublers are used where necessary.

A nacelle encloses each engine. A strut attached to the wing holds the engine and nacelle. A firewall made of corrosion-resistant steel or titanium alloy isolates each nacelle from its strut.

Wings

The wing is made into one piece which extends through the fuselage. The wing to body attachment is permanent. The primary wing structure is an aluminium alloy skin stiffened by stringers made of extruded aluminium alloy. The spars primarily carry the shear loads. The skin and stringers carry most of the bending loads. The wing is also an integral fuel tank.

The trailing edge ribs are made of aluminium alloy. The upper surface is made of an aluminium alloy skin and reinforced honeycomb sandwich of fibre glass and graphite. The lower surface is made of an aluminium alloy skin with a reinforced honeycomb sandwich of aramid/graphite and fiberglass/graphite. There is access to inside of the trailing edge for inspection, maintenance, and repair.

The fixed structure of the leading edge is made of aluminium alloy, fiberglass, or composite fibreglass and aramid, as necessary.

One winglet is installed for each wing. The wing tips consist of upward sweeping winglets. These winglets enhance airplane performance for some operations. The winglets are removable.

Aircraft VT-JFA (MSN 38029) had been manufactured in year 18 July 2012. The aircraft was registered with DGCA under the ownership of M/s Celestial Aviation Trading 71 Limited. The aircraft is registered under Category 'A' and the Certificate of registration No. 4345.

The Certificate of Airworthiness Number 6454 under "Normal category" subdivision Passenger / Mail / Goods was issued by DGCA on 19.07.2012. The specified minimum operating crew is two and the maximum all up weight is 79,015 Kgs. At the time of incident the Certificate of Airworthiness was current and valid up to 24 July 2017.

The Aircraft was holding a valid Aero Mobile License No A-006/WRLO-12 at the time of incident. This Aircraft was operated under Scheduled Operator's Permit No 064 which was valid up to 12.02.2018. As on 18th August 2015 the aircraft had logged 12866:52 Airframe Hours and 7085 cycles.

The aircraft and its Engines are being maintained as per the maintenance program consisting of calendar period/ flying Hours or Cycles based maintenance as per maintenance program approved by Regional Airworthiness office, Mumbai.

Accordingly, the last major inspection A2 (1000 FH) check carried out at 7071 cycles on 15.08.2015. Subsequently all mandatory lower inspections were carried out as and when due before the incident.

The aircraft was last weighed on 10.07.2012 at Mumbai and the weight schedule was prepared and duly approved by the office of Director of Airworthiness, DGCA, Mumbai. As per the approved weight schedule the Empty weight of the aircraft is 41482.00 Kgs and operating Empty weight of the aircraft is 42452.00 Kgs.

Maximum Usable fuel Quantity is 20446 Kgs. Maximum payload with fuel tanks full is 16117 Kgs. Empty weight CG is 16.71 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 9th July 2017. Prior to the incident flight, the weight and balance of the aircraft was well within the operating limits.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine has been complied with as on the date of event.

Transit Inspections are carried out as per approved Transit Inspection schedules and all the higher inspection schedules including checks A1 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 on 22nd April 2015 at Delhi by using FUELSTAT RESINAE kit as per Task Card JPL-28-INSP-001-00 and the colony count was within acceptable limits.

The left Engine S/N 960994 had logged 12839 and 7071 cycles and the right Engine S/N 960351 had logged 16062 Hrs. and 6934 cycles. There was no defect report on the engine on the previous flight.

1.7 Meteorological information

On 17.08.2015, aircraft departed Doha at 1937 UTC and schedule time of arrival Cochin was 0010 UTC on 18 Aug 2015. Weather reported before departure at Doha:

	Time (UTC)	Visibility (m)	Winds (Kts)	Clouds
Destination (Cochin)	0900	4000	300/05	SCT 015 BKN 090
Alternate (Bangalore)	0900	8000	290/10	SCT 012 SCT 080
Diversion (Trivandrum)	0900	4000	270/05	SCT 015 BKN 090

Actual weather at the time of landing in Cochin.

	Time (UTC)	Visibility (m)	Winds (kts)	Clouds	Trend
Destination (Cochin)	2300	3500	000/00	FEW 015 SCT 080	BECMG 3000 BR
	0000	3000	000/00	SCT 006 SCT 015	BECMG 2000 BR
	0030	2000	000/00	SCT 006 SCT 015	BECMG 1500 BR
	0100	1800	000/00	BKN 004 SCT 015	NOSIG

Actual weather at the time of landing in Trivandrum

	Time (UTC)	Visibility (m)	Winds (kts)	Clouds
Alternate (Trivandrum)	0100	2000	290/03	SCT 015 SCT 025

1.8 Aids to navigation

At Trivandrum airport only one runway is available orientation of which is 14/32. ILS approach is only available on Runway 32 and for runway 14 only VOR DME approach is available. PAPI is available for both sides of all the runways. The B737-800 (NG) family of aircraft is fitted with all modern navigational equipment including the DME and ILS systems.

1.9 Communications

There was always two way communications between the cockpit crew and ATC Cochin and subsequently with ATC Trivandrum.

1.10 Aerodrome information

Cochin Aerodrome information

ICAO :VOCI

Co-ordinates

ARP : 100914 N 0762425 E

Elevation : 30 Ft.

Runway Orientation and dimension

Orientation- 09/27 Dimension – 3400m x 45m

R/W & Taxi Tracks Markings Standard as per Annex- 14

Approach and Runway Lighting:

RWY	APCH LGT TYPE LEN INTST	THR LGT COLO UR WBA R	VASIS (MEHT) PAPI	TDZ , LGT LEN	RWY centre line LGT Length, spacing, colour and intensity	RWY edge LGT Length, spacing, colour and intensity
09	SALS420 M,High Var.	Green	PAPI,LEF T 3°	NIL	3400M30M	3400M,60M,W HITE,HIRL
27	CAT1,90 0M,High Var.	Green	PAPI,LEF T 3° 20.317 M	NIL	3400M30M	3400M,60M,W HITE,HIRL

Met Services

MET services are available at the airport. TAF, Trend Forecast and Briefing is available.

Navigation and Landing Aids

PAPI, DVOR, DME and ILS systems are available.

Only manual RVR is available on the aerodrome.

ATS Communication Facilities

Service designation	Call sign	Frequency	Hours of operation	Remarks
APP	Cochin Approach	119.75 MHZ	H24	Emergency 121.50MHz with and TWR , APP and SMC
TWR	Cochin Tower	118.8 MHZ	H24	Emergency 121.50MHz with and TWR , APP and SMC
ATIS	Cochin Information	126.2 MHZ	H24	
SMC	Cochin Ground	121.75 MHZ	H24	.

RFSS (Rescue & Firefighting Services) Category 9

Trivandrum Aerodrome Information

ICAO :VOTV

Co-ordinates

ARP : 082847N 0765511E

Elevation : 15 Ft.

Runway Orientation and dimension

Orientation- 14/32 Dimension – 3398m x 45m

R/W & Taxi Tracks Markings Standard as per Annex- 14

Approach and Runway Lighting:

RWY	APCH LGT TYPE LEN INTST	THR LGT COLOUR WBAR	VASIS (MEHT) PAPI	TDZ, LGT LEN	RWY centre line LGT Length, spacing, colour and intensity	RWY edge LGT Length, spacing, colour and intensity
14	SALS 420M	Green	PAPI Left/3° 19.04M	----	----	3218M 60M white, LIH
32	CAT I SALS 540M HIL 3BARS	Green	PAPI Left/3° 20.76M	----	----	3218M 60M white, LIH

Met Services

MET services are available at the airport. TAF, Trend Forecast and Briefing is available.

Navigation and Landing Aids

PAPI, DVOR, DME and ILS systems are available.

Only manual RVR is available on the aerodrome.

