



**Final Investigation Report
on**

**Serious Incident of Airprox involving M/s EL AL Israel Airlines Ltd.'s Flight no. ELY081 and
M/s Qatar Airways Flight No. QTR8E in Mumbai OCC, on 24 March 2024**

**Government Of India
Ministry of Civil Aviation
Aircraft Accident Investigation Bureau**

FOREWORD

*In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2025, the sole objective of the investigation of an Accident/Incident shall be the prevention of accidents and incidents and **not to apportion blame or liability**. The investigation conducted in accordance with the provisions of the above said rules shall be separate from any judicial or administrative proceedings to apportion blame or liability.*

This document has been prepared based upon the evidences collected during the investigation, opinion obtained from the experts and laboratory examination of various components.

Consequently, the use of this report for any purpose other than for the prevention of future accidents or incidents could lead to erroneous interpretations.

Unless otherwise indicated, all times in this report are stated in Co-ordinated Universal Time (UTC). The relationship between IST and UTC is: $IST = UTC + 5\frac{1}{2}$ hours.

For reasons of data protection and simplification of the text, this report uses exclusively the generic masculine.

Note:

Figures used in this report are taken from different sources and are adjusted from the original for the sole purpose to improve the clarity of the Report. Modifications to images used in this report are limited to cropping, magnification or addition of text boxes, arrows or lines.

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GLOSSARY OF ABBREVIATIONS USED IN THIS REPORT

AAIB	Aircraft Accident Investigation Bureau
AC	Mnemonic used in MTCD conflict (denoting conflict between two aircraft)
AD	Airworthiness Directives
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATPL	Airline Transport Pilot License
ATS	Air Traffic Services
CCWS	Controller Coordination Work Station
C of A	Certificate of Airworthiness
CAR	Civil Aviation Requirement
C of R	Certificate of Registration
CVR	Cockpit Voice Recorder
DATCO	Duty Air Traffic Control Officer
DFDR	Digital Flight Data Recorder
DGCA	Director General of Civil Aviation
FL	Flight level
FO	First Officer
FPS	Flight Progress Strips
FRTO	Flight Radio Telephone Operator's License
Hrs	Hours
ICAO	International Civil Aviation Organization
IST	Indian Standard Time
IIC	Investigator-in-charge
MATS	Manual of Air Traffic Services
MEL	Minimum Equipment List
METAR	Meteorological Aerodrome Report
MTCD	Medium Term Collision Detection
NM	Nautical miles
PIC	Pilot in Command
RA	Resolution Advisory
RWY	Runway
STCA	Short term conflict alert
TA	Traffic Advisory
TCAS	Traffic alert and collision Avoidance system
UTC	Universal Time Coordinated

SUMMARY

Serious Incident of Airprox involving two Boeing 777 aircraft operated by M/s EL AL Israel Airlines Ltd. and M/s Qatar Airways, in the Mumbai FIR, on 24 March 2024.				
1.	Aircraft	Items	Aircraft 1	Aircraft 2
		Operator	M/s EL AL Israel Airlines Ltd.	M/s Qatar Airways
		Type	B777-200	B777-300ER
		Flight No.	ELY 081	QTR8E
		Flight Rule	IFR	IFR
		Nationality	Israel	Qatar
		Registration	4X-ECB	A7-BOB
2.	Pilot – In – Command		ATPL holder	ATPL holder
	Extent of Injuries		Nil	Nil
3.	Co-pilot		ATPL holder	ATPL holder
	Extent of Injuries		Nil	Nil
4.	Extent of Injuries to passengers & Cabin Crew		Nil	Nil
5.	Sector		Gurion International Airport (LLBG), Israel to Suvarnabhumi International Airport (VTBS), Bangkok.	Hamad International Airport (OTHH) Doha to Velana International Airport (VRMM), Male.
7.	Flight Plan Route in OCC sector		VUTAS-L875-BEDIL	KITAL-L894-BIBGO
8.	Type of operation		Scheduled Flight	Scheduled Flight
9.	Phase of operation		Cruising	Cruising
12.	Date & Time of Incident		24 March, 2024 and 0206 UTC	
13.	Place of Incident		Mumbai FIR, India	
14.	Type of Occurrence		Infringement of Separation Minima (Air Proximity)	
15.	Applicable ATC Separation		Procedural based, 10 Minutes lateral/ 1000 feet vertical	
16.	ATS Unit		OCC South sub-sector, Mumbai (VABB)	

SYNOPSIS

On 23rd March 2024, M/s Qatar Airways was scheduled to operate Flight No. QTR8E from Hamad International Airport, Doha, bound for Velana International Airport, Male. On the same day, M/s EL AL Israel Airlines Ltd. was scheduled for Flight No. ELY081 from Ben Gurion International Airport, Israel, bound for Bangkok International Airport.

According to their flight plans, both aircraft took off uneventfully from their respective departure airports on 23rd March 2024. After takeoff, both flights followed their designated air routes. The flight paths of Flight QTR8E and Flight ELY081 overflew Indian airspace (predominantly within the Mumbai FIR) along airways routes L875 and L894.

