

**FINAL INVESTIGATION REPORT OF**  
**SERIOUS INCIDENT TO M/s VISTARA**  
**A-320 AIRCRAFT VT-TTN**  
**ON 04/07/2019**

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

## **FOREWORD**

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

<b><u>INDEX</u></b>		
<b>S. NO.</b>	<b>SUBJECT</b>	<b>PAGE</b>
<b>1.0</b>	<b>FACTUAL INFORMATION</b>	<b>02</b>
1.1	HISTORY OF FLIGHT	02
1.2	INJURIES TO PERSONS	06
1.3	DAMAGE TO AIRCRAFT	06
1.4	OTHER DAMAGE	06
1.5	PERSONAL INFORMATION	07
1.5.1	PILOT FLYING	07
1.5.2	PILOT MONITORING	07
1.6	AIRCRAFT INFORMATION	08
1.7	METEOROLOGY INFORMATION	09
1.8	AIDS TO NAVIGATION	09
1.9	COMMUNICATIONS	09
1.10	AERODROME INFORMATION	10
1.11	FLIGHT RECORDERS	10
1.12	WRECKAGE AND IMPACT INFORMATION	11
1.13	MEDICAL AND PATHOLOGICAL INFORMATION	11
1.14	FIRE	11
1.15	SURVIVAL ASPECTS	11
1.16	TEST AND RESEARCH	11
1.17	ORGANIZATIONAL AND MANAGEMENT INFORMATION	11
1.18	ADDITIONAL INFORMATION	11
1.19	USEFUL OR EFFECTIVE INVESTIGATION TECHNIQUES	19
<b>2.0</b>	<b>ANALYSIS</b>	<b>20</b>
2.1	GENERAL	20
2.2	INTENT OF FUEL POLICY & PROCEDURES	20
2.3	RT CONGESTION IN NORTHERN SECTOR	21
2.4	CIRCUMSTANCES LEADING TO THE INCIDENT	23
<b>3.0</b>	<b>CONCLUSION</b>	<b>25</b>
3.1	FINDINGS	25
3.2	PROBABLE CAUSE OF THE INCIDENT	28
<b>4.0</b>	<b>SAFETY RECOMMENDATIONS</b>	<b>29</b>

<b><u>GLOSSARY</u></b>	
AAIB	Aircraft Accident Investigation Bureau, India
AAI	Airports Authority of India
ACARS	Aircraft Communication Addressing and Reporting System
ARC	Airworthiness Review Certificate
ATS	Air Traffic Service
ATPL	Airline Transport Pilot License
CB	Cumulonimbus
CFP	Computerised Flight Plan
C of A	Certificate of Airworthiness
C of R	Certificate of Registration
CAR	Civil Aviation Requirements
CPL	Commercial Pilot License
CVR	Cockpit Voice Recorder
DGCA	Directorate General of Civil Aviation
ECAM	Electronic Centralised Aircraft Monitor
EDTO	Extended Diversion Time Operations
EFOB	Estimated Fuel on Board
FMGC	Flight Management Guidance Computer
FOB	Fuel on Board
GS	Glide Slope
IAP	Instrument Approach Procedure
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IOCC	Integrated Operations Control Centre
IXJ	Jammu Airport
LRC	Long Range Cruise
MAP	Missed Approach Procedure
MDF	Minimum Diversion Fuel
METAR	METEorological Aerodrome Report
ND	Navigation Display
OFP	Operational Flight Plan
PF	Pilot Flying
PM	Pilot Monitoring
PIC	Pilot In Command
ROD	Rate of Descent
RPL	Repetitive Flight Plan
SID	Standard Instrument Departure
SOPs	Standard Operating Procedures
SSP	State Safety Program
TCU	Towering Cumulus
TSAL	Tata Sia Airlines Limited
V <sub>FE</sub>	Speed (Flaps Extended)
VIAR	Amritsar Airport
VIDP	Delhi Airport
VIJU	Jammu Airport
VIPK	Pathankot Airport
VOR	VHF Omnidirectional Range
UTC	Coordinated Universal Time

**FINAL INVESTIGATION REPORT ON SERIOUS INCIDENT TO M/s VISTARA  
A-320 AIRCRAFT VT-TTN WHILE OPERATING FLIGHT FROM SRINAGAR TO  
JAMMU ON 04/07/2019**

1.	Aircraft Type	A-320
2.	Nationality	INDIAN
3.	Registration	VT –TTN
4.	Owner	M/s Wilmington Trust SP Services (Dublin) Limited
5.	Operator	M/s Vistara Airlines
6.	Pilot – in –Command	ATPL Holder
7.	Place of incident	En-route
8.	Last point of Departure	Srinagar
9.	Intended place of Landing	Jammu
10.	Date of incident	04/07/2019
11.	Time of the incident	0757 UTC
12.	Passengers on Board	139
13.	Extent of Injuries	NIL
14.	Crew on Board	02+05
15.	Extent of Injuries	NIL
16.	Phase of Operation	Enroute
17.	Type of Incident:	Fuel Starvation

(ALL TIMINGS IN THE REPORT ARE IN UTC)

## **1 Factual Information**

### **1.1 History of Flight**

On 04.07.2019, Vistara Airline A-320 aircraft VT-TTN while operating flight from Srinagar to Jammu diverted to Amritsar due to adverse weather over Jammu. While carrying out approach at Amritsar, the aircraft declared “May Day Fuel”. After landing, the fuel remaining on the aircraft was just 460 kgs. The incident was declared as a “serious incident” by AAIB.



#### **ROUTE FOLLOWED BY AIRCRAFT**

The aircraft was under the command of a pilot holding ATPL (PF) with another pilot holding CPL as First officer (PM). There were a total of 139 passengers and 07 crew members on board the aircraft. On the previous leg, just prior to

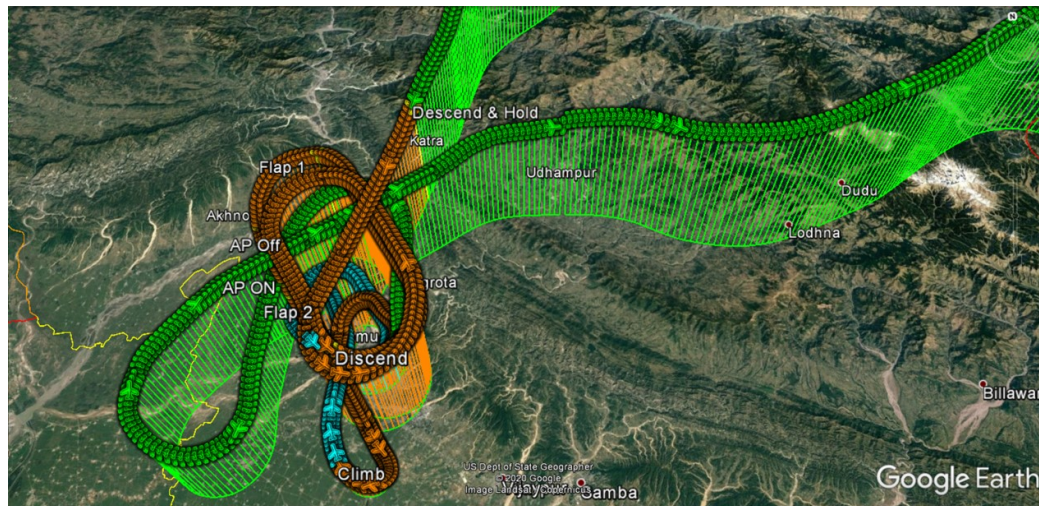
the incident flight, the aircraft was on flight from Delhi to Srinagar operated by the same set of flight crew, wherein the aircraft had flown East of Jammu.

