سلطنة عُمان
وزارة النقل والاتصالات وتقنية المعلومات
Sultanate of Oman
Ministry of Transport, Communications and Information Technology

Oman Transport Safety Bureau

Preliminary Report

OTSB Case File No: AIFN-002/02/2024

B777 TCAS Resolution between Etihad Airways-Boeing B777 and Qatar Airways-A320 in the Muscat FIR

Operator: Etihad Airways
Make and Model: Boeing 777-300(ER)
Nationality and Registration Marks: United Arab Emirates, A6-ETP

Operator: Qatar Airways
Make and Model: Airbus A320
Nationality and Registration Marks: State of Qatar, A7-AHP

Location of the Occurrence: Muscat FIR, 20°32'58.39''N059°59'05.57E
State of Occurrence: Sultanate of Oman
Date of Occurrence: 10th February 2024, 23:55 UTC
Date of Publication: 10 March 2024

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Purpose of the Investigation

The investigation was conducted by Oman Transport Safety Bureau pursuant to Civil Aviation Law (CAL) 76/2019 Chapter 10, and in compliance with the Civil Aviation Regulation CAR-13 -, Sub Part CAR 13.070: Instituting and Conducting of Investigations as State of Occurrence, Accidents or Incidents in the Sultanate of Oman.

The sole objective of the investigation is to prevent future aircraft accidents and incidents and not to apportion blame or liability. Oman Transport Safety Bureau issued this preliminary Report in accordance with the National and International standards, and Industry best practice.

Unless otherwise mentioned, all times in this Report are UTC time. Local Time in The Sultanate of Oman is UTC plus (+) 4 hours. Photos and figures used in this report were taken from different sources and adjusted from the original for the sole purpose of improving clarity of the report.

This Report will be publicly available at: http://www.mtcit.gov.om

Abbreviations

AAIS	Air Accident Investigation Section
AMSL	Above Mean Sea level
AFL	Actual Flight Level
AAI	Air Accident Investigations
AIP	Aeronautical Information Publication
ANSIC	Air Navigation Service Incident Coordination
APW	Area Proximity Warning
ATC	Air Traffic Control
ATCO	Air Traffic Controller
AWY	ATC Airway
BEA	Bureau d'enquêtes et d'analyses pour la sécurité de l'aviation civile
CAA	Civil Aviation Authority
CAL	Civil Aviation Law
CFL	Cleared Flight Level
CR	Central Radar
CVR	Cockpit Voice Recorder
ETD	Etihad Airways
FIR	Flight information Region
FL	Flight level
FMS	Flight Management System
FO	First Officer
FPL	Flight Plan
FPM	Feet Per Minute
Ft	Feet
GCAA	General Civil Aviation Authority
ICAO	International Civil Aviation Organization
IIC	Investigator-in-Charge
LB	Level Burst

LPC	License Proficiency Check
MATSOP	Manual of Air Traffic Services Operational Procedures
MC	Medium Term Conflict Detection
MCT	Muscat
MSAW	Minimum Safe Altitude Warning
NM	Nautical Mile
NTSB	National Transportation Safety Board
OOMS	Muscat International Airport
OPC	Operator Proficiency Check
OTSB	Oman Transport Safety Bureau
PF	Pilot Flying
PM	Pilot Monitoring
QAAI	Qatar Air Accident Investigation
QTR	Qatar Airways
RA	Resolution Advisory
RDR	Radar
RO	Route off
ROC	Rate of climb
ROD	Rate of descent
RVSM	Reduced Vertical Separation Minima
RPA	Radioactive Protection Advisor
SEP	Separation
SOP	Standard Operating Procedures
STCA	Short Term Conflict Alert
SQK	Squawk
SQ	SSR Code Conformance alert
TA	Traffic Advisory
TCAS	Traffic Collision Avoidance system

Indra System Safety net Alert Abbreviation		
STCA	Short Term Conflict Alert	"Yellow" Prediction "Red" Violation
AW	Minimum Safe Altitude Warning (MSAW)	
W	RVSM	
LB	Level Burst	"Yellow" CFL not matching AFL "Red" CFL not matching Mode-S flight level
HG	Heading conformance	
MC	Medium Term Conflict Detection	
RO	Route off	
SQ	SSR Code Conformance alert	

Synopsis

Oman Transport Safety Bureau (OTSB) was notified of the occurrence by the Sultanate of Oman Civil Aviation Authority (CAA) -Directorate General of Air Navigation (DGAN)- Air Navigation Service Incident Coordination (ANSIC) through OTSB email on 11th of February 2024 at 12:34 Local Time.