Both aircraft were under the command of ATPL license-holder pilots, serving as Pilot-in-Command (PIC) and Co-pilot. There were no reported snags or MEL items pending rectification on the TCAS system of either aircraft.

The Oceanic Control Centre (OCC), South Sub-Sector, Mumbai ATS Unit, operates using procedural control techniques. On the night of 23–24 March 2024, at the OCC South Sub-Sector, Mumbai ATS Unit, the Duty Air Traffic Controller (DATCO-1) was assigned to perform duty in the second shift. In the same shift, two additional Air Traffic Controllers (ATCOs) were also assigned to assist DATCO-1, serving as Coordinator and Alpha.

According to the duty roster, on the night of 23–24 March 2024, after completing two hours of duty followed by four hours of rest, DATCO 1, the coordinator, and Alpha resumed their respective duty positions at 2200 UTC for the next four-hour shift.

On 24 March 2024 morning, as per flight plan, Flight QTR8E entered Mumbai FIR at FL350 via waypoint KITAL at 0055 UTC and reported its estimates via CPDLC to OCC South Sub-Sector, Mumbai ATS Unit. Subsequently, Flight ELY081 entered Mumbai FIR at FL350 via waypoint VUTAS at 0113 UTC and reported its estimates via HF to OCC South Sub-Sector, Mumbai ATS Unit.

As per the Flight Progress Strips (FPS) of flights QTR8E and ELY081, were scheduled to cross each other at Waypoint GOLEM in the Mumbai FIR at the same flight level, FL350, during the early morning hours of 24 March 2024.

Upon receipt of the Flight Progress Strips (FPS) for flights QTR8E and ELY081, DATCO-1 noticed the impending conflict. Later, both flights provided their estimates; however, no flight level change was assigned to either aircraft. Additionally, the position estimates were not updated in the Automated System.

At 0130 UTC, while handing over the watch to the coordinator (DATCO-2), DATCO-1 did not brief about the impending conflict at Waypoint GOLEM. After 26 minutes of taking over the watch, DATCO-2 did not notice the breach of Standard Minimum separation between flight QTR8E and flight ELY081, which began at 0156 UTC.

At 0200 UTC, another Duty Air Traffic Controller (DATCO-3) took over the watch from DATCO-2. During the handover, DATCO-2 did not provide any briefing about the prevailing conflict at Waypoint GOLEM. The succeeding DATCO-3 recognized the conflict between flights

QTR8E and ELY081 at approx. 0206 UTC. By that time, both flights were approaching GOLEM at FL350. The minimum longitudinal and vertical separation recorded between the two flights were 9.1 NM (approximately one minute) and zero feet at 0206 UTC. Subsequently, DATCO-3 assigned FL330 to the Flight ELY081. However, the separation between the flights increased gradually as they proceeded on diverging routes after Waypoint GOLEM. Thereafter, the flights were uneventful and landed safely at their respective destination airports. No damage occurred to either aircraft, and no injuries were reported among the occupants.

The occurrence was classified as a Serious Incident and the Director General, AAIB ordered an investigation into the probable cause(s) of this Serious Incident, vide Order No. INV.12012/1/2024-AAIB dated 09 April 2024 under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017.

Unless otherwise indicated, recommendations in this report are addressed to the regulatory authorities of the State having the responsibility for the matters with which the recommendation is concerned.

1. FACTUAL INFORMATION

1.1 History of The Flight

On 23 March 2024, M/s Qatar Airways' Boeing 777 aircraft, bearing registration number A7-BOB, was scheduled to operate flight QTR8E from Hamad International Airport (OTHH), Doha, to Velana International Airport (VRMM), Male. As per the flight plan, flight QTR8E was scheduled to depart at 2220 UTC. However, the flight was delayed by one hour and departed at 2321 UTC from Hamad International Airport (OTHH). The Standard Time of Arrival (STA) at Velana International Airport (VRMM), Male was 0305 UTC on 24 March 2024. The enroute waypoints listed in the flight plan for QTR8E were: OTHH 16L BUNDU B415 SIXIV N318 TOLDA P570 KITAL L894 ELBET ELBET1B VRMM 18.

On the same day, M/s EL AL Israel Airlines Ltd.'s Boeing 777 aircraft, bearing registration number 4X-ECB, was scheduled to operate flight ELY081 from Ben Gurion International Airport (LLBG), Israel, to Bangkok International Airport (VTBS). As per the schedule, flight ELY081 departed from Ben Gurion International Airport (LLBG) at 1945 UTC. The Standard Time of Arrival (STA) at Bangkok International Airport (VTBS) was 0655 UTC on 24 March 2024. The enroute waypoints listed in the flight plan for ELY081 were: LLBG SALAM N134 OSAMA EGLOT UM449 GIBET M449 WEJ T510 RBG B544 JDW G650 KONET XADOX DWA UW885 HARGA UT382 AVEDA UT383 VUTAS L875 MMV P761 PPB P762 DWI L877 MIGAR L524 IBETO WILLA VTBS.