Remote transit briefing was carried out at Srinagar at 0640 UTC. The briefing folder contained METAR at 0430 UTC of Jammu (VIJU). Visibility reported as per METAR was 4500 m (becoming 5000 m) with variable winds of 05 kts and scattered clouds. Fuel on board before take-off from Srinagar was 4.9 Tons and as per the briefing sheet, no discretionary fuel was taken. As per the PIC (PF), extra 600 kg of fuel was uplifted for 16 minutes of holding at destination (Jammu). As per the Computerised Flight Plan (CFP), Amritsar was the only alternate. Fuel uplifted factored for Amritsar as an alternate. Repetitive Flight Plan (RPL) provided on the CFP showed only Amritsar as the filed alternate. The PIC had, however, signed and accepted the Transit Briefing Sheet which indicated Amritsar (VIAR) as 1<sup>st</sup> Alternate & Delhi (VIDP) as 2<sup>nd</sup> Alternate ruling over the RPL of single alternate.

The aircraft chocks were off at 0710 UTC and push back was carried out with APU running. Clearance for start-up was not given immediately due to Air Force activity at that time. The aircraft taxied out at around 0749 UTC and took off at 0754 UTC. Estimated time of reaching overhead Jammu was 0816 UTC. After getting airborne from Srinagar, the aircraft encountered adverse weather near MESAR and deviated 8-10 miles left of track to avoid it. Thereafter, the course was set direct for Jammu. ATC advised the crew to climb to FL 210. When the aircraft was at FL210, ATC passed the following weather information: -

Winds	Variable 6 knots
Visibility	5 kms in dust.
Cloud	4 octa CB at 3000 ft, 30 kms North
Temperature	42
QNH	995
Trend	Thundershower, winds gusting to 29 knots.

On request for descent, aircraft was cleared to FL 140 and was asked to join hold over Jammu. Aircraft was then cleared for 4100 ft. with instruction to report overhead for approach.



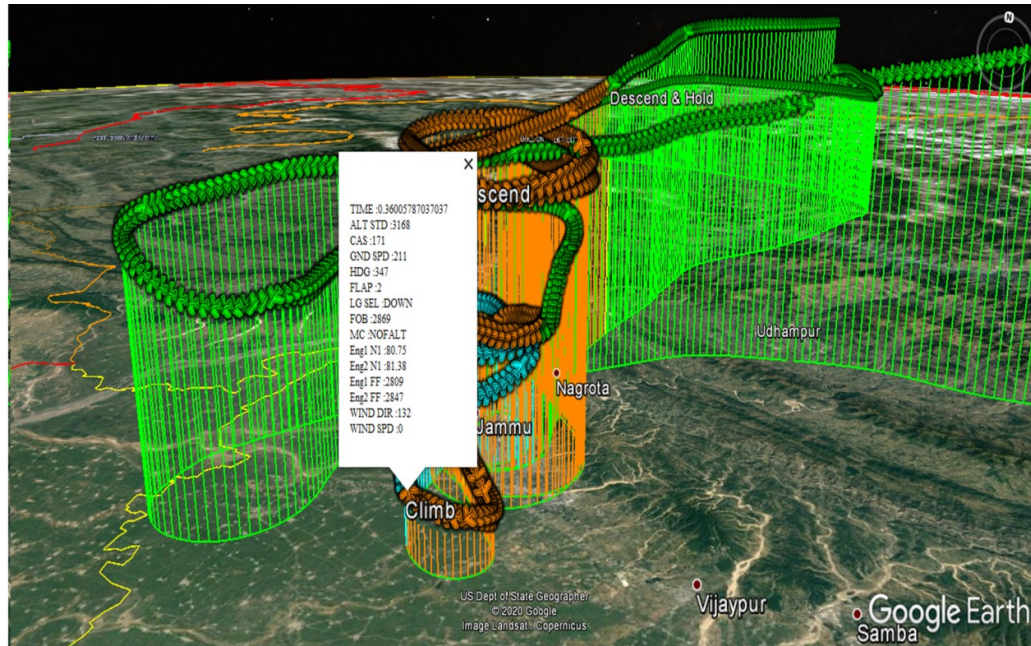
### **APPROACH INTO JAMMU & DIVERSION**

In order to increase ROD, the aircraft was slowed down to 180 knots with "Flap2" selected. Speed brakes were deployed and aircraft was flown manually. After completion of hold, when the aircraft was overhead at about 7000 feet, an orbit was asked to descend further to initial approach altitude. AP was re engaged and the orbit was commenced. During orbits, as per the flight crew, a very large cell at 10 miles east of VOR with smaller TCU in the holding area was observed. At that time, as per the crew, 10 minutes of extra fuel was on board.

The aircraft commenced approach at 4100 feet with a speed of 185 kts. Aircraft proceeded outbound of the approach while descending to 2600 feet and on reaching 2600 ft, there was a sudden increase of wind speed (upto 40 kts) with speed trend and speed showed 200 kts. Crew disengaged the AP and aircraft was made to climb to prevent  $V_{FE}$  exceedance. During final approach track, a strong southerly wind of 40 knots (Tail Wind) was observed. As the wind gradient was 35 kts in 1500 feet, and the tempo gusts forecast, the flight crew decided to discontinue approach. ATC cleared the aircraft to climb to 4100 feet on runway heading. At the time of discontinuation of the approach, Fuel on Board (FOB) was 2.8 tonnes as compared to MDF of 2.6



tonnes as per CFP. The flight crew intimated that they intend to return to Srinagar. ATC reminded the crew that there was a hailstorm warning at Srinagar. Crew then decided to divert to Amritsar. ATC advised the aircraft to climb to 5000 feet and set course for Amritsar.