ATS Communication Facilities

Call sign	Frequency
Thiruvananthapuram Radar	119.6 MHZ
Thiruvananthapuram Approach	119.6 MHZ
Thiruvananthapuram Tower	118.1 MHZ
Thiruvananthapuram Information	126.6 MHZ
EMERGENCY	121.5 MHZ
Thiruvananthapuram Radar	120.9 MHZ 125.95 MHZ
Thiruvananthapuram Ground	121.9 MHZ

RFSS (Rescue & Firefighting Services) Category 9

NOTAM was issued by Trivandrum ATC that "ILS 32 NOT AVBL DUE EQPT REPLACEMENT from 17th Aug 2015 till 24th Aug 2015."

1.11 Flight recorders:

The aircraft was fitted with Solid state Cockpit Voice Recorder having part No. 2100-1025-22 and Serial No. 000729096 and Digital Flight Data Recorder having part No. 2100-4045-22 and Serial No. 000820570 and Digital Flight Data Recorder

1.11.1 Cockpit Voice Recorder:

The CVR was removed at Trivandrum for investigation. During analysis it was observed that 02 hrs of recording was available which starts at time 00:04:40 UTC, when the first go around at Cochin had already taken place and both the crew are discussing about the alternate aerodrome. The First officer informed PIC that Bangalore is given as alternate destination, Coimbatore as second alternate destination and Trivandrum is not given as an alternate. The First officer also informed the PIC that Trivandrum is a VOR approach as ILS is unserviceable. However PIC mentions that visibility reported at Trivandrum is 3000 m, which is okay. At 00:12:41 UTC Cochin ATC advised that visibility has dropped now to 2500 m and at time 00:13:37 UTC cleared 9W-555 for second approach and landing. However 9W-555 was unable to sight the runway and initiated 2nd Go around. Thereafter at time 00:20:06 9W-555 informed ATC that they are re-designating Trivandrum as alternate. The PIC discusses with First officer that by re-designating Trivandrum as alternate, they will have about 20 minutes holding fuel and by that time hopefully the weather will improve for landing, also as the sun is coming up in another 10 mins. At time 00:30:52, Cochin ATC broadcasted that at Trivandrum visibility 3000 m and clouds 1500 ft. After 33 minutes of 2nd go around, the crew of 9W-555 initiated third approach for Rwy 27, however were not able to sight the Runway and initiated 3rd Go-Around at 00:50 UTC. Thereafter, Cochin ATC vectored 9W-555 for Trivandrum.

9W-555 came in contact with Trivandrum ATC at 01:02 UTC and the latest weather was obtained visibility as 1500 m. At time 01:04:32 UTC, PIC requested information from Trivandrum ATC for High intensity approach lights on runway 14 as they would like to use CMV as they were Minimum on Fuel. At time 01:04:42 UTC, ATC informed that only Simple approach lighting system with high intensity is available and also advised 9W-555 to descent to FL110. At time 01:09:09 UTC, 9W-555 informed ATC that they are high on approach and would like to have 360 orbit to the right. AT 01:17:29 UTC, ATC cleared 9W-555 for VOR approach landing Rwy 14. At time 01:19:48 UTC, 9W-555 executed go around and 40 seconds later at time 01:20:38 UTC declared MAY DAY due fuel. Thereafter 9W-555 informs ATC of their intentions of carrying out the visual approach circuit for runway 14. ATC cleared 9W-555 for visual approach runway 14, however the flight crew was not able to sight the runway and executes go-around at 01:26 UTC. The PIC again asked ATC for visual approach for runway 14, ATC at time 1:33:34 UTC cleared Jet 9W-555 for runway 14 with wind 230/03 Kts. The crew again initiates go-around and request ATC to take left 180 degrees turn and self-position for landing inbound on runway 32. At time 1:37:14 UTC ATC cleared Jet 9W-555 for runway 32 wind 230 degrees 04 knots. Thereafter EGPWS caution is activated in the cockpit for caution terrain however crew responds terrain visuals. Later EGPWS pull up warnings are activated and the PIC says terrain is visual. The first officer asked PIC at time 1:38:06 UTC "do you know where it is" and PIC mentions that "just going blindly", thereafter autopilot disconnect noise is recorded and the bank angle alert is also heard and subsequently the aircraft lands on the runway.

1.11.2 DFDR

TIME (UTC)	Place	Go Around	Fuel on Board (Kg)	Altitude (ft)	Vref	CAS	GPWS Warning
2358	Cochin	1 st Go Around	4699	256	145	150	Nil
0017		2 nd Go Around	3919	256	144	150	

0050		3 rd Go Around	2644	288	142	148	
0119	Trivandrum	4 th Go Around	1324	603	141	148	
0127		5 th Go Around	898	586	141	152	
0132		6 th Go Around	662	39	141	149	
0137		-	-	538	141	145	TERRAIN
0137		-	-	535	141	145	PULL UP
0139		Landing	349	-			-

1.12 Wreckage and impact information :

There was no damage to the aircraft.

1.13 Medical and pathological Information:

As per the existing Civil Aviation Requirements the pre-flight medical is not carried out at foreign station; however a post flight Breath Analyser (BA) check is carried out at the final destination. The crew had not undergone pre-flight medical check at Doha and the same was not carried out at Trivandrum after the incident. After the aircraft had flown back to Cochin the post flight BA test was carried out, which was negative.

1.14 Fire

There was no fire.

1.15 Survival aspects

The incident was survival.

1.16 Tests and research : Nil

1.17 Organizational and management information:

M/s Jet Airways (India) Ltd. is a Scheduled Airline having DGCA SOP No. S-6A in Category Passenger and Cargo. The Airline Head Quarter is located at Mumbai. The Air operator permit of the Airline is valid till 12/02/2018. The airline commenced its commenced operations on 5th May 1993.

The Company is headed by CEO assisted by a leadership team of professional of various departments. The Flight Safety Department is headed by Chief of Flight Safety approved by DGCA. The Chief of Safety is a Senior Vice President in the company who reports directly to the Chairman

The airlines operates a fleet of aircraft, which includes 04 Boeing 777-300 ER aircraft, 08 Airbus A330-200 aircraft, 68 next generation Boeing 737-700/800/900 aircraft and 18 ATR 72-212A turboprop aircraft. M/s Jet Airways operates 68 destinations (47 Domestic + 21 international) and having approx 13900 employees.

M/s Jet Airways has a full established Operations training facility for the pilots. The training facility for the Airbus pilots is set up at Bangalore and for the Boeing pilots in Mumbai. Both the training facilities are headed by the Vice President Training who reports to CEO directly. The Engineering training facility for the maintenance of the aircraft is established at Mumbai and Delhi.

1.18 Additional information

1.18.1 Fuel Policy of Jet Airways:

Jet Airways fuel policy is in compliance with DGCA CAR Section 8, Series O, Part II para 4.3.6. This is documented in Jet Airways Operation Manual Part A, Chapter 12.

The fuel policy of M/s Jet Airways for B737 with Destination Alternate is defined as:

- a) **Taxi out Fuel:** 180 kg @ 12 kg/min (Typically 15 min taxi-out fuel would be catered in the system. However, this can be changed by Flight Dispatch based on historical data).

- b) **Trip Fuel:** Starts from Brake Release followed by Climb, Cruise. Descent till 1500 ft AGL over destination and approach and land (240 kgs) Trip fuel calculations from Departure to Destination are at Advisory Cost Index or at constant Mach No, as appropriate. These calculations also include SID and STAR, if applicable.
- c) **Contingency Fuel:** 5% of Trip Fuel for Computerised Flight Plan (10% of Trip Fuel in case of manual flight plan) or of the fuel required from the point of in-flight re-planning based on the consumption rate used to plan the trip fuel but in any case shall not be lower than the amount required to fly for five minutes at holding speed at 450 m (1500 ft) above the destination aerodrome in standard conditions.
- d) **Alternate Fuel:** Missed approach fuel till 1500 ft AGL over destination (130 kg) followed by climb, cruise, descent till 1500 ft AGL over alternate and approach and land (240 kgs). These calculations also include STAR, if applicable. Alternate fuel calculations are at Cost Index or at Max Range Cruise (MRC).
- e) **Final Reserve Fuel:** 30 min holding at 1500 ft AGL over alternate (1400 kgs for manual flight plan).
- f) **APU Fuel** (1 hour): 105 kgs.