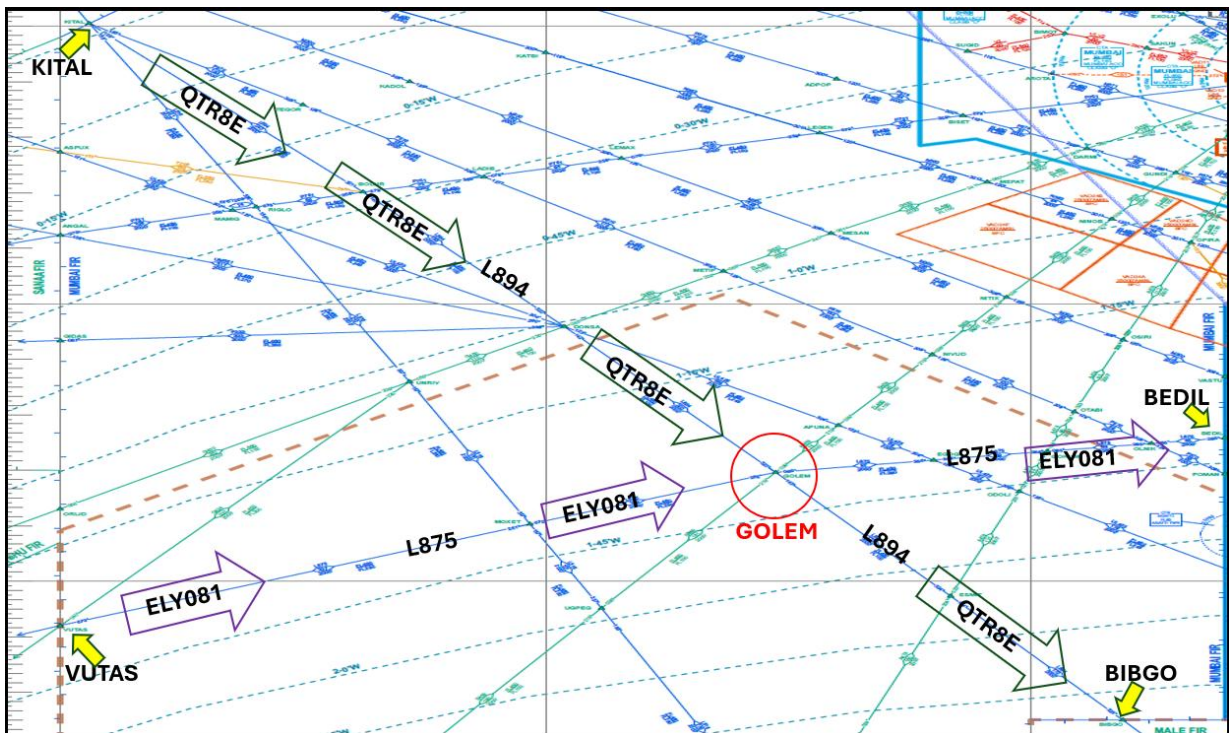


Figure 1: Depicting Flights Route, Entry, Crossing & Exit waypoints in Mumbai FIR

According to the flight plan, enroute flight QTR8E was scheduled to enter the Mumbai FIR at midnight on 23–24 March 2024 at FL350 via waypoint KITAL, and maintain FL350 along route L894 before exiting the Mumbai FIR via waypoint BIBGO, (see Figure 1). Similarly, at midnight on 23–24 March 2024, flight ELY081 was also scheduled to enter the Mumbai FIR at

FL350 via Waypoint VUTAS and maintain FL350 along route L875 before exiting via Waypoint BEDIL. The Routes L875 and L894 intersect at Waypoint GOLEM within the Mumbai FIR (see Figure 1).

On 23 March 2024, three Air Traffic Controllers (relevant to this serious incident) were assigned to perform duties as Duty Air Traffic Controller (DATCO-1), Coordinator (ATCO), and Alpha (ATCO) during the night shift at OCC South Sub-Sector, Mumbai. The OCC South Sub-Sector, Mumbai ATS unit is responsible for providing Air Traffic Service (ATS) information to aircraft operating in the South Sub-Sector of the Mumbai Oceanic region within the Mumbai FIR. According to the Mumbai ATS unit duty roster, the night shift begins at 07:30 p.m. (1400 UTC) and ends at 07:30 a.m. (0200 UTC) the following day. As per the duty roster, the Air Traffic Controllers (relevant to this incident) reported for duty at 07:30 p.m. (1400 UTC) on 23 March 2024. Six trainees were also assigned to undergo training with DATCO-1. The controllers were assigned to perform duties in the second night shift. Accordingly, they carried out their respective duties at three positions—Duty Air Traffic Controlling Officer (DATCO), Coordinator, and Alpha—for two hours from 09:30 p.m. (1600 UTC) to 11:30 p.m. (1800 UTC), followed by four hours of rest from 11:30 p.m. (1800 UTC) to 03:30 a.m. (2200 UTC). After the rest period, the controllers resumed their respective duty positions at 03:30 a.m. (2200 UTC).

The OCC South Sub-sector in Mumbai operates using the Procedural Control Technique to provide Air Traffic Service (ATS) information. This Procedural Control technique is primarily based on the Flight Progress Strip (FPS) and Pilot position reports/Estimates rather than radar surveillance to ensure safe separation of aircraft.