The serious incident involved Etihad Airways ETD455 aircraft with registration marks A6-ETP, Boeing 777-300 (ER) and Qatar Airways QTRN71 Registration marks A7-AHP, Airbus 320.The aircraft entered Muscat Flight Information Region (FIR) as QTRN71 was maintaining FL350 flying on an easterly direction and reciprocal traffic ETD455 was maintaining FL340 flying on a westerly direction on (bidirectional) Airway P570 between waypoints KITAL and GOLNI. Air Traffic Controller (ATCO) cleared QTRN71 to descend from FL350 to FL330 which is through the level of ETD455 maintaining FL340. At 23:55:39 UTC as QTR71N was descending through FL341, with a rate of descent of 400 feet per minute (fpm) and ETD455 was maintaining FL340, both aircraft were at FL340 head-on, with a closing distance of 7.38 NM between them, the Traffic Collision Avoidance System and Resolution Advisory TCAS-RA were activated by both aircraft. By the time the controller instructed both QTRN71 and ETD455 to turn right 50 degrees to avoid the conflict, both pilots reported TCAS advisory. Then both aircraft reported TCAS RA and applied the TCAS-RA avoidance manoeuvre. ETD455 resumed FL340 once it was clear of conflict and QTRN71 continued to descend to FL310 as instructed by ATCO. Thereafter, both aircraft continued to their destinations and landed safely without any further incident.

The OTSB instituted and decided to conduct an investigation and classified the occurrence as a serious incident requiring investigation. The following parties were notified:

- State of Operator and Registry United Arab Emirates General Civil Aviation Authority- Air Accident Investigations (GCAA-AAI)
- State of Operator and Registry Qatar Air - Accident Investigation (QAAI)
- State of Design and Manufacturer of Boeing 777-300ER United States of America National Transportation safety Board (NTSB)

- State of Design and Manufacturer of Airbus A320 France-Bureau d'enquêtes et d'analyses pour la sécurité de l'aviation civile French Safety Investigation Authority (BEA)
- International Civil Aviation Organization (ICAO)
- Sultanate of OMAN Civil Aviation Authority (CAA)

In line with OTSB Investigation procedures, the Director of OTSB appointed an Investigator-In-Charge (IIC) and an investigation team to assist the IIC with the investigation. Bureau d'enquêtes et d'analyses pour la sécurité de l'aviation civile (French Safety Investigation Authority -BEA)-France did not appoint an accredited representative. The following parties are involved in the investigation by appointing accredited representatives and advisor to the investigation: -

- National Transportation Safety Board (NTSB) of United State of America Boeing: Organization responsible for type design and final assembly of the aircraft.
- State of Operator, and Registry United Arab Emirates General Civil Aviation Authority- Air Accident Investigations (GCAA-AAI)
- State of Operator and Registry Qatar Air Accident Investigation (QAAI)

After the investigation is completed, OTSB will release and publish the Final Report. The Final Report will be made public at the below link:
http://www.mtcit.gov.om.

1. Factual Information.

1.1. History of the Flight.

1.1.1. On the 10th February 2024, Etihad Airways with registration marks A6-ETP, a Boeing 777-300 ER departed from Sydney Kingsford Smith Airport (YSSY) on an international scheduled flight ETD455 with intended destination Abu Dhabi International Airport (OMAA). While Qatar Airways with a registration marks A7-AHP, an Airbus A320-200 on the same day departed from Hamad International Airport (OTHH) on an international scheduled flight QTR71N with intended destination Valena International Airport (VRMM).

1.1.2. Both aircraft had a flight plan through Muscat flight information region (FIR) on a bidirectional airway P570 where QTR71N entered MCT airspace at FL350 eastbound from waypoint BONAM to KITAL and ETD455 entered MCT airspace at FL340 westbound from waypoint KITAL to SODEX. The incident occurred over Muscat FIR, East Sector during night time between waypoints KITAL and GOLNI. At the time of the incident, the ATCO controlled 15 aircraft in the east sector.

1.1.3. At 23:47:30, QTR71N established contact with the ATCO while maintaining FL350 and was radar identified. ETD455 established contact with Muscat Control at 23:50:00 and was given to squawk (SQK) 4026 and instructed to continue flight plan route after being radar identified at FL340. At 23:52:03 after crossing waypoint TAVKO, ATCO called QTR71N however, there was no response from the QTR71N.

Figure1: QTR71N passed waypoint TAVKO maintaining FL350 and ETD455 over KITAL maintaining FL340

1.1.4. At 23:53:01, ATCO called QTR71N but there was no response. Again, at time 23:53:18, ATCO called QTR71N with a clearance to descend to FL330, QTR71N read back and acknowledged. At 23:53:33 QTR71N called ATCO to confirm if FL330 is going to be the final level, and ATCO replied negative expect FL310 once clear from traffic and to initially descend to FL330.The QTR71N acknowledged the descend clearance to FL330 and to expect FL310. At 23:53:45 – ATC Radar MC (Medium term conflict detection) warning was activated between QTR71N and ETD455 and at 23:53:53 the yellow STCA (Short Term Conflict Alert) was activated between QTR71N on descent passing through FL348 with a ROD 500 fpm and ETD455 maintaining FL340.