1.18.2 Fuel Planning for the sector DOH-COI:

The flight dispatch taking into consideration the fuel policy stated above, expected weather, expected delays, and other pertinent information about destination and alternate airports had carried out the fuel planning for 9W-555.

9W555 was dispatched with a total of 16100 Kgs. The minimum legally required fuel for the flight was 15295 Kgs. In case of 9W555 the Advisory hold fuel was 00:19 minutes (750 Kgs)

Departure fuel was 16,100kgs which included advisory extra holding fuel at Cochin of 750 kgs which gives 19 min holding fuel.

Following is the detailed breakup of fuel summary uplifted from Doha.

<i>Fuel Component</i>	<i>Quantity</i>	<i>Time</i>
<i>Taxi</i>	216 Kgs	00:18
<i>Trip</i>	11112Kgs	04:07
<i>Contingency</i>	556Kgs	00:14
<i>Alternate – VOBL</i>	2178Kgs	00:44
<i>Final Reserve</i>	1128Kgs	00:30
<i>APU</i>	105Kgs	
<i>Min Fuel Required</i>	15295Kgs	05:53
<i>Advisory Hold Over Destination</i>	750Kgs	00:19
<i>Round Off Extra</i>	55Kgs	
<i>Total Fuel</i>	16100Kgs	06:13
<i>Fuel Over Destination</i>	4772Kgs	
<i>Minimum Take-Off Fuel</i>	15079Kgs	
<i>Actual Departure Fuel</i>	16100Kgs	06:13

1.18.3 Low Fuel State

M/s Jet Airways Operational Manual defines the process of coordinated escalation process with ATC for protection of final reserve fuel in case of fuel emergency. The escalation process is define in three steps.

1) **Step 1:** The PIC shall request delay information from ATC when unanticipated circumstances may start leading to a situation of calculated on-board fuel on landing at the destination aerodrome less than Minimum Diversion Fuel (MDF) i.e. sum of the final reserve fuel plus any fuel required to proceed to an alternate aerodrome.

Note: It is also considered when approaching the MDF, ATC should be informed regarding fuel / flight time to make good a landing else divert to alternate.

2) **Step 2** : The PIC shall advise ATC of a minimum fuel state by declaring minimum fuel when, having committed to land at a specific aerodrome, the pilot calculates that any change to the existing clearance to that aerodrome may result in landing with less than planned final reserve fuel.

Note: The declaration of minimum fuel informs ATC that all planned aerodrome options have been reduced to a specific aerodrome of intended landing and any change to the existing clearance may result in landing with less than planned final reserve fuel. This is not an emergency situation but an indication that an emergency situation is possible should any additional delay occur.

3) **Step 3**: The PIC shall declare a situation of fuel emergency by broadcasting MAYDAY, MAYDAY, MAYDAY, FUEL. When the calculated usable fuel predicted to be available upon landing at the nearest aerodrome where a safe landing can be made is less than the planned final reserve fuel.

Note: If the aircraft lands with less Than Final Reserve Fuel, a FSR must be filed.

1.18.4 CONVERSION OF REPORTED METEOROLOGICAL VISIBILITY (CMV) TO RVR

In accordance with DGCA CAR section 8, series F part I para 4.9, M/s Jet Airways Operation Manual defines the CMV which shall not be used as planning tool for dispatch of a flight; it shall only be used by Flight crew during in-flight.

In case when RVR is not reported, a pilot shall derive RVR/CMV (equivalent to an RVR) by using the following conversion table depending upon the type of approach lighting and day/night conditions. The RVR/CMV derived will be used by the Flight Crew to commence or continue an approach to the applicable Decision Altitude/Minimum Decision Altitude.

The availability / serviceability of runway lighting facilities will be checked from airport or from the concerned ATC Tower. The minimum length of approach lights for application of CMV is 420 m. The CMV table shall not be used for the following:

- a) for calculating take-off minima. or
- b) for calculating any other required RVR minimum below 800 m. or
- c) for visual approach / circling approach. or
- d) when reported RVR is available.

If the RVR is reported as being above the maximum value assessed by the aerodrome operator. e.g. 'RVR more than 1500 meters it is not considered to be a reported RVR in this context and the conversion table may be used.

In case of international airfields CMV can only be used provided that State authorise application of CMV. This information is published in the Jeppesen Text: Section - ATC country specific pages or Aeronautical Information Publication (AIP) of the State.

Conversion of Meteorological visibility to RVR:

RVR / CMV = Reported Meteorological Visibility x Factor		
Lighting Elements in Operation	Factor	
	Day	Night
HI approach and runway lighting	1.5	2.0
Any type of lighting installation other than above	1.0	1.5
No lighting	1.0	Not applicable

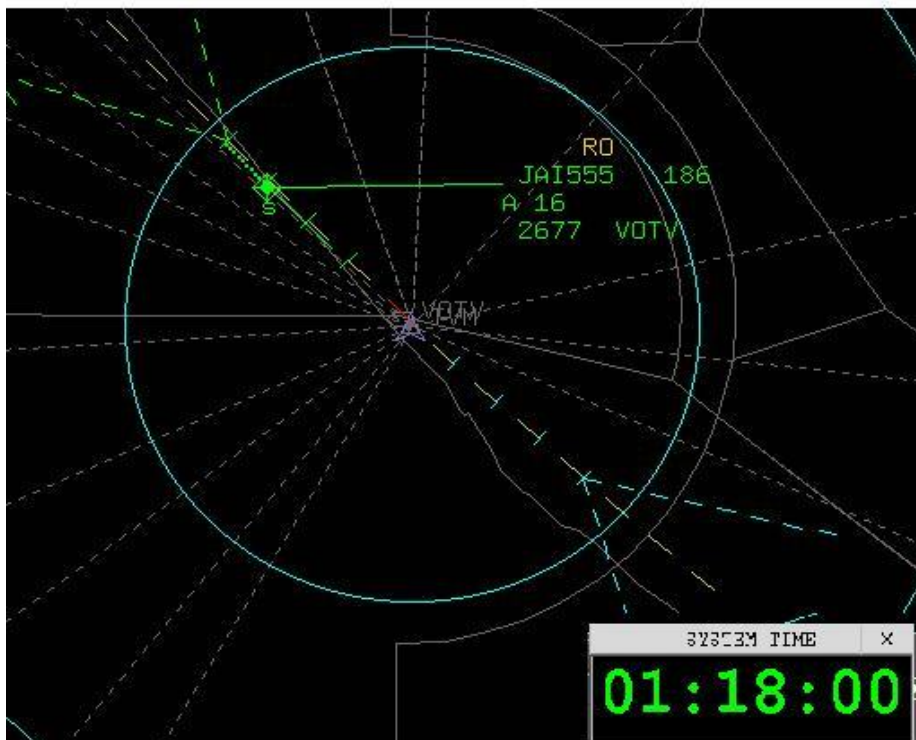
1.18.6 Alternate Airport Requirement

Jet Airways Operation Manual Part A, Chapter 7, specifies the requirements for the nomination of Alternate Airports. As the weather condition at expected time of arrival at destination were forecasted to be above the landing minima, only one destination alternate airport was required to be nominated.