The OCC South Sub-sector Mumbai is also equipped with an Automated System (CCWS). This system generates synthetic tracks of aircraft and predicts imminent traffic conflicts by triggering various alerts and warnings, such as Medium-Term Conflict Detection (MTCD) alert/warning.

During the course of investigation, a senior CNS personnel posted at Mumbai, ATS unit, with extensive experience on this Automated System explained that the purpose of CCWS is to assist Air Traffic Controllers working in a procedural control environment. The Automated System is not the primary conflict detection mechanism in such an environment; rather, it serves to enhance situational awareness.

According to the Standard Minimum Separation published on the Airports Authority of India's website, the applicable separation standard in the OCC South Sub-sector, Mumbai is 10 minutes (approximately 80 NM) and 1,000 feet vertically.

At 005609 UTC, Flight QTR8E reported its position via CPDLC: "Position Report 19 58.8N 60 22.0E 0056Z F350 BOLUR 0121Z DONSA 0324Z -41C 300 69 0.83M KITAL 0055Z F350."

Subsequently, at 005759 UTC, Flight QTR8E reported its estimate via CPDLC: "Estimate BIBGO 0245, F350."

According to DATCO-1's statement, upon reviewing the FPS for Flights QTR8E and ELY081, DATCO-1 noticed a potential conflict situation at Waypoint GOLEM, where both flights were crossing at FL350. DATCO-1 further stated, based on a past experience, wherein updating

the aircraft Estimate of one aircraft, later created a lot of confusion and difficulties in traffic handling. Hence, DATCO-1 opted to wait for Pilot Position Update.

At 01:10 UTC, Flight ELY081 reported its estimates via HF as: "F350 CPDLC VUTAS 0113, GOLEM 0207, EGOGI 0218, OLNK 0234, BEDIL 0239, JLBR."

At 01:30 UTC, DATCO-1 handed over the watch to the Coordinator (DATCO-2) for the remaining 30 minutes. According to DATCO-1's statement, during the handover, DATCO-1 verbally briefed DATCO-2 as follows: "One aircraft is to be cleared to FL370 near BIBGO, and ELY081 at FL350 entered VUTAS just 10 minutes earlier. This will create traffic and must be managed carefully with respect to other aircraft."

At 01:30 UTC, while taking over the watch, DATCO-2 received a verbal briefing from DATCO-1. The relevant extract from DATCO-2's statement is quoted as: "...received a briefing about an immediate conflict on AWY L894, but no specific briefing regarding the conflict at GOLEM was provided..."

During the watch hours, DATCO-2 was unable to recognize the developing conflict between Flights QTR8E and ELY081 at Waypoint GOLEM. According to ATC records, the breach of standard minimum separation between Flights ELY081 and QTR8E began at 0156 UTC. However, no MTCD warning was triggered by the automated system. The current breach of separation between flights ELY081 and QTR8E at GOLEM remained undetected by DATCO-2.

Later, at 0200 UTC, DATCO-2 handed over watch to the succeeding morning shift Duty ATCO (DATCO-3). During the handover, no information regarding the ongoing standard minimum separation breach between flights ELY081 and QTR8E was conveyed to the morning shift ATCO (DATCO-3).

As per DATCO-3's statement, the conflict was detected when the AC alert was triggered between Flight ELY081 and QTR8E, at the time when DATCO-3 was resolving another conflict between ELY081/F350 and AXB398/F350 at waypoint BEDIL. DATCO-3 stated: *"When I entered FL330 in CFL, the SMACK window opened, showing a conflict with QTR. By that time, both aircraft were at GOLEM. When RBL was applied between them, the separation was 10 NM."* Later, DATCO-3 instructed flight ELY081 to descend to FL330.

As per ATC records at time 0206 UTC, the Standard Minimum Separation between Flight ELY081 and QTR8E was reduced to 9.1 NM (approx. 1 minute) at F350 near Waypoint GOLEM. Subsequently, separation between the flights increased gradually as they were on the diverging routes after crossing the waypoint GOLEM.

At the time of the occurrence, traffic density in the Mumbai FIR was moderate and both aircraft were in communication with ATC via HF and/or CPDLC. No TA/RA alert was generated in either aircraft. No MTCD warning was generated in the Automated System.

There was no damage to either aircraft, and no injuries were reported among the occupants of either aircraft.

1.2 Injuries to Persons

There were no injuries to any occupants on board either aircraft.

1.3 Damage to Aircraft

There was no damage to either aircraft

1.4 Other Damage

Nil

1.5 Personnel Information

1.5.1 Flight Crew

1.5.1.1 Pilot-In-Command

The Pilot-in-Command of both flights, QTR8E and ELY081, held valid Airline Transport Pilot Licenses (ATPL). No issues or lapses regarding the Pilot-in-Command's licenses, qualifications, or authorizations for either flight was observed during the investigation. Both Pilots-in-Command were appropriately qualified and authorized to undertake their respective flights on 24 March 2024.