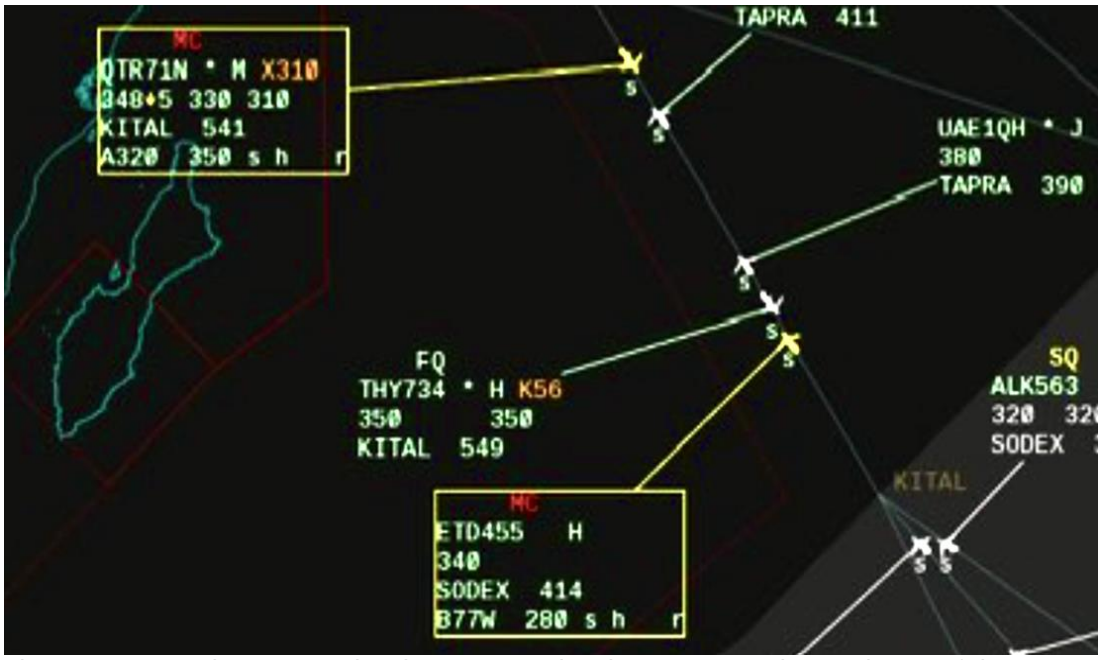

Figure 2:ATC Radar Screen showing QTR71N leaving FL350 on descend -rate of descent 500ft fpm to FL330 and ETD455 maintaining FL340 with MC and STCA both activated.

1.1.5 At 23:55:24, ETD455 maintaining FL340, reported traffic ahead while QTR71N was descending through FL341, ROD 400 fpm. At 23:55:30, ATCO instructed QTR71N to immediately turn to the right 50 degrees.

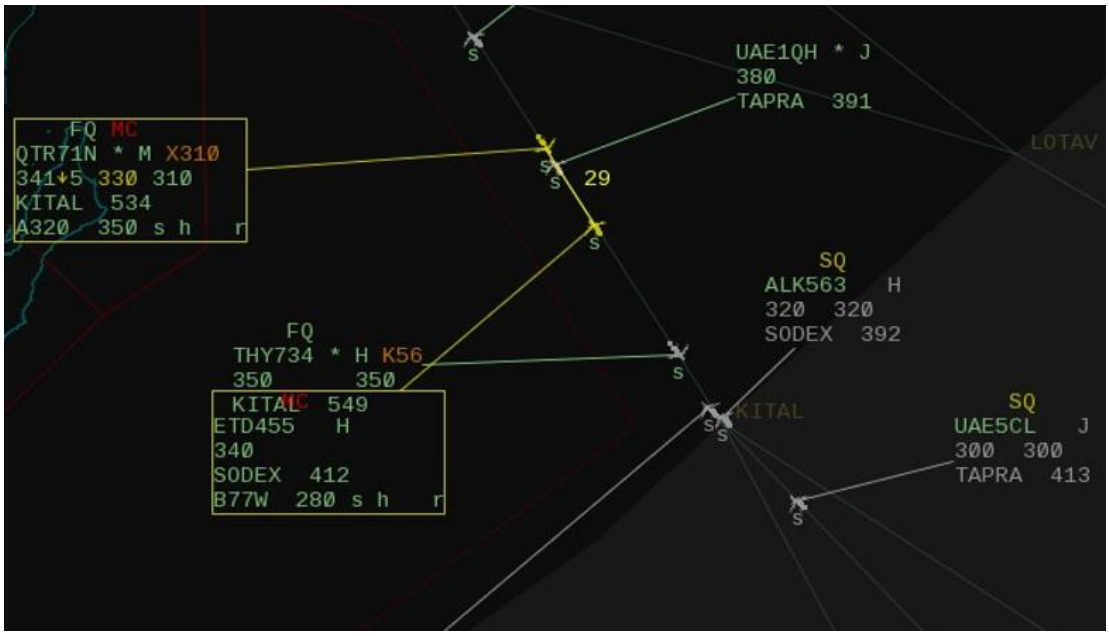

Figure 4: QTR71N at FL341 on descent to FL330 ROD 500 fpm and ETD455 maintaining FL340 with a separation of 29 seconds head-on closing rapidly.

Figure 5: QTR71N at FL341 descending to FL330 and ETD455 at FL340 with a separation of 13 seconds head-on closing rapidly.