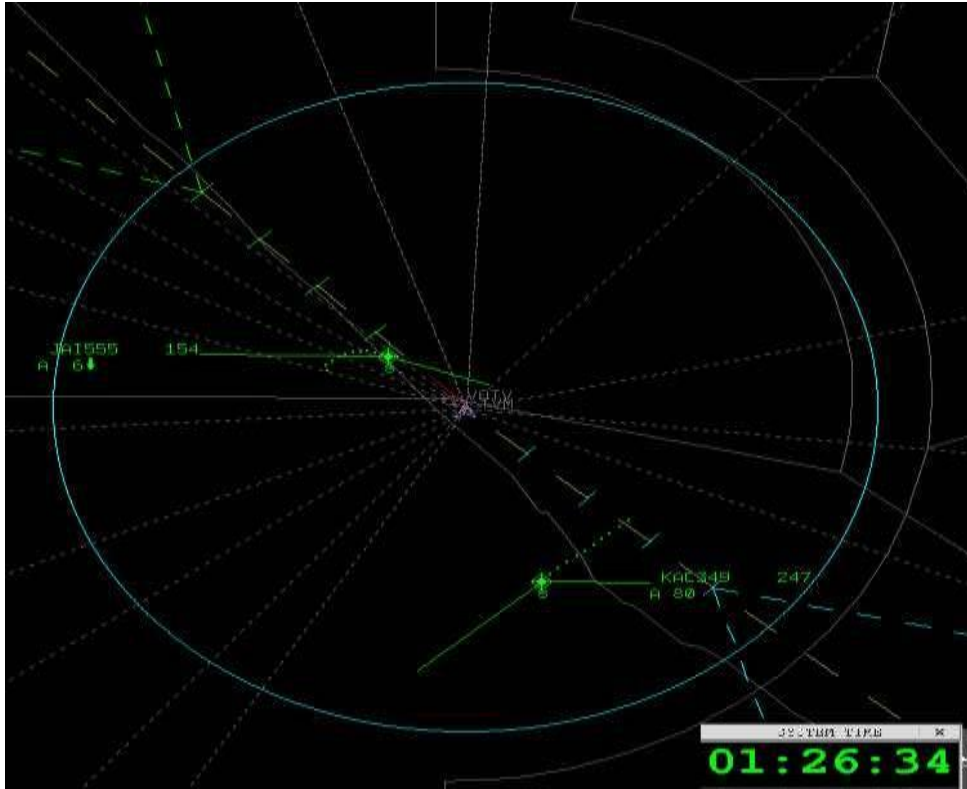
The nominated Alternate Airport also fulfilled the criteria specified in Operations Manual Part A, Chapter 7 for Destination Alternate Aerodromes. As per Jet Airways operational manual, there is no provision of re-designating an alternate aerodrome in flight.

1.18.7 ATC Radar Plots of Trivandrum Aerodrome

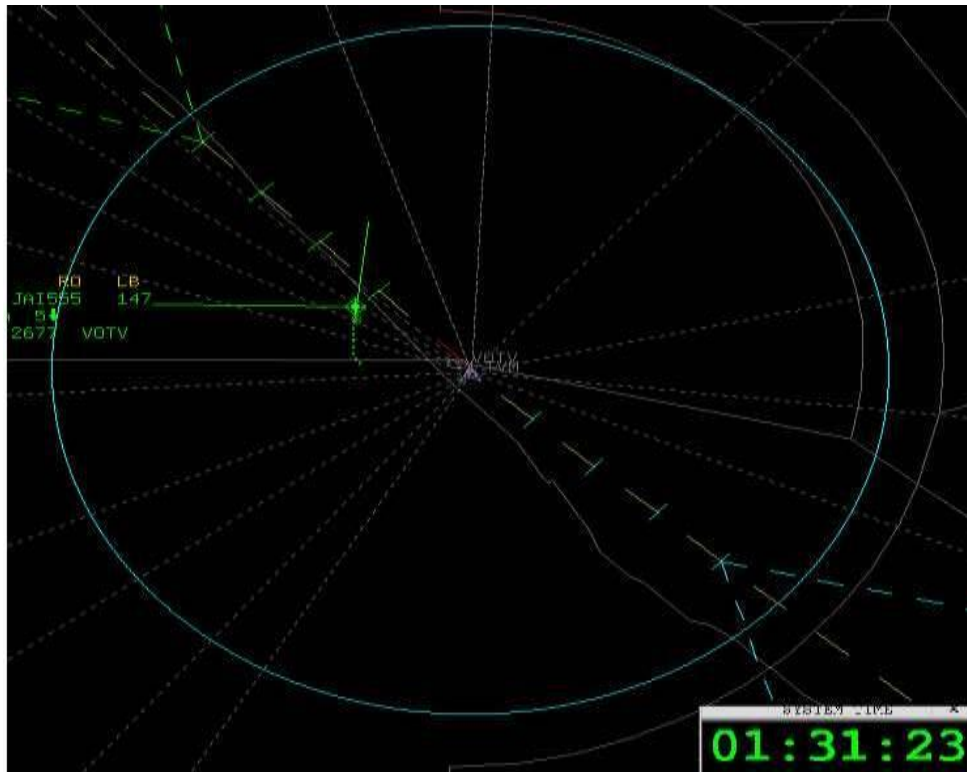
The radar pictures at Trivandrum ATC were analysed and all the 03 approaches made by 9W-555 at Trivandrum for runway 14 and 01 approach made for runway 32 were captured and analysed.



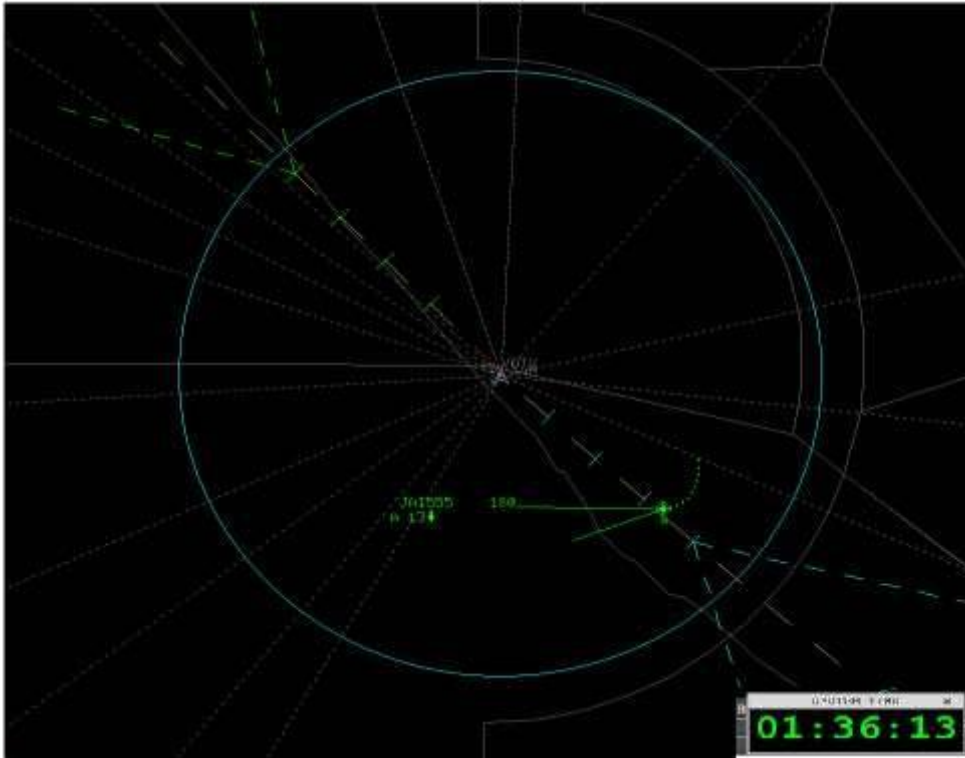
1st VOR approach on Runway 14 at Trivandrum