Flight No.	QTR8E	ELY081
Nationality	Qatari	Israel
Age	45 Years	57 years
License Type	ATPL	ATPL
Date of issue	15 May 2019	06.11.2019
Endorsements as PIC	B777/787	B787/ B767/B747
Total Flying Experience	21882:49	2129 Hours
Hours Flown on Type	11086:20	105 Hours

1.5.1.2 Co-Pilot

The Co-pilot of both flights, QTR8E and ELY081, held valid Airline Transport Pilot Licenses (ATPL). No issues or lapses regarding the Co-pilots licenses, qualifications, or authorizations for either flight was observed during the investigation. Both Co-pilot were appropriately qualified and authorized to undertake their respective flights on 24 March 2024.

Flight No.	QTR8E	ELY081
Nationality	Indian	Israeli
Age	28 Years	57 Years
Date of Joining the Organization	18 Jun 2022	17 Nov 2002
License Type	ATPL	ATPL
Date of issue	24 Oct 2022	06 Nov 2019
Total Flying Experience	3100:55 Hours	6889 Hours
Hours Flown on Type	868:55	406 Hours

1.5.2 Air Traffic Control Officer (ATCO)

1.5.2.1 Duty ATCO (DATCO-1)

Table 1: DATCO-1 Details	
Age (Years)	31
Date of Issue & Validity of License	15-10-2010; 15-10-2052
Station and Unit	Mumbai and OCC South Sector
Endorsement in License	Oceanic Control, Area Control Procedural
Date of Medical Validity	27-10-2025
Last date of proficiency check	07-09-2023
Total experience in the Unit of Incident (Number of days)	461 days
Number of hours completed as OJTI in the unit	380:30 hours

On the date of event, DATCO-1 was a rated ATCO and a trainer. During the investigation, the team discussed the event with DATCO-1. The relevant points from the discussion with DATCO-1 are summarized below:

- While keeping the strips for ELY081 and QTR8E, DATCO-1 noticed that potential traffic situation is evolving at waypoint GOLEM on the strip. But DATCO-1 wanted to ensure by taking pilot estimates from both aircraft.
- DATCO-1 stated that, on a previous occasion, a system glitch had caused the flight strip estimates to differ by approximately 20-25 minutes from actual estimates which had resulted in significant confusion.
- While handing over the watch at time 0130 UTC, DATCO-1 briefed the DATCO-2 (mainly verbally).
- The relevant portion of briefing was *".....all coordination had been done. Two pending works, 1. one aircraft was to be given higher to F370 near BIBGO. 2. ELY081, F350 has entered VUTAS just 10 min before which will be traffic and will need to be taken care of with respect to other traffic"*.
- DATCO-1 stated that, *"when ELY081 entered Mumbai FIR, I was aware that it will form traffic, because it is at a non-FLAS FL (other than F330)"*.
- A total of six to seven trainees were assigned to the night shift of 23–24 March 2024 for training under DATCO-1. The training was imparted individually by DATCO-1, with the final session held between 0000 UTC and 0130 UTC.
- DATCO-1 felt that the briefing given to DATCO-2 on that day was less elaborative.

1.5.2.2 Duty ATCO (DATCO-2)

Table 2: DATCO-2 Details	
Age (Years)	28
Date of Issue & Validity of License	30-06-2023; 24-08-2055
Station and Unit	Mumbai and OCC South Sub-Sector
Endorsement in License	Oceanic Control
Date of Medical Validity	16-11-2027
Last date of proficiency check	30-06-2023
Total experience in the Unit of Incident (Number of days)	107 days

On the date of event, DATCO-2 was a rated ATCO. During the investigation, the team discussed the event with DATCO-2. The relevant points from the discussion with DATCO-2 are summarized below:

- a) For the entire night duty 2nd shift on 23–24 March 2024, DATCO-2 worked at the Coordinator position, except for a 30-minute period between 0130 UTC and 0200 UTC, when DATCO-2 took over the channel.
- b) DATCO-2 was marked as OCC -D controller in the duty roster. However, as per supervisor instructions DATCO-2 took over coordinator position.
- c) As per DATCO-2 statement, mostly DATCO-1 was monitoring the CCWS (Automated system).
- d) Position Estimate for QTR8E was received by DATCO-2, whereas Position Estimate for ELY081 was received by the Trainee. The FPS board and strip were managed by DATCO-1, and the trainee (OJT-1) was under DATCO-1's supervision.
- e) DATCO-2 took -over the watch at 0130 UTC as per advice of DATCO-1.
- f) While take over the watch at 0130 UTC, DATCO-2 received verbal briefing from DATCO-1. DATCO-2 stated that “.....received briefing about immediate conflict on AWY L894. No specific briefing about the conflict on GOLEM was received by me.....”.
- g) During the watch, DATCO-2 attention was occupied in resolving the immediate conflict as briefed by DATCO-1.
- h) According to DATCO-2, there was no discussion with DATCO-1 concerning the conflict between ELY081 and QTR8E at Waypoint GOLEM, nor regarding the FLAS allocation of ELY081.
- i) DATCO-2 was aware of the fact that Flight ELY081 and Flight QTR8E were on FL350. But was unable to detect the conflict. DATCO-2 stated that, immediately after taking over the watch, DATCO-2 was occupied in resolving a conflict at AWY L894 between two different aircraft. Furthermore, there was no MTCD warning.
- j) DATCO-2 stated that the briefing received from DATCO-1 was inadequate.
- k) DATCO-2 took break around 5.00 am IST for 20-25 minutes and DATCO-1 took twice break first around 06.00 am and second around 06.30 am for 10-15 minutes. After the break DATCO-1 asked Coordinator to take rest for 10 -15 minutes and subsequently take over the watch from 0130 UTC.