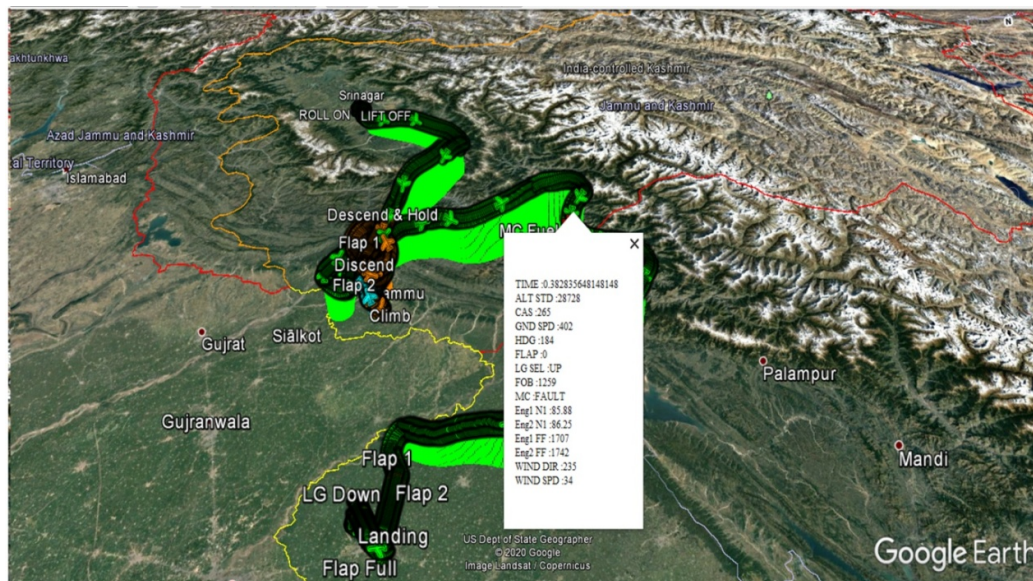
### **DIVERSION TO AMRITSAR**

Due to the presence of a very large CB east of the Jammu airport and in order to assess the situation, the flight crew requested to climb to 10000 ft(overhead), so the situation could be assessed. ATC cleared the aircraft in stages to 7000 ft, then 14000 ft and thereafter 15000 feet as two of the following aircraft were also diverting.

During climb to 15000 feet, AP was disconnected by flight crew a few times in order to navigate weather. Due to presence of International Border, VIJU ATC had not cleared the aircraft on southerly track. There were large CB cells North, North East, East and South East of Jammu. The aircraft climbed to higher altitudes as there was lot of deviation due to bad weather. On seeing the aircraft climbing beyond FL150, ATC cautioned the flight crew not to climb beyond 15000 feet as there was traffic at FL160.

After circumnavigating the large buildup of CB east of Jammu, the flight crew programmed FMGC for BIKUX. ND showed widespread green and yellow

patches throughout the track. ATC advised the crew to take deviations to avoid bad weather. At that time, estimated fuel on board was less than 1.2 T and while climbing through FL 270, ECAM FUEL L LO PR caution came on. Flight crew requested and finally climbed to FL 310 as against FL 170.



### **APPROACH & LANDING AT AMRITSAR**

Approach for Amritsar was initiated and Amritsar Radar was contacted. Descent clearance was given from FL250 to FL160. Minimum fuel status was informed to ATC Amritsar. After re- checking FOB, and rechecking FMGC destination EFOB, minimum Fuel was changed to Mayday Fuel by flight crew. The aircraft was initially cleared down to FL 210. ATC asked for intended runway for approach. Close to GS interception, ECAM message FUEL L(R) Pump LO PR 1+2 came ON. At that time, FOB was about 550 Kgs. The aircraft landed at Amritsar with 460 kgs. of fuel remaining. There was no fire. A few passengers had nausea and vomited during flight.

## **1.2 Injuries to Persons**

INJURIES	CREW	PASSENGERS	OTHERS
FATAL	Nil	Nil	Nil
SERIOUS	Nil	Nil	Nil
MINOR / NONE	07	139	Nil

## **1.3 Damage to Aircraft**

None

#### **1.4 Other Damage**

None

#### **1.5 Personnel Information**

##### **1.5.1 Pilot Flying (PF)**

Age	52 years
License	ATPL
Date of Issue	21.07.1997
Valid up to	18.08.2021
Class	Single/Multi Engine, Land
Endorsements as PIC	A310, A320, B747
Date of Med. Exam	18.01.2019
Med. Exam valid upto	17.01.2020
FRT0 License.	Valid
Total flying experience	11414:00 hours
Experience on Type	2491:00 hours
Total flying experience during last 06 months	417:00 hours
Total flying experience during last 30 days	80:00 hours
Total flying experience during last 07 Days	21:03 hours
Total flying experience during last 24 Hours	04:03 hours
Last Flown on Type	04.07.2019

##### **1.5.2 Pilot Monitoring (PM)**

Age	34 years
License	CPL
Date of Issue	07.03.2011

Valid up to	06.03.2021
Class	Single/Multi Engine,
Category	Aeroplane
Endorsements as PIC	Cessna 172, PA34
Date of Med. Exam	26.07.2019
Med. Exam valid upto	25.07.2020
FRTTO License.	Valid
Total flying experience	1963:00hours
Experience on Type	1735:00hours
Total flying experience during last 06 months	215:00 hours
Total flying experience during last 30 days	18:00 hours
Total flying experience during last 07 Days	18:00hours
Total flying experience during last 24 Hours	04:03 hours
Last Flown on Type	04.07.2019

## 1.6 Aircraft Information

Airbus A-320 aircraft (MSN 7347) was manufactured in year 2016. The aircraft is registered with DGCA under the ownership of M/s Wilmington Trust SP Services (Dublin) Limited. The Certificate of Registration is 4770, which is valid upto 04.10.2022. The Certificate of Airworthiness (6803) under "Normal Category" subdivision Passenger/Mail/Goods was issued by DGCA on 14.10.2016. Aircraft was operated under a valid Scheduled Operator's Permit. As on 04.07.2019, the aircraft had logged 9363:46 hours. As per weight schedule, the MTOW of the aircraft is 73500 Kgs, maximum usable fuel is 18,696 Kgs and maximum allowable payload with full fuel is 10,870 Kgs.

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, Delhi. Accordingly, all inspections (Preflight checks, Daily inspection) were carried out as and when due before the incident. 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.

### 1.7 Meteorological Information

Following is the METAR information of Jammu (time of observation 0430 UTC) provided to the flight crew at Sri Nagar during transit briefing: -

Winds	Variable 02 knots
Visibility	4500 meters in dust becoming 5000 meters
Clouds	Scattered at 20000 feet
Temperature	38 degrees C
QNH	0997

For Amritsar (time of observation 0600UTC), it was

Winds	180/06 knots
Visibility	3500 meters in Haze
Clouds	Scattered at 4000 feet
Temperature	38 degrees C
QNH	0998
No Sig.	