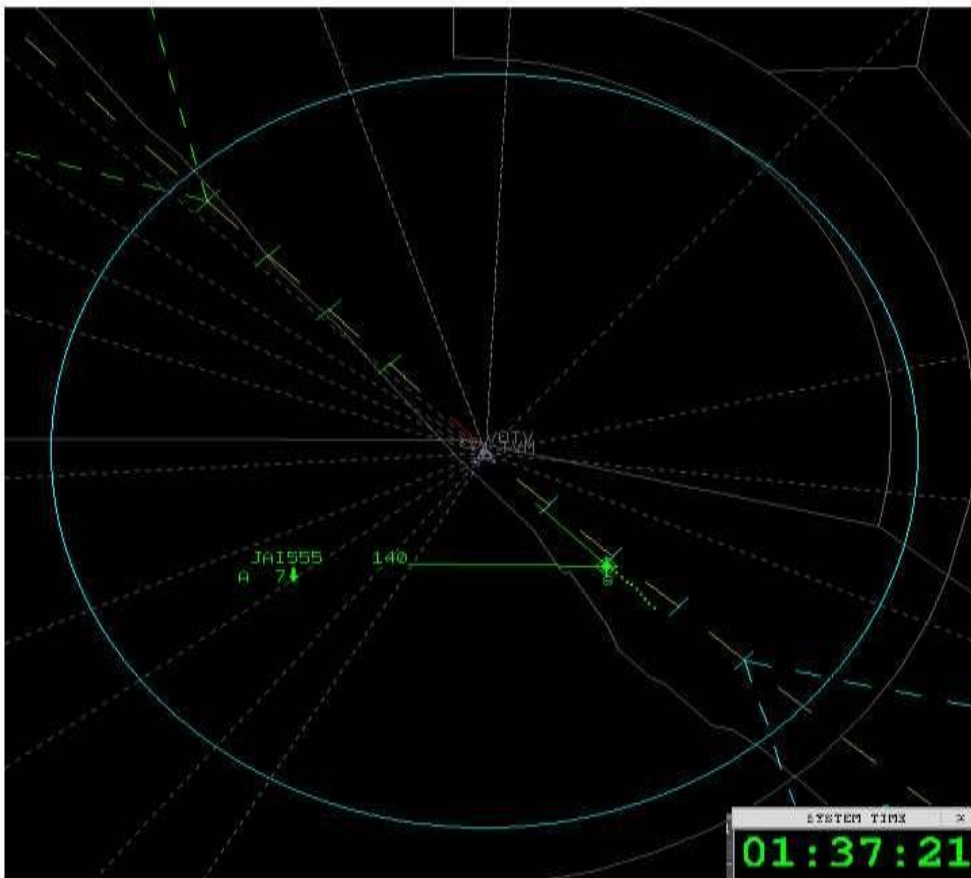
Aircraft turning right with less than 02 nm to make 2nd visual approach on runway 14 without the runway being in visual contact and thereby being unstabilized.



Aircraft turning right at around 02 nm to make 3rd visual approach on runway 14 without the runway being in visual contact and thereby being unstabilized



After 3^d go-around aircraft takes 360^o to self-positioned for runway 32



On 4th approach PIC sights the runway 32 below 500 ft for landing without being in prior visual contact with the runway.

1.18.8 Co-ordination between Trivandrum and Cochin ATC

The ATC tape transcript of Trivandrum and the Direct Speech Circuit (DSC) between Cochin and Trivandrum was replayed for investigation. As per the DSC replay, at time 00:29:15 UTC, ATC Cochin informed Trivandrum that three aircraft are holding overhead Cochin for weather improvement and are most likely to divert to Trivandrum. At time 00:29:23 UTC, Trivandrum ATC informed Cochin that current prevailing visibility is 3000 m. Further at 00:33:07, Trivandrum ATC confirmed Cochin to accept the diversions for Trivandrum. At time 00:37:03 UTC, Cochin ATC informed Trivandrum that visibility at Cochin is now 2000 m and trend is one thousand five hundred meters. At time 00:46:24 UTC, Cochin ATC informed Trivandrum that 9W-555 is likely to divert to Trivandrum. At time 00:53:37 UTC, Cochin ATC informed Trivandrum that 9W-555 has diverted and set course to Trivandrum. At time 00:56:39 UTC, ATC Trivandrum informed Cochin that visibility has now dropped to 2500 m and trend is reducing. At time 00:59:42 UTC, ATC Trivandrum updated Cochin that visibility is 1500 m now and informed Cochin to advise Jet Airways accordingly. The same was acknowledged by Cochin ATC.

At time 01:00:27 UTC, Trivandrum ATC asked Cochin whether he has advised about the latest weather to the diverting aircrafts.

At time 01:01:44 UTC, 9W-555 came in contact with Trivandrum ATC and . At time 01:02:49 UTC, Trivandrum ATC informed Cochin that for runway 14 approach minima is 2100 m and the present visibility is 1500 m and for runway 32 approach 2500 m and informed Cochin ATC to advise diverting aircraft that now they have to decide whether to hold at Trivandrum or back to Cochin. At time 01:05:10 UTC, Trivandrum ATC informed Cochin that still visibility is 1500 m and trend is 2000 m.

1.19 Useful or effective investigation techniques: NIL

2. ANALYSIS

2.1 Serviceability of the aircraft:

Aircraft VT-JFA (MSN 38029) had been manufactured in year 2012. The aircraft was registered with DGCA under the ownership of M/s Celestial Aviation Trading 71 Limited. At the time of incident the Certificate of Airworthiness and flight release prior to flight was current and was valid. On the day of incident, the aircraft VT-JFA had logged 12866:52 Airframe Hours and 7085 cycles. This Aircraft was operated under Scheduled Operator's Permit No 064 which was valid up to 12.02.2018.

The aircraft and Engines were being maintained under continuous maintenance as per maintenance program consisting of calendar period based maintenance and flying Hours/ Cycles based maintenance as per maintenance program approved by O/o Deputy Director General, DGCA, Mumbai. Accordingly, the last major inspection A2 (1000 FH) check carried out at 7071 cycles on 15.08.2015. Subsequently all mandatory lower inspections were carried out as and when due before the incident.

The left Engine S/N 960994 had logged 12839 and 7071 cycles and the right Engine S/N 960351 had logged 16062 Hrs. and 6934 cycles. There was no defect report on the engine on the previous flight.

All the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine has been complied with as on date of event. The defect record of the aircraft were scrutinised for a period of one month prior to the date of occurrence of the serious incident and no defect was found pending on the aircraft. Prior to the incident flight the weight and balance of the aircraft was well within the operating limits.

From the above it is inferred that the serviceability of the aircraft is not a factor to the incident.

2.2 Fuel Planning

The Jet Airways fuel policy is in compliance with DGCA CAR Section 8, Series O, Part II para 4.3.6 and the same is also documented in Jet Airways Operation Manual Part A, Chapter 12. The Fuel upliftment for the sector is calculated by central flight dispatch at Mumbai taking into consideration the fuel policy, expected weather, expected delays, and other pertinent information about destination and alternate airports. Considering the fuel policy the minimum legally required fuel for the flight was 15295Kg however 9W-555 was dispatched with a total of 16100Kg with the advisory hold fuel was 00:19 minutes (750 Kgs).

From the above it is inferred that the fuel planning for the flight was not a factor to the incident.

2.3 Weather

After the 9W-555 came in contact with Cochin ATC the weather reported by ATC at 2300 UTC was visibility 3500 meter haze, few clouds at 1500 ft and scattered cloud at 8000 ft. The visibility requirement for landing on ILS runway 27 was RVR 650m and the DA was 320 feet. The flight was uneventful until top of descent into Cochin. However during approach the crew was not able to make visual contact with the runway due to low clouds and initiated a go-around.

Subsequent to the first Go-Around the ATC broadcasted that the visibility has dropped to 2500m. The PIC attempted second approach on runway 27 and again on reaching DA did not sight the Runway and executed 2nd go-around. Immediately thereafter, Cochin ATC broadcasted latest visibility as 2000m, with low clouds and trend is reducing visibility.