1.5.2.3 Duty ATCO (DATCO-3)

Table 3: DATCO-3 Details	
Age (Years)	32
Date of Issue & Validity of License	13-11-2020; 17-06-2052
Station and Unit	Mumbai and OCC South Sub-Sector
Endorsement in License	Oceanic Control, Area Control Procedural
Date of Medical Validity	28-10-2025
Last date of proficiency check	20-12-2023
Total experience in the Unit of Incident (Number of days)	420 days

On the date of event, DATCO-3 was a rated ATCO. During the investigation, the team discussed the event with DATCO-3. The relevant points from the discussion with DATCO-3 are summarized below:

- DATCO-3, took over the watch from the DATCO-2, at 0200 UTC.
- DATCO-3 neither received any briefing regarding the prevailing conflict between Flights QTR8E and ELY081 at GOLEM nor DATCO-3 detected the conflict while taking over.
- The prevailing conflict between Flight QTR8E and Flight ELY081 had come to the notice of DATCO-3 at the time when DATCO-3 was attempting to resolve a conflict between Flights ELY081 and AXB398/F350 at Waypoint BEDIL, and an AC alert (Conflict between two aircraft) between Flight QTR8E and ELY081 was generated.
- In order to resolve the conflict with flight AXB398/F350 at Waypoint BEDIL, Flight ELY081 was given descend to FL330.
- DATCO-3 reported the breach of Standard Minimum separation between Flights QTR8E and ELY081 at GOLEM in the logbook.

1.5.2.4 On Job Trainee -1 (OJT-1):

Table 4: OJT-1 Details	
Age (Years)	26
Date of start of training in unit	17-10-2023
Hours of training completed in Unit of incident	16 hours
Endorsement in License	No endorsement
Date of Medical Validity	25-12-2026
Total experience in the Unit of Incident (Number of days)	12 days (OJT)

On the date of incident, OJT-1 was deputed for training under DATCO-1. During the investigation, the team discussed the event with OJT-1. The relevant points from the discussion with OJT-1 are summarized below:

- On the night of 23-24 March 2024, OJT-1 was assigned to get On-Job-Training under DATCO-1 and was also assigned to perform duty at ALPHA position.

- b) OJT-1 performed night duty at Alpha position from 1600 UTC to 1800 UTC, 2200 UTC to 0000 UTC and 0130 UTC to 0200 UTC. OJT-1 received Training under DATCO-1 from 0000 UT to 0130 UTC.
- c) During training hours OJT-1 was tasked (under supervision of DATCO-1) for placing/removing the FPS on the FPS board, marking estimates and revised estimates on the FPS on receipt from HF / CPDLC. However, while working as an Alpha, OJT-1 was required to perform all task as given in the duties and responsibilities in MATs.
- d) FPS for ELY081 was printed during OJT-1 Alpha position and Flight ELY081 estimate was written by the OJT-1. But OJT-1 could not detect conflict between Flight ELY081 and Flight QTR8E at Waypoint GOLEM.
- e) As per OJT-1's statement, DATCO-1 did not discuss anything about the developing conflict at waypoint GOLEM.

1.5.2.5 On-Job- Trainee -2 (OJT-2):

Table 5: OJT-2 Details	
Age (Years)	24
Date of start of training in unit	08 Sep 2023
Hours of training completed in Unit of incident	150 hours
Endorsement in License	No endorsement
Total experience in the Unit of Incident (Number of days)	203 days (OJT)

On the date of event, OJT-2 was deputed for training under DATCO-1. During the investigation, the team discussed the event with OJT-2. The relevant points from the discussion with OJT-2 are summarized below:

- a) On the night of 23-24 March 2024, OJT-2 was also assigned to get On-Job-Training under DATCO-1 and was also assigned to perform duty at ALPHA position.
- b) OJT-2 performed night duty at Alpha position from 0000 UTC to 0200 UTC and received Training under DATCO-1 from 2200 UTC to 2400 UTC.
- c) During training hours OJT-2 was tasked (under supervision of DATCO-1) for placing/removing the FPS on the FPS board, marking estimates and revised estimates on the FPS on receipt from HF / CPDLC. However, while working as an Alpha, OJT-2 was required to perform all task as given in the duties and responsibilities in MATs.
- d) FPS for QTR8E was printed during OJT-2 Alpha position and Flight QTR8E estimate were received during the training hours of OJT-2.