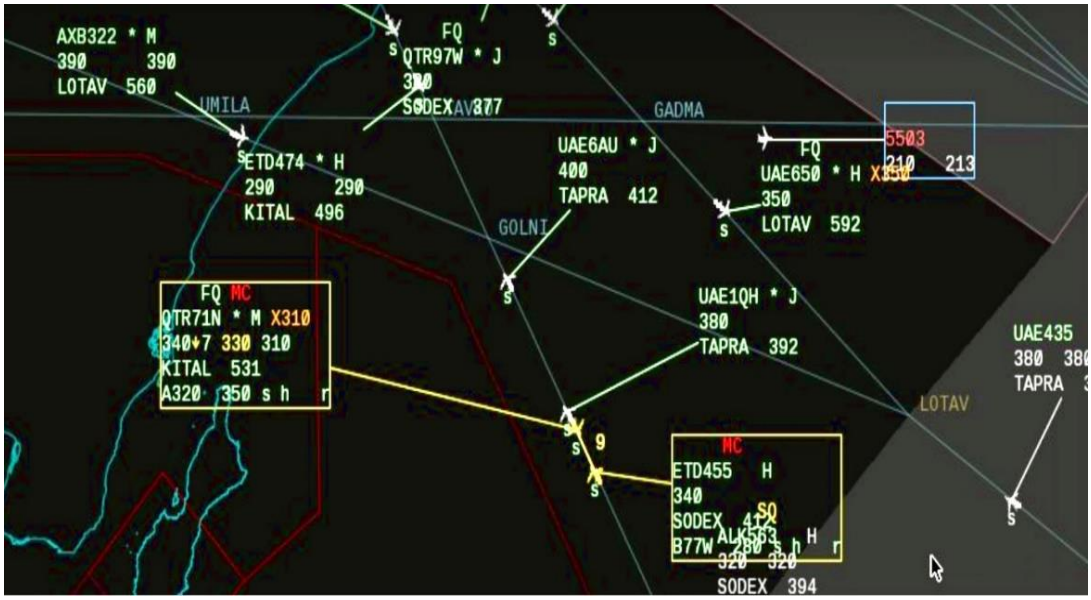

Figure 6 :QTR71N and ETD455 both at FL340, with a distance of 7.38 NM and 9 seconds head-on closing rapidly.

1.1.6. At 23:55:41, ATCO instructed ETD455 to immediately turn right 50 degrees while QTR71N was descending through FL340, ROD=700 fpm and ETD455 was climbing through FL342, ROC=1200 fpm. The distance between both traffic was 9 seconds -6.36 NM head-on.

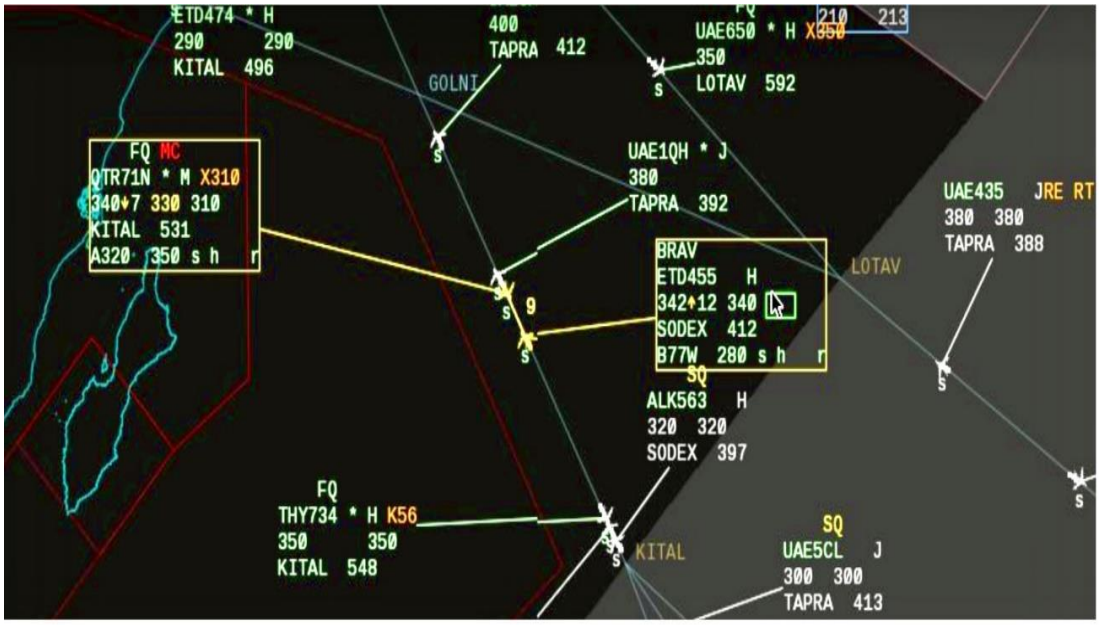

Figure 7: QTR71N descending through FL340 for FL330 ROD 700 fpm and ETD455 climbing thru FL342 ROC 1200 fpm.

1.1.7 At 23:55:48 ETD455 readback that they are turning right 50 degrees and performing TCAS RA.23:55:51(RED STCA was activated between QTR71N on descent passing through FL337, ROD of 1800 fpm and ETD455 climbing through FL344, ROC1900 fpm. The distance between the two aircraft was 3.22 NM.