After 33 minutes of 2nd go around, 9W-555 initiated third approach; the ATC gave weather updates to 9W-555 as visibility reducing to 1500m in mist and low clouds at 400 feet. And again on third approach the PIC was not able to sight the runway at DA and carried out the 3rd Go-Around and diverted to Trivandrum.

After carrying out the 2nd Go-Around at Cochin at 0017 UTC the PIC re-designated his alternate destination as Trivandrum as the reported visibility was 3000 meters at Trivandrum. However after diversion when 9W-555 came in contact with Trivandrum ATC at 01:02 UTC the visibility at Trivandrum had dropped to 1500 meter.

Trivandrum ATC cleared the aircraft 9W-555 for VOR approach landing Rwy 14 with visibility reported as 2000 metres. The crew of 9W-555 made 03 attempts on runway 14 however could not sight the runway at DA on all the three attempts due to low clouds in the approach path. The aircraft finally landed on runway 32 on the fourth attempt.

From the above it is inferred that weather was the contributory factor affecting the PIC decision which eventually resulted into fuel emergency at Trivandrum.

2.4 Pilot Decision making and situational assessment:

On 17/08/2015, M/s Jet Airways, Boeing 737-800 aircraft VT-JFA was scheduled to operate flight 9W-555 (Doha-Cochin). Both the operating crew had rested prior to operating the flight.

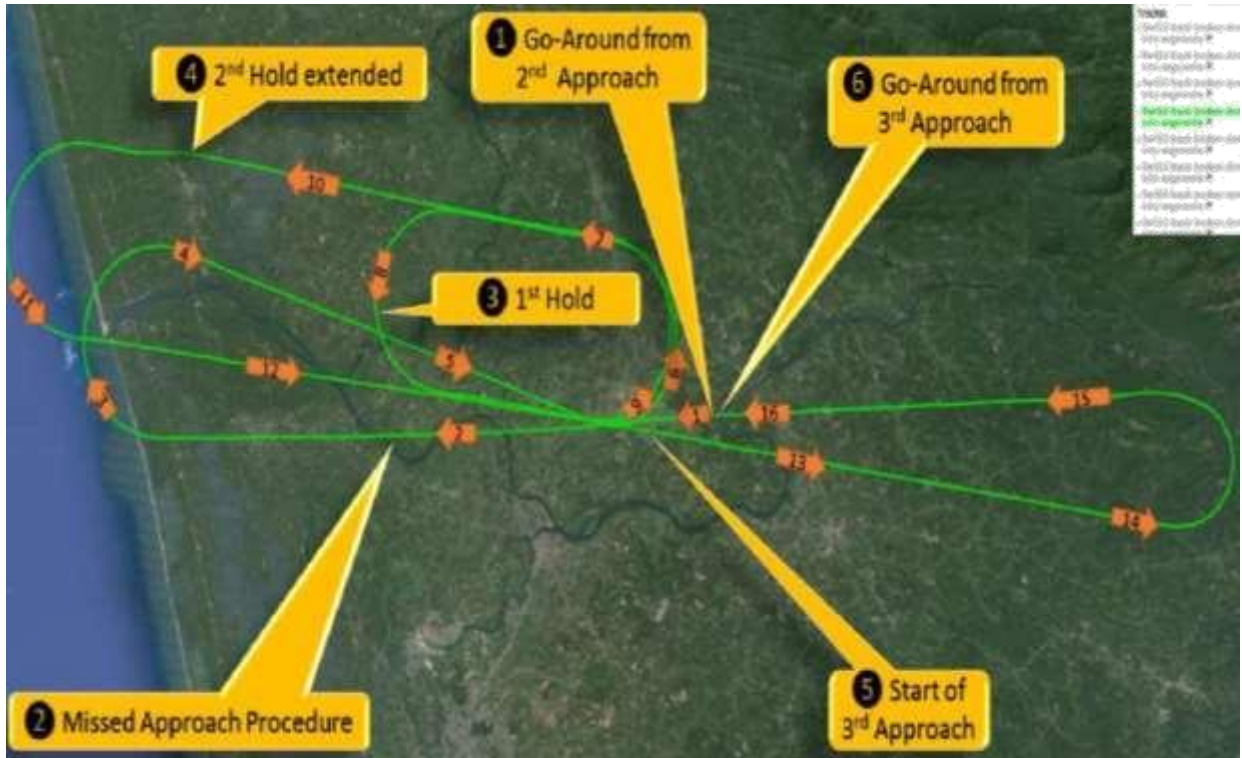
The flight departed Doha at 1940 UTC. The flight was uneventful until top of descent into Cochin and arrived overhead Cochin at 2348 UTC. ATC cleared the flight for ILS approach Rwy 27. The weather reported by ATC Cochin at the time of landing was visibility 3500 meter, haze. The visibility requirement for Rwy 27 was RVR 650m. During approach, crew was not able to make visual contact with the runway due to low clouds and carried out a go-around at around DA.

Thereafter the PIC followed the missed approach procedure and joined the holding pattern to attempt the second approach. The crew discussed the alternate destination fuel requirements for Coimbatore and Trivandrum. The F/O informed the PIC regarding the NOTAM that at Trivandrum only VOR Approach is available as ILS is unavailable.

While 9W-555 was heading to overhead Cochin to proceed outbound for making second approach, Air India Express flight 474 which was ahead of 9W-555 executed a go-around and reported low clouds at 600 feet. Thereafter ATC advised 9W-555 that the visibility has dropped to 2500 meters. However the PIC of 9W-555 still continued the approach, and again on reaching DA did not sight the Runway and executed 2nd go-around. The fuel on board after the 2nd go-around was 3919 Kgs and was above MDF for alternate destination i.e. Bangalore of 3306 Kgs however the PIC re-designated alternate destination in order to make 3rd approach at Cochin. The decision of PIC to re-designate Trivandrum as alternate Aerodrome may have been influenced by the departing Kuwaiti 352 aircraft informing Cochin ATC that on line-up there was a small patch of cloud touching the ground but visibility was around 3 Kms and also ATC Cochin had broadcasted that Trivandrum visibility is 3000 m and clouds at 1500 feet.

The F/O had expressed concern about the possibility of visibility dropping further due Haze at Trivandrum, however the PIC took the decision of re-designation Trivandrum as alternate destination. Cochin ATC had informed 9W-555 of reducing trends in visibility to 1500 m in mist and low clouds now at 400 feet, however the PIC informed ATC his intentions for 3rd approach even though the weather had further deteriorated.

After 33 minutes of 2nd go around, 9W-555 made 3rd approach for Rwy 27 however at DA as Runway could not be sighted and initiated the 3rd go-around. After making three unsuccessful landings attempts at Cochin, the fuel on board was just above the MDF Trivandrum, the PIC of 9W-555 diverted to Trivandrum.



At 0100 UTC, Cochin ATC advises 9W555 that as per latest information from Trivandrum, visibility is 2500m. At 0102 UTC 9W-555 contacted Trivandrum ATC and on initial contact with Trivandrum ATC, informed that the latest visibility at Trivandrum is 1500 m and to expect R/W 14 for arrival as RVR of Rwy 14 was 2100 metres and was less than Rwy 32.