1.5.3 Duties and Responsibilities

1.5.3.1 Sector Controller (DATCO)

Details of Duties and Responsibilities of Sector Controller is clearly defined in Para 4.22.3 of the Manual of AIR Traffic Services -Part-2 (MATs-2) pertaining to ATS Mumbai and published by AAI, Mumbai. The relevant extract from the MATs-2 is appended below:

“4.22.3 Duties and responsibilities of OCC Sector Controller

- 1) *OCC Sector Controller shall provide ATC Service, Air Traffic Advisory Service, Flight Information Service and Alerting Service as relevant to the airspace within the jurisdiction of OCC - Sector.*
- 2) *OCC Sector Controller shall ensure standard separation between aircraft flying within the airspace of jurisdiction of the OCC Sector concerned and at the entry / exit points of FIR.*
- 3) *Sector controller shall also perform duties and responsibilities of ADS-C / CPDLC controller as given below, as normally whenever coordinators are deployed, separate ADS-C/CPDLC controllers are not provided.*
- 4) *OCC Sector Controller shall maintain close coordination with HF/RT communicators to ensure exchange of aircraft messages promptly and correctly.*
- 5) *OCC Sector Controller shall issue ATC clearance/ traffic information as appropriate to flights operating to/from other aerodromes within the jurisdiction of OCC sector concerned and ensure entry of such FPL data in GPWS.*
- 6) *OCC Sector Controller shall report to the Technical Supervisor, any malfunctioning/ unserviceability of GPWS, CCWS, VCCS system etc., and maintain proper record thereof.*
- 7) *OCC Sector Controller shall initiate appropriate action in respect of aircraft overdue or which failed to report with OCC and inform the RCC Officer for necessary SAR action.*
- 8) *OCC Sector Controller shall coordinate with relevant ATC units before issuing instruction and clearances, where applicable.*
- 9) *OCC Sector Controller shall take appropriate actions in the event of degradation of any of the sub system.*
- 10) *OCC Sector Controller shall manage flight progress board and keep it updated to correctly display flow of air traffic.*
- 11) *OCC Sector Controller shall ensure all FPL/ CPL data and current position report data are input in GPWS.*
- 12) *OCC Sector Controller shall monitor synthetic tracks of flights progress on CCWS based on input of current position report data, level changes, estimates etc., in GPWS.*
- 13) *OCC Sector Controller shall ensure appropriate actions in accordance with procedures in the Contingency Plan relevant to aircraft emergencies, accident, Bomb Threat, unlawful interference, etc.*
- 14) *OCC controllers should implement 50NM longitudinal separation along RNP10 routes wherever applicable.*
- 15) *Whenever any LHD is noticed, logbook entries should be made and inform to OCC(Sup). Follow SOP for Air Traffic Controllers to reduce Category 'E' LHDs.*

- 16) *Ensure that ADC number is available for aircraft flying / entering ADIZ-west. Any deviation from the approved route within ADIZ shall be informed to the MLU.*
- 17) *Monitor the serviceability of the equipment and if unserviceable, inform WSO and SSO.*
- 18) *Obtain operator details of non-scheduled East bound overflying aircraft in oceanic airspace and record the same in logbook.*
- 19) *As far as possible OCC controller should obtain the operator's name for billing purpose of nonscheduled flights operating on overflying routes (only for east bound overflying Indian airspace & west bound only for departures from VRMM-Not for landing within India) may be obtained through either HF/relay through other aircraft/CPDLC etc.*
- 20) *HFRT reports can directly be accessed from ECIL position at RNFC section for correct billing purpose. In case the said information is received through CPDLC; a log entry may be made so that the same can be accessed from CPDLC backup records. This is to prevent loss of revenue due to Non-realization of RNFC billing.*
- 21) *As internet facility is extended to computer provided for OCC officials, INMCC messages can be viewed using INMCC website. OCC controllers may make use of this facility in addition to CADAS system for confirming and updating information on Website for efficient handling of distress messages.*
- 22) *Monitor the serviceability of the equipment and if unserviceable, inform WSO and SSO.*
- 23) *Verify the functional capabilities of the ADS/CPDLC.*
- 24) *Apply Data link connection management procedures.*
- 25) *Manage ADS contracts*
- 26) *Update position reports at the compulsory reporting points, along with the estimates for the next fix.*
- 27) *Pass messages or requests received on CPDLC, to the sector controller concerned or Duty Officer, RCC.*
- 28) *Promptly issue the ATC clearances/ Instructions/ Information/ query to aircraft concerned.*
- 29) *Ensure message closure within reasonable time.*
- 30) *Monitor the information contained in the ADS data block and check for conformity with the current clearance.*
- 31) *Provide assistance in emergency and notify the sector/ATS unit/FIR concerned and inform WSO.*
- 32) *Notify the concerned aircraft of any failure of Data link connection or the failure of CGP/ SITA link and to continue on voice (VHF/HF). Notify the aircraft of the*

subsequent restoration of the facility.

33) OCC controllers shall perform any duties as assigned by the watch supervisory officer.