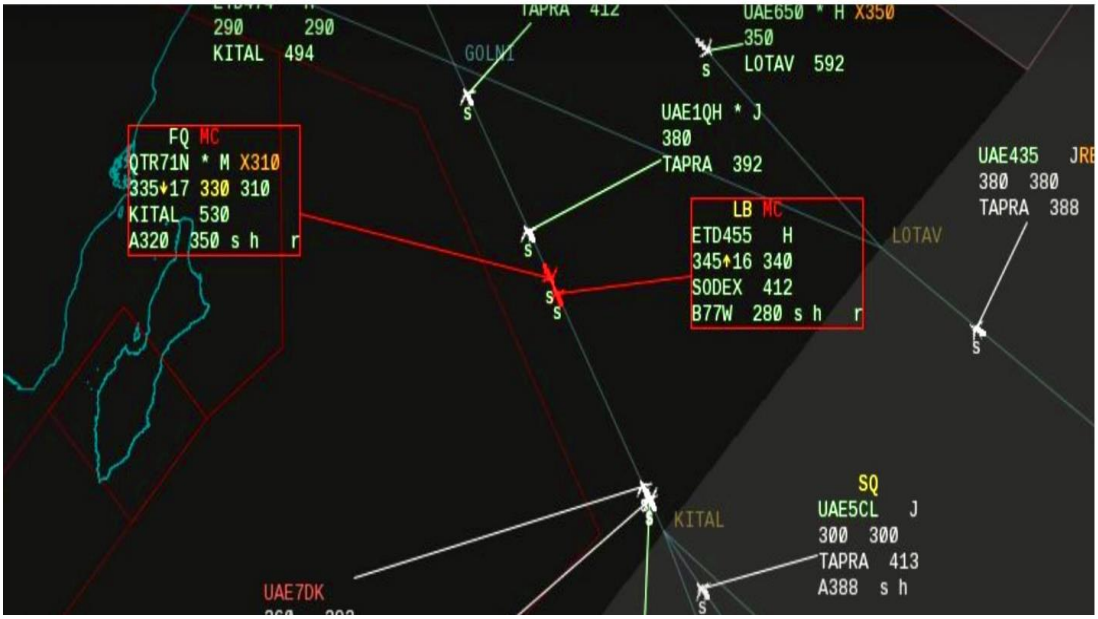

Figure 8 QTR71N descending through FL335, ROD1700 fpm and ETD455 climbing through FL345 ROC of fpm with a distance of 2.16 NM and 5 seconds with a vertical separation of 1000ft.

1.1.8 ETD455 resumed FL340 once it was clear of conflict and QTRN71 continued to descend to FL310 as instructed by ATCO. Both aircraft continued to their destinations and landed safely without any further incident.

1.2. Injuries to Persons ETD455.

Injuries	Pilot	Cabin Crew	Passengers	**Total on Board**	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	-	-	-	-
No Injuries	4	12	349	**365**	-
Total	**4**	**12**	**349**	**365**	-

Note: Other, means people on ground.

Injuries to Persons QTRN71

Injuries	Pilot	Cabin Crew	Passengers	**Total on Board**	Other
Fatal	-	-	-	-	-
Serious	-	-	-	-	-
Minor	-	**-**	-	**-**	-
No Injuries	4	8	253	**365**	-
Total	**4**	**8**	**253**	**365**	-

Note: Other, means people on ground.

1.3. Damage to Aircraft.

1.3.1 No damages were reported.

1.4. Other Damage.

1.4.1 No other damages were reported

1.5. Personnel Information:

1.5.1 **Captain ETD445**

Nationality	Thai		
Medical validity	Expiry: 31/12/2024	Licence type	Airline Transport
Licence validity	Expiry: 24/08/2024	Type endorsed	Yes
Ratings	Instrument rating, Multi-Engine, B787, MPA, B777		
Latest LPC	22/01/2024	Latest OPC	07/12/2023

Flying experience:

Total hours	10215.5
Last 24 hrs	Not applicable
Last 7 days	13:32
Last 30 days	60:57
Last 90 days	204:09

Note: No flying hours in the last 24 hours Prior to the incident, preceding the flight as the crew was on crew rest period.

1.5.1.1 The PIC was initially issued an Airline Transport Pilot license (ATPL) on 22ndJune 2011. The license was valid with an expiry date of 24th August 2024.

1.5.1.2 The PIC was issued a Class (one) 1 medical certificate on 21st November 2023 with an expiry date of 31st December 2024. The last medical assessment date was conducted on 20th November 2023 with no limitations (VNL).

1.5.2 First Officer (FO) ETD445

Nationality	Czech		
Medical valid	Expiry: 13/07/2024	Licence type	Airline Transport
Licence valid	Expiry: 18/08/ 2030	Type endorsed	Yes
Ratings	Instrument rating, Multi-Engine, B777, B787, MPA		
Latest LPC	02/02/2024	Latest OPC	14/02/2024

Flying experience:

Total hours	6645.5
Last 24 hrs	Not applicable
Last 7 days	13:46
Last 30 days	85:24
Last 90 days	254:19

1.5.2.1 The FO was initially issued with the license on 28th September 2014 and a validation was conducted on 31st March 2022 with an expiry date of 18th August 2030.