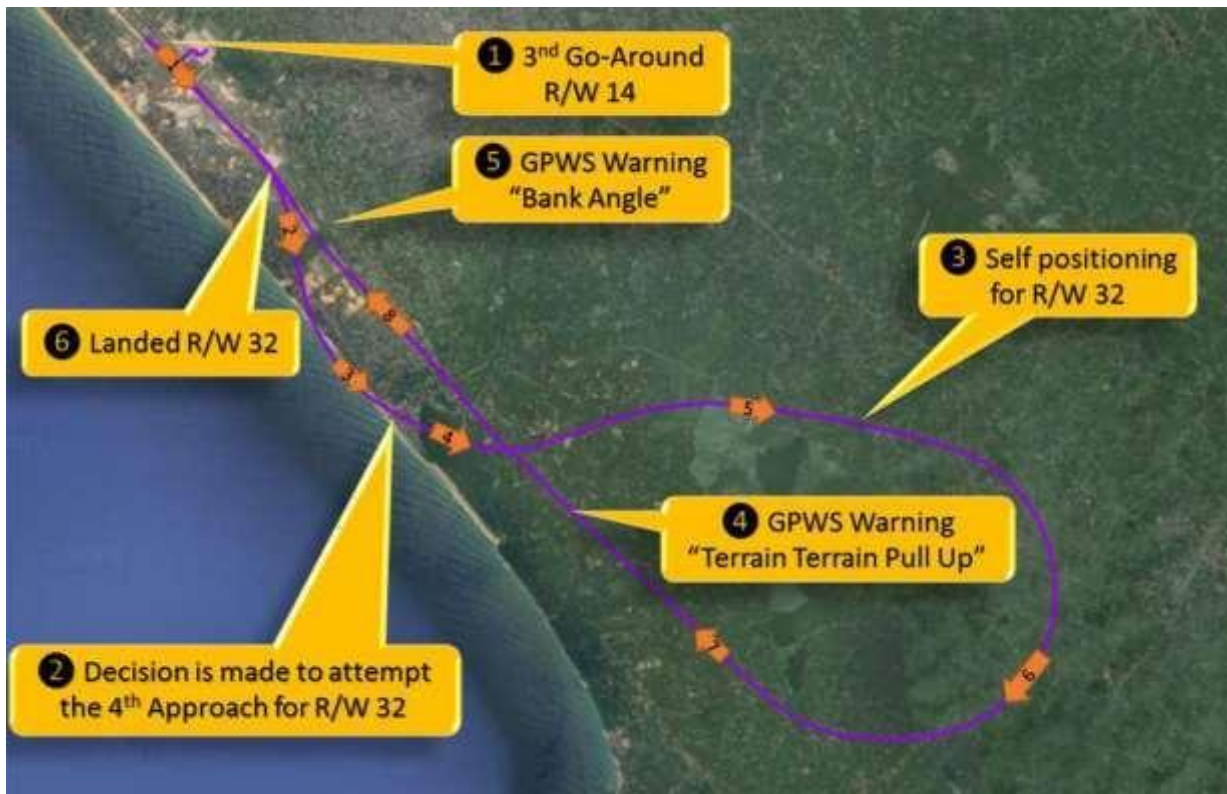
PIC of 9W-555 converted the visibility of Rwy 14 at Trivandrum into RVR using CMV which was calculated to be 2250 m and was within the Aerodrome Operating Minima of the crew of 9W-555.

The crew advised ATC that they were on "MINIMUM FUEL". Thereafter, ATC vectored 9W-555 for straight in VOR approach Rwy 14 with visibility 2000 metres. During approach and landing, the crew was unable to sight the runway and initiated the 1st go – around at Trivandrum (4th go round of the flight) at 0119 UTC and declared "MAY DAY due Fuel".



After carrying out the go-around the PIC requested ATC for right hand visual circuit for Rwy 14. As 9W-555 reported turning base, ATC advises 9W555 that they were just abeam the runway and same was acknowledged by 9W-555. During the approach to Rwy 14/32 the PIC was not in visual contact with the airfield and by the time 9W-555 sighted the runway the crew realize that they are too high and not aligned with the runway. The PIC realizing that they are too high for a safe landing, the PIC decided to initiate the second go-around (Fifth Go-Around of the flight).

The PIC again request Trivandrum ATC for a visual approach for R/W 14. ATC informed 9W-555 that visibility for both the runways at Trivandrum is 2000m. The PIC descends to 1000 feet of airfield elevation on downwind, and later descends to 500 feet while turning base, however, the visual contact with runway was not made. During this approach also the aircraft was not aligned to the extended runway centreline, as neither crew had the Runway insight as they turned final. As the crew start a bank left to align with the runway GPWS "Bank Angle" warning is activated and PIC initiated go-around. This was the 3rd Go- Around in Trivandrum and 6th Go-Around of the flight. The fuel on board after go-around was 662Kg.



After carrying out the 6th Go around and climbing to 700 feet AGL the PIC realised that fuel was very less and requested ATC to take left 180⁰ turn and to self-position for making visual landing for inbound runway 32. The PIC continued the approach for runway 32 without any visual contact with the runway and with all GPWS warnings "TERRAIN TERRAIN PULL UP" and also the GPWS bank angle alert as the aircraft manoeuvred at low altitude. The aircraft finally landed safely on runway 32 on the 7th approach. After landing, the total fuel on board was only 349 Kgs.

From above it is inferred that flight crew situational awareness and decision making and for the same is a factor to the incident on following accounts.

- a) The PIC carried out a total of 07 approaches for the sector flight
- b) PIC decision of Re-designating the alternate destination to have more holding fuel in order to carry out another approach at Cochin when the ATC had broadcasted that visibility had reduced and with reducing trends.
- c) All the three visual approaches at Trivandrum were in below minima conditions and below circuit altitude. The PIC also ignored several EGPWS

cautions/warnings on the last approach in a manner that jeopardised the safety of the passengers and the aircraft.

d) The decision of PIC to choose Trivandrum over Bangalore as alternate destination as Bangalore had better prevailing weather conditions and had ILS available for landing.

2.5 Co-ordination between Cochin and Trivandrum ATC

As the MAY DAY call was given by 9W-555 at Trivandrum, the Tape transcript and Direct Speech Circuit (DSC) were preserved and available for investigation. The same was downloaded and were analysed. However the tape transcript for Cochin ATC was not preserved and hence were not available for investigation.

On initial contact of Kuwaiti 349 with VOTV ATC, Kuwaiti 349 is advised about the visibility of 1500m in VOTV. Kuwaiti 349 advises ATC that with the reported visibility they would not be able to start an approach into VOTV. ATC responds that the reducing trend in visibility from 2500m was advised to VOICI ATC earlier; and that the visibility has now dropped to 1500 m. Kuwaiti 349 responds that they had not been advised about this information by VOICI ATC, and that the last visibility information they had was 3000 m. VOTV ATC again responds by advising Kuwaiti that the trend in reduction of visibility was informed to VOICI ATC.

Analysis of the Direct Speech Circuit (DSC), it was known that at time 01:00:27 UTC, Trivandrum ATC had asked Cochin whether the latest weather has been advised to the diverting aircrafts, however there is no confirmation from Cochin recorded on the DSC for this transmission.

It appears that there was a lag in flow of information regarding the downward trend of visibility from Trivandrum ATC to the diverting aircrafts that were under control of Cochin ATC. The timely and accurate transmission of information may have had an effect on the decision made by the diverting aircraft to Trivandrum which was under Cochin ATC control.

2.6 Circumstances leading to the Incident

M/s Jet Airways has no company policy pertaining to the number of approaches/missed approaches to be made in inclement weather conditions. After carrying out two go-arounds at Cochin the PIC of 9W-555 re-designated Trivandrum as the alternate Aerodrome in order to gain more holding fuel over and above the planned advisory holding fuel over Cochin. Also the PIC did not value the inputs given by the first officer that at Trivandrum ILS was not available and if the weather drops at Trivandrum, they will be stuck with VOR approaches, however PIC took decision to divert to Trivandrum. The absence of a company policy pertaining to the re-designation of destination alternate during the flight in inclement weather led to the flight crew choosing an alternate, which was probably not the best decision given the available information and the prevailing weather conditions.

When the crew came in contact with Trivandrum ATC, visibility had deteriorated to 2000 m. After carrying out the first Go-around at Trivandrum, the aircraft fuel was below the Minimum reserve fuel and subsequently, the MAYDAY call was announced by the PIC. Thereafter the crew decided to undertake visual approaches at circuit altitude for Rwy 14.