### 1.8 Aids to Navigation

Jammu airport is equipped with following Navigation and Landing Aids.

a	Air-to-ground communication VHF/Ground to Ground Communication- HF/DVTRS/Master clock System /ATIS/DIAL-UP (AFTN) /DSCN /VPN / AMSS/VCCS & LAN/WAN	ATC with IAF/TER-128.5 MHz DSCN,LAN/WAN (AAI)
b	NDB & DVOR /DME (High Power)	NDB –IAF JA 415 KZ, DVOR-JJU 113.3 MHZ, DME (HP)-1167-1104 MHZ
c	ILS/DME (Low Power)(LLZ/GP)	RWY 36- CAT I(LLZ-IJMU 110.1 MHZ, GP-334.4 MHZ)



## 1.9 Communications

There was always two way communications between the aircraft and ATC. During climb, aircraft was given step climb by VIJU ATC and the subject flight was required to contact Northern Control. Due to adverse weather around VIJU and the area near Bikux & Pathankot (VIPK), there were other aircraft also in communication with Northern Control requesting weather deviation. There was a lot of confusion whether the flight was cleared to FL 150 or not, which was finally resolved and the clearance given to the flight was FL150.

## 1.10 Aerodrome Information

Jammu Airport is operated by Indian Air Force and AAI maintains the Civil Enclave. The IATA location Identifier code is IXJ and ICAO location Indicator code is VIJU. The flight traffic permitted is only day IFR/ VFR flights and no night operation is permitted. Precision Approach ILS CAT-I is available.

## 1.11 Flight Recorders

The Cockpit Voice Recorder (CVR) data and the Digital Flight Data Recorder (DFDR) data were downloaded for investigation. Relevant portion of CVR (when aircraft was in contact with Jammu ATC) is given below: (Time is relative time starting 00:00 on CVR)

01:07:56	P2	Northern Vistara 611
01:08:00	Tower	Vistara 611
01:08:02	P2	How do you read sir Vistara 611
01:08:04	Tower	Vistara 611 jammu
01:08:05	P1	Go ahead sir
01:08:06	Tower	I advised you to stop climbing 150
01:08:09	P1	We are maintaining 150
01:08:11	Tower	Indicated is 155
01:08:14	P1	We are on 995 we are at 150
01:08:16	P2	Northern Vistara 611 reading you 5
01:08:20	Tower	Confirm you are with Northern
01:08:21	P1	Affirm
01:08:22	Tower	You climb without our clearance traffic is holding over Jammu at 16000ft how can you climb
01:08:29	P2	We were cleared by Jammu sir to level 15000ft to maintain 15000
01:08:43	Tower	Vistara 611 contact northern
01:08:56	P1	Northern this is Vistara 611 we were cleared by Jammu to climb 15000 we are with you now and we have been asked to change over and what altitude you want us to maintain
01:09:12	P1	Jammu Vistara 611 requesting further climb
01:09:20	P1	Jammu Vistara 611 requesting further climb
01:09:22	Tower	Contact Jammu
01:09:24	P1	He told us to change over to you sir
01:09:27	Tower	Why are you calling Jammu

01:11:22	P1	Climb 240 <u>Vistara 611</u>
01:11:45	P1	See what she wants
01:11:46	P2	I told her that we are diverting to <u>Amrit</u>
01:12:32	P1	In this we deviate around like this
01:12:32	P2	Ok
01:12:47	P1	Want to go back check weather on your side also
01:12:53	P1	My god what a build up
01:13:03	P2	Whenever you get time
01:13:10	Tower	<u>Vistara 611</u> , climb to level 230
01:13:14	P2	Climb level 230, <u>Vistara 611</u>
01:13:42	P1	What a build up my god
01:13:45	P2	Should I activate second direct
01:14:22	P1	See what she wants

## 1.12 Wreckage and Impact Information

Not Applicable

## 1.13 Medical and Pathological Information

Both the cockpit crew and all cabin crew had undergone Breath analyser check during the pre-flight medical check prior to the flight at Delhi and were found negative.

## 1.14 Fire

There was no fire.

## 1.15 Survival Aspects

The incident was survivable.

## 1.16 Test and Research

Nil

## 1.17 Organizational and Management Information

The aircraft was operated by a Scheduled Airlines.

### 1.17.1 Airlines Fuel Policy & Operational Requirement

#### Fuel Policy

As per the Fuel Policy of the operator contained in Operations Manual Part 'A', Reserve Fuel is the sum of Alternate fuel, Final Reserve Fuel / alternate holding Fuel and the Contingency Fuel (If not consumed). These three are defined as follows:

✚ Alternate Fuel is the fuel required to fly from Destination to an Alternate Airport and is based on forecast winds, temperatures and the appropriate gross weight, for the following phases of flight:

- i. A missed approach from the applicable minima at the destination aerodrome to missed approach altitude, taking into account the complete missed approach procedure.
- ii. Climb from missed approach point to planned cruise level / altitude. Fuel figure of 100 kg is catered for Go-Around. In addition, departure track is based on the expected runway in use and the appropriate SID.
- iii. Cruise at LRC.
- iv. Descent from final cruise altitude to the point where the approach is initiated, taking into account the expected arrival procedure.
- v. Approach from end of descent to touchdown. A fuel figure of 120 kg and 240 kg is included for approach and landing for A320 variants and B737-800 versions respectively.

There is a Note as follows:

“For flights that require a second destination alternate, the destination alternate fuel required in accordance with TSAL fuel policy shall be the amount of fuel, as calculated, that enables the aircraft to proceed to the destination alternate airport requiring the greater amount of fuel.”

✚ Final reserve fuel (alternate holding fuel)

The fuel required (flight planning stage) to hold at 1500 ft above airport elevation in standard conditions with flaps up for 30 minutes at Holding speed for the appropriate gross weight, at the destination alternate airport. The operator has determined a fixed final reserve fuel value of 1150 kgs.

✚ Contingency Fuel is to cater for deviations from planned operations and shall not be less than 200 kgs. The contingency fuel displayed on the OFP is the fuel that shall remain till the end of the flight barring any deviations from planned operations.



## Additional Fuel

A supplementary amount of fuel required if the minimum fuel calculated in is not sufficient to:

- Allow the aeroplane to descend as necessary and proceed to an alternate aerodrome in the event of engine failure or loss of pressurization, whichever requires the greater amount of fuel based on the assumption that such a failure occurs at the most critical point along the route;
  - Fly for 15 minutes at holding speed at 450 m (1500 ft) above aerodrome elevation in standard conditions; and
  - Make an approach and landing;
- Meet additional requirements not covered above;

Discretionary fuel is extra amount of fuel to be carried at the discretion of the Pilot in Command.

### **Operational Requirement**

In the same chapter of Operations Manual, there is a heading Operational Requirement which mentions that a flight shall not be commenced unless, taking into account both the meteorological conditions and any delays that are expected in flight, the airplane carries sufficient fuel and oil to ensure that it can safely complete the flight and shall take into account:

- ❖ Anticipated meteorological conditions
- ❖ An IAP at the destination followed by a MAP
- ❖ Weights
- ❖ Routings
- ❖ Delays
- ❖ ATS procedures
- ❖ The procedures prescribed in the operations manual for loss of pressurization, where applicable, or failure of one engine while en-route; and
- ❖ Any other conditions that may delay the landing of the airplane or increase fuel and/ or oil consumption.