1.5.2.2 The FO was issued a Class 1 medical certificate on 19th June 2023 with an expiry date of 13th December 2024. The last medical assessment date was conducted on 16th June 2023.

1.5.3 **Captain (PIC) QTR71N:**

Nationality	Indian		
Medical validity	Expiry: 14/06/2024	Licence type	Airline Transport pilot licence
Licence validity	Expiry: 31/01/2025	Type endorsed	Yes
Ratings	Instrument rating, Multi-Engine, A320		
Latest LPC	22/01/24	Latest OPC	23/01/24

Flying experience:

Total hours	8235:47
Last 24 hrs	10:49
Last 7 days	19:44
Last 30 days	46:49
Last 90 days	152:51

1.5.3.1 The license initially issued on 30th September 2014 with an expiry date of 06th April 2030.

1.5.3.2 The Captain was issued a Class 1 medical certificate on 14th June 2023 with an expiry date of 14th June 2024. The last medical assessment date was conducted on 14th June 2023. The medical certificate had a limitations (VML) to wear corrective distant, intermediate and near vision and carry spare set spectacles.

1.5.4**. First Officer (FO) QTR71N**

Nationality	Brazilian		
Medical validity	Expiry: 24/12/2024	Licence type	Commercial pilot licence
Licence validity	Expiry: 31/12/2024	Type endorsed	Yes
Ratings	Instrument rating, Multi-Engine, A320		
Latest LPC	17/12/2023	Latest OPC	18/12/2023

Flying experience:

Total hours	4234:51
Last 24 hrs	1:29
Last 7 days	9:24
Last 30 days	66:04
Last 90 days	136:47

1.5.4.1 The FO was issued with license on 22nd January 2023 and a validation was conducted on 17th December 2023 with an expiry date of 31st December 2024.

1.5.4.2 The FO was issued a Class 1 medical certificate on 13th November 2023 with an expiry date of 24th December 2024. The last medical assessment date was conducted on 13th November 2023.

1.5.5 **Air Traffic Controller:**

Nationality	Omani		
Medical valid	13/10/2025	Licence type	AIR TRAFFIC CONTROLLER
Licence valid	31/03/24	Type endorsed	YES
Ratings	ACC RDR	LPR	LEVEL 4

1.5.5.1 The ATCO license was issued on 22nd March 2009. The license proficiency check was conducted on 20th November 2023 with an expiry date of 31st March 2024.

1.5.5.2 ATCO was also issued with English language proficiency rating LEVEL 4 on 22nd March 2009, tested and renewed on 13th October 2022 with an expiry date of 13th October 2025.

1.5.5.3 The ATCO medical was assessed on 21st February 2023 and issued a Class three (3) medical certificate on 23rd February 2023 with an expiry date of 24th February 2024.

1.5.5.4 The ATCO was issued with ratings to allow operating as a controller at OOMM as Area RDR/INDRA. The last Air Traffic Control Rating Proficiency check was conducted on 20th November 2023.

1.6 Aircraft Information:

1.6.1 Airframe Information (ETD445)

Manufacturer/Model	The Boeing Company Boeing 777-3FXER	
Serial Number	41699	
Year of Manufacture	2013	
Total Airframe Hours (At Time of Incident)	50119:06	
Last Inspection (Date & Hours (TSN))	10 February 2024	50119:06
Last Inspection Airframe Cycles (CSN)	6933	
Hours Since Last Inspection	TBA	
Type of inspection preformed	Transit Check	
CRS Issue Date	10 February 2024	
C of A (First/initial Issue Date)	25 June 2013	
C of A (Expiry Date)	24 June 24	
C of R (Issue Date) (Present Owner)	25 June 2013	
Type of Fuel Used	Jet A1	
Operating Category	Transport (passenger)	
Previous Accidents	NIL	

Engine 1:

Manufacturer/Model	GE/GE90-115B
Serial Number	907472
Part Number	GE90-115BG03
Hours Since New	30283:40
Hours Since Overhaul	11560:42
Hours since last shop visit	11560:42
Cycles Available Before Next Shop Visit	2165
Oil type	BP/Eastman Turbo Oil 2197

Engine 2:

Manufacturer/Model	GE/GE90-115B
Serial Number	907403
Part Number	GE90-115BG03
Hours Since New	44357:12
Hours Since Overhaul	22239:49
Hours since last shop visit	22239:49
Cycles Available Before Next Shop Visit	628
Oil type	BP/Eastman Turbo Oil 2197

1.6.2 Aircraft Information (QTR71N):

Manufacturer/Model	Airbus A320-232
Serial Number	4858
Year of Manufacture	2011
Total Airframe Hours (At Time of Incident)	49091:31 (as of 10 Feb)
Last Inspection (Date & Hours (TSN))	Date 13 December 2023 Hours 48438
Last Inspection Airframe Cycles (CSN)	Last A & C Check Date 13 December 2023 Cycles 13733
Hours Since Last Inspection	12970:16
Type of inspection preformed	Combined A & C Check
CRS Issue Date	13 December 2023
C of A (First/initial Issue Date)	04 October 2022
C of A (Expiry Date)	Nil
C of R (Issue Date) (Present Owner)	15 March 2020 JPA No. 146 Co., Ltd.
Type of Fuel Used	Jet A1
Operating Category	Commercial Air Transport Operation (CAT)
Previous Occurrences	Attached list of TORs related to A7-AHP