After declaring MAYDAY, the crew attempted 02 visual approaches for Rwy 14 and 01 visual approach for Rwy 32. All the three visual approaches at Trivandrum were in below minima conditions and below circuit altitude. Crew also ignored several EGPWS cautions/warnings on the last approach and finally landed on Rwy 32 in a manner that jeopardised the safety of the passengers and the aircraft. The crew were committed to land due to fuel shortage.

3. Conclusions

3.1 Findings

1. The Aircraft had valid Airworthiness Certificate and was complying all the concerned Airworthiness Directive, mandatory Service Bulletins, DGCA Mandatory Modifications on this aircraft and its engine as on date of event.
2. Both the operating crew were duly qualified on type B737 aircraft to operate the flight.
3. Both the crew had rested well prior to undertaking the flight Doha-Cochin on 18/8/2015.
4. The complete sector flight is during the period of WOCL.
5. 9W555 was dispatched with a total fuel of 16100 Kgs which was well above the minimum legally required fuel as per CAR for the flight i.e. 15295 Kgs.
6. The departure time for 9W-555 was 1937 UTC, however weather available for Cochin before Departure from Doha was of 0900UTC.
7. The aircraft came in contact with Cochin ATC, at around 2300 UTC and the visibility reported was 3500 metres in haze.
8. The RVR requirement for ILS runway 27 at Cochin was 650 metres and the DA was 320 feet.
9. The crew of 9W-555 initiated the first Go-Around at 2358 UTC due low clouds and being not able to sight the runway.
10. After carrying out the first Go-Around the crew discussed the alternate fuel requirements for Coimbatore and Trivandrum. The F/O advised the Captain that at Trivandrum only VOR Approach is available as ILS is not available.
11. Air India Express B737 aircraft operating flight 474 which was ahead of 9W-555 on approach for R/W 27 at Cochin executed a Go-Around due low clouds at 600 feet.
12. Thereafter Cochin ATC broadcasted that the visibility has dropped to 2500 meters.
13. 9W-555 thereafter commenced a 2nd approach and again on reaching DA did not sight the Runway due low clouds and executed 2nd go-around at 0017 UTC.
14. The fuel on board after the 2nd go-around was 3919Kg, which was above the

MDF for Bangalore i.e. 3306 Kgs.

15. The crew of 9W-555 thereafter advise the ATC about re-designation of Trivandrum as the alternate Aerodrome, as this would give them 20 min more holding time over Cochin.
16. ATC Cochin cleared the aircraft to return overhead CIA to commence the third approach. At the same time advised them that visibility has dropped to 2000 m with a trend of reducing visibility.
17. Air India Express flight 474 requested Cochin ATC to confirm visibility with Trivandrum ATC. Subsequently Cochin ATC broadcasted to all stations "Trivandrum visibility is 3000 m and clouds at 1500 feet".
18. The crew of 9W-555 intimated Cochin ATC that they would like to make 3rd attempt and if unsuccessful, they will be diverting to Trivandrum.
19. ATC Cochin gave further weather updates to 9W-555 that weather for ILS 27 "tempo visibility reducing to 1500 m in mist and low clouds now at 400 feet" and thereafter cleared 9W-555 for ILS approach runway 27.
20. After 33 minutes of 2nd go around, 9W-555 initiated 3rd Go-Around at 0050 UTC at DA as the Runway was not sighted.
21. The fuel on board after 3rd Go-Around was 2644Kgs which was above the MDF for Trivandrum i.e. 2614 Kgs
22. After the third go around, the crew of 9W-555 set course and diverted to Trivandrum.
23. ATC Trivandrum at time 00:56:39 UTC, had informed Cochin ATC that visibility has dropped to 2500 m with reducing trend and subsequently at time 00:59:42 UTC, informed that visibility is 1500 m and to advise Jet Airways 9W-555 accordingly. The same was acknowledged by Cochin ATC.
24. As per ATC tape transcript and CVR readout available the change of visibility in Trivandrum was not broadcast by Cochin ATC to 9W-555 which was diverting to Trivandrum.
25. On the initial contact with TRV Approach Radar, 9W-555 was informed that the prevailing visibility at the airfield is 1500 m. The crew of 9W-555 thereafter informed Trivandrum ATC about minimum fuel conditions.

26. ATC Trivandrum informed that for runway 14 RVR is 2100m and the MDA was 560.
27. The crew of 9W-555 checked for the availability of high intensity lighting system (HILS) on runway 14 as they would like to use CMV to land on runway 14. ATC Trivandrum informed that HILS was not available on runway 14 and only Simple intensity lighting system with high intensity is available for runway 14.
28. At around 12,000 feet, the crew of 9W-555 requested for a right orbit to lose height as they were being vectored straight in for VOR DME Rwy 14 and were high on profile.
29. ATC cleared 9W-555 for VOR approach Rwy 14 with a visibility of 2000 m.
30. During approach and landing, the crew was unable to sight the runway and initiated the 1st go – around at Trivandrum (4th go round of the flight) at 0119 UTC. The fuel on board was 1324 Kgs.
31. About 40 seconds after the Go-Around, when the fuel on board was below 1300 Kgs, 9W-555 Declared “MAY DAY due Fuel”.
32. Thereafter the PIC of 9W-555 informed ATC of his intention for a right Hand visual circuit for Rwy 14.
33. The Trivandrum ATC cleared 9W-555 for visual approach runway 14 with a visibility 2000 metres.
34. During the 2nd approach the crew sighted the runway late and realize that they were not aligned with the runway. At time 0126 UTC crew initiated the 2nd go around at Trivandrum (5th go around of the flight).
35. The crew again requested Trivandrum ATC for circling approach for Rwy 14, but during finals, once again crew was late in sighting the runway and the aircraft was again not aligned with the runway, and at 0132 UTC the crew initiated the 3rd go around at Trivandrum (6th go around of the flight). The fuel on board was now 662 Kgs.
36. Thereafter the PIC requested ATC to take left 180^o turn to self-position for inbound runway 32 at 700 feet. This activated EGPWS caution “TERRAIN TERRIAN” followed by EGPWS warning “TERRAIN TERRAIN PULL UP”. The aircraft finally landed safely on runway 32 on the 7th attempt at 0139 UTC.

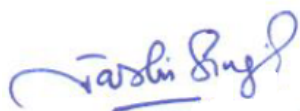
37. The PIC of 9W-555 preferred visual approach over VOR approach and carried all three visual approaches in below minima conditions.
38. The final reserve fuel was 1128 Kgs however after landing the total fuel on board was 349 Kgs.
39. There was no damage to the aircraft.
40. There were no fire and no injury to any of the occupants on board the aircraft.
41. The aircraft was refuelled at Trivandrum and crew flew back to Cochin and landed safely.
42. Jet Airways Company Operations Manual does not have any guidelines for the number of approaches to be carried out before a diversion is considered.
43. Jet Airways Company Operations Manual does not have any guidelines for re-designating the alternate aerodrome in flight.

3.2 Probable cause of the Incident

1. The absence of a company policy pertaining to the number of approaches/missed approaches in inclement weather led to the crew of 9W-555 attempting total of 07 approaches/missed approaches at Cochin and Trivandrum. The crew also attempted 03 visual approaches at Trivandrum in below minima conditions, below circuit altitude and ignored several EGPWS cautions/warnings, thereby jeopardising the safety of the passengers and the aircraft.
2. The absence of a company policy pertaining to the re-designation of destination alternate during the flight in inclement weather led to the flight crew choosing an alternate, which was probably not the best decision given the available information and the prevailing weather conditions.

3.3 Recommendations

1. DGCA may advise Jet Airways to define the policy on the number of approaches and missed approaches in inclement weather conditions.
2. DGCA may advise Jet Airways to define the criteria and processes for re-designation of destination alternates during flight.
3. DGCA may advise Jet Airways to include Low Fuel scenarios and decisions making training exercises during refresher LOFT simulator training sessions.



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Date: 29th Sep 2016
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