*It is mentioned that the final authority and responsibility for fuel loads and the fuel management in flight is with the Pilot in command and he shall ensure that the amount of usable fuel remaining in flight is not less than the fuel required to proceed to an aerodrome where a safe landing can be made, with final reserve fuel remaining. The fuel for a flight is calculated on the Operational flight Plan (OFP), and it assumes the following:*

- A. ATC flight plan routing and flight levels can be expected to be achieved.
- B. Delays due to traffic or special activity are not expected, unless published. The final decision regarding the total amount of fuel to be carried rests with the pilot in command.

*It is also mentioned that the alternate aerodrome considered is usually the nearest, and may not always be the most appropriate.*

The standard flight fuel planning consists of:

- a) Taxi fuel;
- b) Trip fuel;
- c) Contingency fuel 5%
- d) Alternate fuel (Higher of the two alternates);
- e) Final reserve fuel; and

Additional fuel is a supplementary amount of fuel which may be required when the minimum fuel calculated may not be sufficient to cater for circumstances for a given flight.

Chapter 16 of the Operations Manual contains the following comment regarding RPL (R15):

“Reflects the ICAO ATC flight plan as generated on completion of the OFP between the City pair. The same may also be filed with the concerned ATS unit”.

## 1.18 Additional Information

### 1.18.1 DGCA CAR SECTION 8, SERIES O PART II

DGCA has issued CAR section 8 Series O Part II on “Operation of Commercial Air Transport – Aeroplanes”, which also covers “Fuel Requirements”. The relevant extract of the above said CAR is reproduced below: -

#### 4.3.6 Fuel requirements

4.3.6.1 An aeroplane shall carry a sufficient amount of usable fuel, to complete the planned flight safely and to allow for deviations from the planned operation.

4.3.6.2 The amount of usable fuel to be carried shall, as a minimum, be based on the following data:

a) -----

b) The operating conditions for the planned flight including:

- 1) Anticipated aeroplane mass;
- 2) Notices to Airmen;
- 3) ***Current meteorological reports or a combination of current reports and forecasts;***
- 4) Air traffic services procedures, restrictions and anticipated delays; and
- 5) The effects of deferred maintenance items and/or configuration deviations.

4.3.6.3 The pre-flight calculation of usable fuel required shall include the following: -

- a. Taxi fuel, which shall be the amount of fuel expected to be consumed before take-off; taking into account local conditions at the departure aerodrome and auxiliary power unit (APU) fuel consumption;
- b. Trip fuel, which shall be the amount of fuel required to enable the aeroplane to fly from take-off or the point of in-flight re-planning until landing at the destination aerodrome taking into account the operating conditions of 4.3.6.2 b);
- c. Contingency fuel, which shall be the amount of fuel required to compensate for unforeseen factors. It shall be 5 per cent of the planned trip fuel or of the

fuel required from the point of inflight 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 (1 500 ft) above the destination aerodrome in standard conditions;

Note - Unforeseen factors are those which could have an influence on the fuel consumption to the destination aerodrome, such as deviations of an individual aeroplane from the expected fuel consumption data, deviations from forecast meteorological conditions, extended delays and deviations from planned routings and/or cruising levels.

d. Destination alternate fuel, which shall be:

1) Where a destination alternate aerodrome is required, the amount of fuel required to enable the aeroplane to

- a. Perform a missed approach at the destination aerodrome;
- b. Climb to the expected cruising altitude;
- c. Fly the expected routing;
- d. Descend to the point where the expected approach is initiated; and
- e. Conduct the approach and landing at the destination alternate aerodrome; or

2) where two destination alternate aerodromes are required, the amount of fuel, as calculated in 4.3.6.3 d) 1), required to enable the aeroplane to proceed to the destination alternate aerodrome which requires the greater amount of alternate fuel; or

e. Final reserve fuel, which shall be the amount of fuel calculated using the estimated mass on arrival at the destination alternate aerodrome or the destination aerodrome, when no destination alternate aerodrome is required:

1) -----

2) for a turbine engine aeroplane, the amount of fuel required to fly for 30 minutes at holding speed at 450 m (1 500 ft) above aerodrome elevation in standard conditions;

f. Additional fuel, which shall be the supplementary amount of fuel required if the minimum fuel calculated in accordance with 4.3.6.3 b), c), d) and e) is not sufficient to:

- 1) allow the aeroplane to descend as necessary and proceed to an alternate aerodrome in the event of engine failure or loss of pressurization, whichever requires the greater amount of fuel based on the assumption that such a failure occurs at the most critical point along the route;
  - i) Fly for 15 minutes at holding speed at 450 m (1 500 ft) above aerodrome elevation in standard conditions; and
  - ii) Make an approach and landing;
- 2) allow an aeroplane engaged in EDTO to comply with the EDTO critical fuel scenario as established by DGCA;
- 3) Meet additional requirements not covered above;

g. ***Discretionary fuel, which shall be the extra amount of fuel to be carried at the discretion of the pilot-in-command.***

4.3.6.4 -----

4.3.6.5 A flight shall not commence unless the usable fuel on board meets the requirements in 4.3.6.3 a), b), c), d), e) and f) if required and shall not continue from the point of in-flight re planning unless the usable fuel on board meets the requirements in 4.3.6.3 b), c), d) e) and f) if required.

4.3.6.6 Notwithstanding the provisions in 4.3.6.3 a), b), c), d), and f); DGCA may, based on the results of a specific safety risk assessment conducted by the operator which demonstrates how an equivalent level of safety will be maintained, approve variations to the pre-flight fuel calculation of taxi fuel, trip fuel, contingency fuel, destination alternate fuel, and additional fuel. The specific safety risk assessment shall include at least the:

- a) Flight fuel calculations;
- b) Capabilities of the operator to include:

- i) A data-driven method that includes a fuel consumption monitoring programme; and/or
- ii) The advanced use of alternate aerodromes; and
- c) Specific mitigation measures.

#### 4.3.7 In-flight fuel management

##### 4.3.7.1 -----

4.3.7.2 The pilot-in-command shall continually ensure that the amount of usable fuel remaining on board is not less than the fuel required to proceed to an aerodrome where a safe landing can be made with the planned final reserve fuel remaining upon landing.

4.3.7.2.1 The pilot-in-command shall request delay information from ATC when unanticipated circumstances may result in landing at the destination aerodrome with less than the final reserve fuel plus any fuel required to proceed to an alternate aerodrome or the fuel required to operate to an isolated aerodrome.

4.3.7.2.2 The pilot-in-command 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.

4.3.7.2.3 The pilot-in-command shall declare a situation of fuel emergency by broadcasting MAYDAY MAYDAYMAYDAY 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.