Engine 1:

Manufacturer/Model	V2500
Serial Number	V15977
Part Number	V2527-A5
Hours Since New	41389:41
Hours Since Overhaul	41389:41
Hours since last shop visit	486:13
Cycles Available Before Next Shop Visit	Estimated date before next shop visit 17 January 2029 based on the MTBER
Oil type	EASTMAN Turbo Oil 2197

Engine 2:

Manufacturer/Model	V2500
Serial Number	V15902
Part Number	V2527-A5
Hours Since New	43888:31
Hours Since Overhaul	43888:31
Hours since last shop visit	486:13
Cycles Available Before Next Shop Visit	Estimated date before next shop visit 17 January 2029 based on the MTBER
Oil type	EASTMAN Turbo Oil 2197

1.7 Meteorological Information:

1.7.1 To be discussed in the final report.

1.8 Aids to Navigation.

1.8.1 Both aircraft were equipped with standard navigational equipment as approved by the GCAA and Qatar CAA. There were no records indicating that the navigation system was unserviceable prior to the serious incident.

1.9 Communications.

1.9.1 Both aircraft were equipped with a standard communication system as approved by the United Arab Emirates GCAA and Qatar CAA. No defects that could render the communication system unserviceable were recorded before the flight.

1.10 Aerodrome Information.

1.10.1 Departure Aerodrome (ETD455):

ICAO designation	YSSY (Kingsford Smith, Sydney, NSW, Australia)		
Aerodrome co-ordinates	S33°56.8' E151°10.6'		
Aerodrome elevation	21feet (ft) above mean sea level (AMSL)		
Runway designations	34L/16R	34R/16L	07/25
Runway dimensions	3962M x 45M	2438M x 45M	2530M x 45M
Runway used	16R		
Category for Rescue Fire Fighting	10		
Approach facilities	Radar Control, ILS Approach, HIALS/PAPI		
Aerodrome status	Licensed Airport (Open)		

Destination Aerodrome:

ICAO designation	OMAA (Zayed International, Abu Dhabi, UAE)	
Aerodrome co-ordinates	N24°26.0' E054°39.1'	
Aerodrome elevation	83ft above mean sea level (AMSL)	
Runway designations	31L/13R	31R/13L
Runway dimensions	4100M x 60M	4106M x 60M
Category for Rescue Fire Fighting	10	
Approach facilities	Radar Control, ILS Approach, HIALS/PAPI	
Aerodrome status	Licensed Airport (Open)	

1.10.2 Aerodrome Information (QTR71N):

Departure Aerodrome:

ICAO designation	Hamad International Airport (OTHH)
Aerodrome Coordinates	N25.27 E051.61

Aerodrome elevation	13 FT/42°C	
Runway designations	16L / 34R	16R / 34L
Runway dimensions	4850 X 60	4250 X 60
Runway used	N/A	
Category for Rescue Fire Fighting	CAT 10	
Approach facilities	ILS, RNP, GVA, Runway Lights, PAPI's	
Aerodrome status	Licensed	

Destination Aerodrome:

ICAO designation	Valena International Airport (VRMM)
Aerodrome co-ordinates	N04.19 E073.53
Aerodrome elevation	6 FT / 31.7°C
Runway designations	18/36
Runway dimensions	3200 X 45
Category for Rescue Fire Fighting	CAT 9
Approach facilities	ILS, RNP, VOR, Runway Lights, PAPI's
Aerodrome status	Licensed

1.11 Flight Recorders.

1.11.1 Both aircraft were fitted with both the Flight Data Recording (FDR) and the Cockpit Voice Recording (CVR) however, OTSB determined that there is no need to remove both FDR and CVR for downloads. OTSB will be relying on other flight information data such as Flight Data Management (FDM), Air Traffic Services (ATC) communication records to assist in the investigation.

1.12 Wreckage and Impact Information.

1.12.1 Not relevant to the occurrence.

1.13 Medical and Pathological Information.

1.13.1 Not relevant to the occurrence.

1.14 Fire.

1.14.1 Not relevant to the occurrence.

1.15 Survival Aspects.

1.15.1 To be discussed in the final report.

1.16 Tests and Research.

1.16.1 To be discussed in the final report.

1.17 Organizational and Management Information.

1.17.1 Both flights were scheduled international passenger flights, operated under Part 121.

1.17.2 The operator (Etihad Airways) was issued an Air Operating Certificate (AOC) by the State of Registry and State of Operator, UAE-GCAA, issued on 5th September 2023 with an expiry date of 31st October 2025. The certificate authorized the operator to perform Air carrier operations as specified in the operator's operations specifications, in accordance with the operations manual and UAE Civil Aviation Regulations.

1.17.3 The operator (QATAR Airways and Cargo) was issued an Air Operating Certificate (AOC) by the State of Registry and State of Operator, QATAR CAA, issued on 25th December 2023 and valid until suspended or revoked. The certificate authorized the operator to perform commercial air operations as defined in the operator's operations specifications, in accordance with the operations manual, Law No. 15 OF 2002, as amended and its ensuing Regulations.