#### **1.18.2 Fuel Planning for the flights – DGCA Air Safety Circular (ASC) 03 of 2019**

DGCA, has issued an Air Safety Circular considering increasing number of incidents wherein the operating crew have declared MAYDAY FUEL for seeking priority in landing due to adverse weather conditions or due to aerodrome limitations. The deficiencies in fuel planning, crew decision making and support provided by the ATC mentioned in the ASC are

- ✚ Fuel carried on-board did not cater for second alternate

- ✚ During flight, crew while deciding the alternate for diversion have not considered the nearest safe landing airport.
- ✚ Crew did not declare MINIMUM FUEL to ATC.
- ✚ After a crew has declared a MINIMUM FUEL, ATC has given additional clearances resulting in further depletion of fuel.

The ASC refers to the CAR Section 8 Series O Part II which prescribes minimum fuel requirements for the operation of aircraft and mentions the following:

During adverse weather conditions or aerodrome limitations conditions, second destination alternate should also be factored during the flight planning stage. Para 4.3.6 (d) (2) regarding selection of second destination alternate inter alia requires as follows: “where two destination alternate aerodromes are required, the amount of fuel, as calculated in 4.3.6.3 d) 1), required to enable the aeroplane to proceed to the destination alternate aerodrome which requires the greater amount of alternate fuel;”

It further reiterates that Flight dispatch should update the crew during transit halts regarding weather conditions at destination and alternates. Use of electronic briefing folder may also be considered for providing data to the crew.

For Air Traffic Control Units, the action suggested is “whenever a crew declares MINIMUM FUEL to the ATC, it means 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. The ATC should facilitate the early landing for the aircraft. The above instructions are for strict compliance by all the aircraft operators and ATC.”

#### **1.19 Useful or Effective Investigation Techniques**

Nil

## **2 Analysis**

### **2.1 General**

- Both operating crew were appropriately licensed and qualified to operate the flight.
- The aircraft had a valid Certificate of Airworthiness at the time of incident.
- The Aircraft held valid Certificate of Release to Service which was issued at the airport of departure.
- Airworthiness Directives, Service Bulletins, DGCA Mandatory Modifications had been complied with. Transit inspections were carried out as per the approved transit inspection schedules and all higher inspection schedules including checks/inspection as per the manufacturer's guidelines as specified in Maintenance Programme and approved by the Quality Manager.

### **2.2 Intent of Fuel Policy & Procedures**

In today's aviation scenario, maximum cost in operations is of fuel. Flight operations procedures of the operators are therefore based on reducing the overall fuel consumption and thereby the fuel cost. Across the Airlines, these fuel saving measures are covered in the training and through the issuance of SOPs. It is expected that flight crew would follow procedures which reduce fuel uplift and fuel used.

Careful perusal of the company Fuel Policy and the Transit Briefing Sheet was carried out. Though the Fuel Policy mentioned in the Operations Manual is in line with the DGCA CAR, however, the practice followed during daily operations by the operator is different. The CFP showed that a single alternate was filed in the RPL.

As per the Operations Manual, RPL reflects the ICAO ATC flight plan as generated on completion of the OFP between the City pair and the same may also be filed with the concerned ATS unit. So it clearly indicates that Amritsar as a single alternate has been filed with concerned ATS unit. However, the "Transit Briefing Sheet" prepared in coordination with IOCC/ Flight Dispatch and accepted by the PF at 0640 UTC mentions two alternates; 1<sup>st</sup> alternate



Amritsar (VIAR) and second alternate Delhi (VIDP), which means that (as per the policy of Operator) the flight was required to carry fuel commensurate with two alternates.

There was another fuel emergency incident which occurred to a flight of the same operator (15<sup>th</sup> July 2019, UK-944 (Mumbai – Lucknow)). Investigation has revealed similar issues pertaining to Fuel uplifted, Flight Following & Decision making on part of the flight crew.

Various other fuel related occurrences within the country were reviewed and a pattern was observed in all these cases. On some flights, operators file two alternates, carry fuel for the longest alternate as per the DGCA requirement but no extra fuel to hold over destination due to ATC congestion is taken (traffic or due to weather) though required by the DGCA CAR. In-flight, once the aircraft reaches over destination, it continues holding (as expected) overhead the destination (due to ATC congestion or due to traffic or weather) and do not consider diverting to the farthest alternate. Instead, the flight crew waits till the last moment expecting situation to improve for landing and thereby burn fuel while holding till the fuel on board is for the closest alternate. At times there is tacit advise via ACARS to “Hold till MDF of ----airport” (usually closest airport) before commencing diversion. This leaves the flight crew with no other option but advice ATC about “Minimum Fuel” upon diversion followed usually by “May Day Fuel” in case they encounter any traffic delay upon reaching the only alternate they are left with. In this regard, recommendations addressed to DGCA and Operators in the earlier investigation reports have not been implemented in true letter and spirit. Otherwise DGCA must have clearly conveyed without any scope of ambiguity in the regulations that operators have to formulate policy and procedures to carry fuel for defined ATC congestion period and also in case of severe bad weather (Thunderstorms etc.) expected on arrival at destination for a definite minimum time (for additional holding).

### **2.3 RT Congestion in Northern sector**

During climb, aircraft was given step climb by VIJU ATC and the subject flight was required to contact Northern Control. Due to adverse weather around

VIJU and the area near Bikux & Pathankot (VIPK), there were other aircraft also in communication with Northern Control requesting weather deviation. There was a lot of confusion whether the flight was cleared to FL 150 or not, which was finally resolved and the clearance given to the flight was FL150. In addition to avoiding severe weather, flight crew was also battling ATC communication between VIJU ATC & Northern Control.

During regular operations into Northern Sector, it is observed that flight crew is required to monitor multiple radio frequencies at the same time and coordinate climb/descent with different ATC units. This increases the workload for the flight crew exponentially and also increases the possibility of errors.

Further, being a mountainous region there can be a huge difference between the Aerodrome QNH and the Area QNH. In case the flight crew does not remember to change from Aerodrome QNH to Area QNH during climb or vice versa during descent due to distraction (mainly due to radio telephony congestion or weather), there can be a huge variation between the indicated altitude with an altimeter set to Aerodrome QNH and the other set to Area QNH.

□ Extract of CVR defining the moments of confusion regarding climb to FL 150:

01:07:56	P2	Northern Vistara b11
01:08:00	Tower	Vistara 611
01:08:02	P2	How do you read sir Vistara 611
01:08:04	Tower	Vistara 611 jammu
01:08:05	P1	Go ahead sir
01:08:06	Tower	I advised you to stop climbing 150
01:08:09	P1	We are maintaining 150
01:08:11	Tower	Indicated is 155
01:08:14	P1	We are on 995 we are at 150
01:08:16	P2	Northern Vistara 611 reading you 5
01:08:20	Tower	Confirm you are with Northern
01:08:21	P1	Affirm
01:08:22	Tower	You climb without our clearance traffic is holding over Jammu at 16000ft how can you climb
01:08:29	P2	We were cleared by Jammu sir to level 15000ft to maintain 15000
01:08:43	Tower	Vistara 611 contact northern
01:08:56	P1	Northern this is Vistara 611 we were cleared by Jammu to climb 15000 we are with you now and we have been asked to change over and what altitude you want us to maintain
01:09:12	P1	Jammu Vistara 611 requesting further climb

As can be seen from above extract, in view of the above mentioned reasons, there was a lot of confusion between ATC and the flight crew, when the

aircraft had missed approach at Jammu and was climbing. This has been the reason of Air Miss and serious incidents earlier also.

## **2.4 Circumstances Leading to the Incident**

CFP of the flight shows that one single alternate was filed with ATC and fuel uplifted was also for only one alternate (VIAR). However at time 0640 UTC, PF signed and accepted the “Transit Briefing Sheet” showing two alternates; 1<sup>st</sup> alternate as Amritsar (VIAR) and second alternate as Delhi (VIDP). Notwithstanding on board fuel only catered for a single alternate of Amritsar (VIAR).

Flight crew accepted the “Transit Briefing Sheet” with Jammu (VIJU) weather of 0430 UTC, Amritsar (VIAR) weather of 0600 UTC& Delhi weather of 0600 UTC. During discussions with the flight crew, they were asked if they have observed the weather near Jammu, Bikux&Pathankot at the time when they were inbound from Delhi to Srinagar. Both mentioned that there was no significant weather observed. However, both of them confirmed that they had not received current Jammu weather prior to take-off. This was taken after getting airborne via ACARS and was a regular feature.

Flight crew did not realize how fast thunderstorms develop in the “Northern Sector” (Mountainous sectors) and the severity of the weather. Also one needs to keep in mind the narrow corridor which is available between VIJU-Bikux-VIPK-VIAR, and as such there is hardly any space to seek weather deviations. This leads to the point of significance of current METAR being made available to the flight crew before departure by the operator.

IOCC (Central Flight Dispatch) prepared the “Transit Briefing Sheet” which indicated the need of a second alternate as per the Flight Dispatcher (same was confirmed during discussion). This should have given an idea to PF to uplift fuel for second alternate as well, with option of various alternates. The additional fuel on board would have ensured that the flight did not enter into a “Fuel Emergency” situation at the time they diverted to Amritsar (VIAR).The Flight dispatcher confirmed that the CFP was not amended to avoid delay.

After getting airborne from Srinagar, the sector is far too short and flight crew is normally busy achieving the required altitude by MESAR. The RT congestion is very high & is difficult as flight crew have to monitor multiple radio frequencies, follow concept of “Area QNH”, and keep a track of the incoming traffic. In addition to these, if adverse weather is also there, the workload becomes really high. That was the situation on the day of incident.

Flight crew after receiving Jammu (VIJU) weather commenced descent and wanted to proceed outbound directly for the VOR approach, however, the flight was high on profile due to which it had to carry out few orbits and proceed outbound for the VOR approach. During approach, 40 knots of Tail Winds were experienced and PF decided to discontinue the approach.

After discontinuing approach, the flight crew set course towards Srinagar. On being informed by Jammu ATC that “Hail” is predicted in Srinagar, PF decided to divert to their 1<sup>st</sup> Alternate Amritsar. Due to bad weather in east of Jammu airport and International Border South of Jammu airport, PF decided to initially fly North-North East (Heading 060 degrees) and continued on this heading to avoid adverse weather. The weather was severe and instead of diversion maintaining FL170, PF decided to climb to FL 330, which they subsequently changed to FL 310. This lateral deviation and climb to FL310 due to weather caused the flight to consume additional fuel.

The aircraft started to turn right in order to regain course towards Pathankot & Amritsar. Around FL270, “Master Caution: L(R) Low Fuel Pressure” came ON. En-route, the aircraft experienced severe weather & turbulence. (However aircraft going through severe to extreme turbulence was not reported by the flight crew upon landing at Amritsar. This probably was done to avoid technical grounding of the aircraft in Amritsar and is a clear violation of DGCA CAR Section 5, Series C, Part 1). Approach for Amritsar was initiated and Amritsar Radar was contacted. Descent clearance was given from FL250 to FL160. “Minimum fuel status” was informed to ATC Amritsar. After re-checking FOB, and rechecking FMGC destination EFOB, “Minimum Fuel” was changed to “Mayday Fuel” by flight crew.

Close to GS interception, ECAM message FUEL L(R) Pump LO PR 1+2 came ON. At that time, FOB was about 550 Kgs. The aircraft thereafter landed safely at Amritsar with 460 kgs. of fuel remaining.

### **3 CONCLUSION**

#### **3.1 Findings**

1. The aircraft was having a valid Certificate of Registration and Certificate of Airworthiness. The ARC was also valid.
2. All maintenance schedules, mandatory modifications and checks were carried out as per the requirements. There were no defects / snags pending rectification.
3. The flight crew fulfilled all requirements to operate the flight.
4. Flight crew (PIC) accepted the "Transit Briefing Sheet" with two alternates; 1<sup>st</sup> as Amritsar (VIAR) and second as Delhi (VIDP).
5. Fuel uplifted catered only for 1<sup>st</sup> alternate.
6. Flight crew did not update themselves with latest METAR & TAFOR.
7. Instead of maintaining diversion as per Flight Plan i.e. FL170 the aircraft climbed to FL310 due to weather which entailed additional fuel burn.
8. Flight crew experienced heavy RT congestion as other aircraft were also on the same frequency (Northern Control) and was required to monitor multiple VHF radio frequencies.
9. Flight crew did not inquire from ATC regarding Chandigarh (VICG) weather.
10. After the flight, PF did not report the severe to extreme turbulence experienced during flight.

In addition to the above findings, root cause analysis of the incident was carried out particularly taking into account the systemic deficiencies in the organization(s), unsafe supervision, preconditions to the unsafe act and lastly the unsafe act itself.

**(A) Organisational Factors**

**(i) DGCA**

As per the Aircraft Act 1934, the Director General of Civil Aviation or any other officer specially empowered by the Central Government shall perform the safety oversight functions in respect of matters specified in the Act. It is responsible for regulation of air transport services to/from/within India and for enforcement of civil air regulations, air safety and airworthiness standards. In order to carry out the above duties and functions, DGCA issues Civil Aviation Requirements (CAR) under various sections and Section 8 deals with “Aircraft Operations”. Under Series ‘O’ of Section 8 is issued a CAR on “Operation of Commercial Air Transport – Aeroplanes”. Under Para 4.3.6.1 of this CAR are given fuel requirements which mention that an aeroplane shall carry a sufficient amount of usable fuel, to complete the planned flight safely and to allow for deviations from the planned operation. The said CAR available on DGCA website was issued on 8<sup>th</sup> July, 2011 and the last revision was on 30<sup>th</sup> October 2018.

The requirements laid down have been discussed in the earlier analysis and as brought out, the operator has in their Manuals mentioned that the above said CAR will be followed but in the subsequent paragraphs of the Manuals on fuel planning utilized the gaps/ ambiguity in the CAR for taking minimum fuel on board.