1.18 Additional Information

1.18.1 ETIHAD Airways: Boeing 737 Flight Crew Operations Manual

Traffic Avoidance:

Immediately accomplish the following by recall whenever a TCAS traffic advisory (TA) or resolution advisory (RA) occurs.

WARNING: Comply with RA if there is a conflict between RA and air traffic control.

WARNING: Once as RA has been issued, safe separation can be compromised if current vertical speed is changed, except as necessary to comply with the RA. This is because TCAS II to TCAS II coordination may be in progress with the intruder aircraft, and any change in vertical speed that does not comply with the RA may negate the effectiveness of the other aircraft's compliance with the RA.

Note: If stick shaker or initial buffet occurs during the maneuver, immediately accomplish the APPROACH TO STALL RECOVERY procedure.

Note: If high speed buffet occurs during the maneuver, relax pitch force as necessary to reduce buffet, but continue the maneuver.

Note: Do not use flight director pitch commands until clear of conflict.

For Traffic Advisory (TA):

Pilot Flying	Pilot Monitoring
Look for traffic using traffic display as a guide. Call out any conflicting traffic	
If traffic is sighted, maneuver if needed	

Note: Maneuvers based solely on a TA may result in reduced separation and are not recommended.

Resolution Advisory (RA)

An RA commands one of the two maneuvers to the flight crew recommending:

- a maneuver intended to provide separation from all threats; or
- a maneuver restriction intended to maintain existing separation.

In the event of an TCAS RA, without undue delay the pilot shall:

a. respond immediately by following the RA, as indicated in the respective fleet OM-B, unless doing so would jeopardize the safety of the aircraft.

b. follow the RA even if there is a conflict between the RA and an ATC instruction to maneuver.

c. No maneuver in the opposite sense to an RA.

d. Workload permitting but as soon as possible ATC of nay RA which requires a deviation from the current ATC instruction clearance.

e. Promptly comply with modified RAs.

f. Limit the alterations of the flight path to the minimum extent necessary to comply with the RAs.

g. Promptly return to the ATC instruction or clearance when the conflict is resolved.

h. Notify ATC when returning to the current clearance.

Note: For any type specific procedures refer to type specific OM-B

When a TCAS RA is activated the flight crew shall use standard ICAO phraseology TCAS RA to notify ATC. Once an aircraft departs from its ATC clearance or instruction in compliance with an RA, or a pilot reports and R, the controller ceases to be responsible for providing separation between that aircraft and any other aircraft affected as a direct consequence of the maneuver induced by the RA. The controller will resume responsibility for providing separation to all the affected aircraft when the flight crew report “CLEAR OF CONFLICT”.

Nothing in the above procedures or those specified in the respective type OM B shall prevent the commander from exercising his best judgement and full authority in the choice of the best course of action to resolve a traffic conflict or avert a potential collision.

Whenever an aircraft has maneuvered in response to TCAS RA, the commander shall submit a mandatory ASR.

1.18.1 QATAR Airways: A318/A319/A320/A321 Flight Crew Operating Manual:

(MEM) TCAS WARNING-RESOLUTION ADVISORY

Always follow RA orders, even if this results in crossing the intruder altitude, because these orders ensure the best altitude separation.

CAUTION: Be aware that the intruder may have a TCAS, and may maneuver in response to a coordinated RA order. Therefore, not following an RA order could compromise safe separation.

- All RA, except any CLIMB RA during approach in CONF 3 or FULL:

AP (if engaged) ……OFF
BOTH FDs……OFF

Respond promptly and smoothly

VERTICAL SPEED……ADJUST or MAINTAIN

L2

Adjust or maintain the vertical speed as required, to reach the green area and/or avoid the red area of vertical speed scale

L1

Note: Avoid excessive maneuvers while attempting to maintain the vertical speed just outside the red area of the vertical speed scale, and within the green area. If necessary, use the full speed range between Vαmax and VMAX

- Any CLIMB RA during approach in CONF 3 or FULL:

GO-AROUND……PERFORM

Follow the SRS GA mode.

VERTICAL SPEED……MONITOR

L2

Check that the vertical speed remains out of the red area of the vertical speed scale and take over if necessary.

L1

Respect stall, GPWS, or wind shear warnings.

ATC……NOTIFY

- When the “CLEAR OF CONFLICT” aural alert sounds:

ATC……NOTIFY LATERAL AND VERTICAL GUIDENCE……ADJUST

L2

Adjust the lateral and vertical guidance to resume normal navigation, in accordance with ATC clearance.

L1

AP/FD……AS RQRD

L2

If necessary, reengage the AP/FD.

1.19 Useful or Effective Investigation Techniques.

1.19.1 To be discussed in the final report.

2. Analysis

2.1 To be discussed in the final report.

3 Conclusions

3.1 General

The investigation is on-going and will be looking into other aspects of this serious incident investigation which may or may not have safety implications.

3.2 Findings

To be discussed in the final report.

3.3 Causes and Contributing Factors

To be discussed in the final report.

4 Safety Recommendations

The Investigation is on-going and should at any stage OTSB identify any safety issues, OTSB will issue the safety recommendations to address any safety concerns or risk identified.