After the subject incident, the very next day DGCA had issued an ASC 3 of 2019, on fuel planning for the flights. The circular though does not have any legal binding on the operators. Requirements of issuing a binding circular are laid down in AC 1 of 2010. However, it has identified that the incident occurred as

- Fuel carried on-board did not cater for second alternate
- During flight, crew while deciding the alternate for diversion have not considered the nearest safe landing airport.
- Crew did not declare MINIMUM FUEL to ATC.
- After a crew has declared a MINIMUM FUEL, ATC has given additional clearances resulting in further depletion of fuel.

However, there is no mention of what should be done and how the action will obviate the occurrences in future. Otherwise also, it is agreed that that there have been number of such occurrences, then what actions were suggested by DGCA under SSP (It qualifies for one of the top most Safety Performance Indicators) or mitigation actions taken by the operator under SMS.

Be that as it may, the CAR on the subject should have been revisited by now and root cause of the non following of the provisos of CAR be fixed by clarifying the ambiguous portion. In addition, the existing reasons which have been brought out as a result of reactive (investigation) process, should have been detected during the surveillance inspections carried out by the Flight Operations Inspectors or during scrutiny of the Manuals and SOPs of the operator.

Further in the above mentioned ASC 03 of 2019, it is mentioned that “After a crew has declared a MINIMUM FUEL, ATC has given additional clearances resulting in further depletion of fuel”. In the subject incident, the ATC units were “Defence Establishments”. It is not understood as to how the issuance of ASC will fix the problem.

**(ii) Operator**

- Putting subtle pressure on flight crew to divert only to “Suitable Alternates” which company preferred due to availability of ground handling.
- Not able to provide the flight crew with the latest weather and satellite picture of the destination airport.
- Not revising the CFP (may require additional fuel) in view of non-availability of latest weather and satellite picture.

**(B) Unsafe Supervision**

- Inadequate Flight Following by IOCC.
- No monitoring/ supervision of non-availability of the latest weather for destination Jammu (VIJU) before departure from Srinagar.
- Not briefing the PF to uplift fuel for second alternate as defined in “Transit Briefing Sheet” especially when destination weather was not provided to PF and that too during “Monsoon Months”.

**(C) Pre-Conditions to the Unsafe Act**

- Pre-conceived notion in the mind of flight crew to divert to Suitable Alternate (because of conscious ambiguity in definition that in case the situation demands PF is authorized to divert to an “Acceptable Airport”).
- Not mitigating the risks associated with non compliance of requirement of latest weather (basic norm)

**(D) Unsafe Act**

- PF not being aware (situational) of the weather development near Bikux and Pathankot in spite of operating Delhi to Srinagar just prior to operating Srinagar to Jammu.
- PF not insisting for latest weather of destination Jammu (VIJU).
- PF accepting “Transit Briefing Sheet” with second alternate as Delhi but not uplifting fuel till Delhi as the 2<sup>nd</sup> alternate in spite of not having latest destination weather.
- PF not checking the en-route weather for diversion airport Amritsar (VIAR) on weather radar while en-route to Jammu (VIJU). Had it been so, revised fuel for diversion could have been planned and early diversion could have been initiated instead of diverting exactly at “Minimum Diversion Fuel” (MDF). The flight subsequently had to take additional lateral diversion to avoid weather which added to additional fuel burn.
- PF decision to climb to FL 310 instead of FL 170 added to additional fuel burn.
- PF not checking Chandigarh weather and not considering diversion to Chandigarh but continuing diversion to Amritsar (Suitable alternate).

**3.2 Probable Cause of the Incident**

The incident occurred because of the following: -

- The operator not addressing the issue of current weather being made available to flight crew before departure of flight and ineffective flight following.
- Tacit understanding on the part of flight crew to divert only to Suitable Alternates because of ambiguous documentation.



- PF not exercising his authority and not asking for latest Jammu weather
- PF not uplifting fuel for second alternate as mentioned on the Transit Briefing Sheet.
- Flight crew not anticipating additional fuel requirement due to expected weather deviations in monsoon months.
- Crew not updating themselves with the en-route weather to VIAR due to reduced Situational Awareness.

#### **4 SAFETY RECOMMENDATIONS**

- 4.1 DGCA must advise all scheduled operators to carry enough fuel sufficient to fly till the second alternate (longest alternate in terms of fuel) in case the latest destination weather is not available, i.e. METAR for the preceding 30 minutes before departure not available for Destination airport or 1<sup>st</sup> Alternate airport. Further DGCA CAR on the subject should be revised to cater for extra fuel for the flights of less than 60 minutes duration particularly when the latest weather at destination or 1<sup>st</sup> alternate is below the requirements.
- 4.2 All operators must educate the flight crew about the difference between Suitable alternate and Adequate alternate and PF should have the authority to divert to an Adequate airport if the situation so demands. No action should be considered against flight crew if they have decided to divert to an adequate airport and not a Suitable alternate (which may be the preference of the operator).
- 4.3 Vistara should clarify the significance of 1<sup>st</sup> & 2<sup>nd</sup> Alternate provided on the Transit Briefing Sheet.
- 4.4 IOCC/ Flight Dispatch proactively must provide fuel on CFP till the second alternate in case the latest weather of 30 mins before departure of any flight is not available.
- 4.5 All operators must ensure that the latest weather report, METAR, Satellite Picture & TAFOR are made available to flight crew before departure from any transit station.
- 4.6 All operators must follow DGCA CAR Section 5, Series C, Part 1 requirements and the matter of experiencing severe to extreme turbulence in

flight must be reported after landing in the aircraft "Tech-Log" so the aircraft can be inspected before the next flight for its structural integrity.

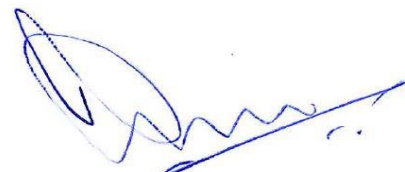
- 4.7 All operators should educate their employees on developing good "Safety Culture" and this aspect may be covered in the annual recurrent training for flight crew, engineers & cabin crew.
- 4.8 DGCA should remove the ambiguity from the existing CAR on the subject through an amendment and mention in unequivocal manner the requirement of carriage of additional fuel to hold over destination in case of air traffic congestion due to weather or any other specified reason. This fuel must be separate from Contingency, Alternate Fuel, 30 mins Holding Fuel over Alternate and Final Fuel. This fuel may be a part of "Discretionary Fuel".
- 4.9 Safety study may be carried out by DGCA in association with Airports Authority of India and Indian Air Force for revisiting the existing procedures and recommend revised coordination procedure among various ATC units in the Northern sector to reduce the workload of flight crew. This will ensure that flight crew monitor only one VHF frequency at any given time as per the International best practice and thereby reduce the threat of Air Miss and unauthorized deviations.



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



(Shilpy Satiya)  
Investigator



(Capt. Dhruv Rebbapragada)  
Investigator

Date: 29.10. 2020

Place: New Delhi