1.5.3.2 A- Controller (Alpha)

Details of Duties and Responsibilities of A- Controller (Alpha) is clearly defined in Para 4.22.4 of the Manual of AIR Traffic Services -Part-2 (MATs-2) pertaining to ATS Mumbai and published by AAI, Mumbai. The relevant extract from the MATs-2 is appended below:

“4.22.4 Duties and responsibilities of OCC–Sector Flight Data Assistants (SFDA)/A-Controller

- *OCC-Sector flight Data assistant shall collect estimates from Coordinator & process the same in the GPWS. The automation system processes the flight plan estimates submitted by the controllers to generate extrapolated flight trajectories and associated flight progress strips. The submission of estimates includes information about CALL SIGN, BOUNDARY FIX, SSR CODE, FLIGHT LEVEL, ESTIMATED TIME AT BOUNDARY FIX and SPEED. Any error in these parameters can lead to generation of a false trajectory, incorrect flight progress strip and can affect the performance of MTCD functionality. The controllers shall exercise abundant caution while submitting the estimates and shall refer to the filed flight plan (available in the history tab), whenever any abnormal parameter is encountered, for example abnormally low cruising speed or low cruising level.*
- *When the received estimate of a flight is not matching with the available FPL of the flight, the route field shall be modified only after due verification from*
 - a. Transferring ATS unit / FIR and/or*
 - b. Next / adjacent ATS unit / FIR and/or*
 - c. Operator / PIC of the flight*
- *Estimates of the international military flights entering ADIZ shall be submitted in the system immediately on reception of the estimate information. Such estimates shall also be submitted in ECIL system immediately. 3-AFMLU shall be coordinated on voice channel / hotline reg. international military flight and availability of estimate in 3-AFMLU system shall be ensured to obtain ADC in time. The content of AOR number of such flight shall also be verified from 3-AFMLU.*
- *No deviation from the approved route in AOR shall be approved by ATC. If such deviation is required due weather / contingency, then prior approval from 3-AFMLU shall be obtained and proper entry shall be made in logbook.*
- *OCC-Sector flight Data assistant shall receive various messages such as FPL, DEP, EST, CHG, ARR, DLA, CDN etc., from other ATS units and promptly process the same in the GPWS.*
- *OCC-Sector flight Data assistant shall prepare all relevant FPS manually and provide it to the OCC Sector Controller, in case of failure of automatic strip printer.*
- *OCC-Sector flight Data assistant shall ensure that all FPLs transmitted through*

AFTN/ AMSS are available in the FDPS database, if not available then create FPLs in GPWS, based on the FPL message received on AMSS printer to avoid any loss of FPL in FDPS database.

- OCC-Sector flight Data assistant shall assist the OCC controller in GPWS operations whenever required.*
- OCC-Sector flight Data assistant shall operate telephones, VCCS and AMSS Comm. Systems.*
- OCC-Sector flight Data assistant shall exchange FPL/ DEP/ CHG/ EST/ DLA/ ARR/ CDN messages with adjacent ACC/ OCC on advice of the OCC Sector Controller.*
- OCC-Sector flight Data assistant shall create FPLs in GPWS based on the FPL messages received on AFTN/ AMSS printer, when DCO-Briefing position is unserviceable.*
- OCC-Sector flight Data assistant shall assist the OCC Sector Controller in meeting the situation objective.*
- OCC-Sector flight Data assistant shall alert the OCC sector Controller whenever any Non-RVSM approved aircraft is flying or flight planning in RVSM airspace.*
- OCC-Sector flight Data assistant shall perform any duties as assigned by the watch supervisory officer.*
- The relieving officer shall first take over watch in the Logbook and sign to that effect followed by the handing over of watch by the relieved officer and make entry in logbook regarding any issue pertaining to A-Controller.*
- Operate ECIL computer system for obtaining ADC/ OCC/ YA No. and in the event of non-availability of ECIL system, assign OCC No., and where necessary obtain ADC No., from MLU manually.*
- Filing of flight plans of flights originating from Mumbai FIR other than Mumbai with the exception of those stations which are already having AFTN facility.*
- Verify YA No. / AOR No. in respect of Non-scheduled flights from the daily sheet of YA/ AOR No. and advise to the OCC sector controller accordingly.*
- Coordinate with MLU and manage issue of ADC No. in a timely manner.*
- Coordinate with ARO and MLU in respect of Non-scheduled flights from the daily sheet of YA/ AOR No.*
- Acknowledge the Distress Messages received in the CADAS system and make an entry into the register provided.*
- Estimate for entry point or ensuing waypoint in Mumbai FIR pertaining to civil or military flight required to transit through shall be entered in ECIL system before the flight is expected to enter in ADIZ, in time along with ATS automation system. If unable to make entry due to some reason the same shall be conveyed to OCC supervisor without any delay so that manually prepared estimate will be physically handed over to AFMLU.*

- The relieving officer shall first take over watch in the logbook and sign to that effect followed by the handing over of watch by the relieved officer and make entry in logbook regarding any issue pertaining to A-Controller.

1.6 Aircraft Information

1.6.1 Aircraft Specific (4X-ECB)

Aircraft Model	BOEING 777-258
MSN	30832
Year of Manufacturer	2001
Name of Owner	EL AL Israel Airline Ltd
C of R issued on	21 February 2001
Standard Airworthiness Certificate issued on	08 August 2022
Standard Airworthiness Certificate Expired on	07 August 2024
Aircraft Empty Weight	139951.8 Kg
Maximum Takeoff weight	285499 Kg
Date of Aircraft weighment	06 June 2022
Next Weighing due	06 June 2027
Total Aircraft Hours	83308 Hours
Last major inspection	C check Inspection
Engine Type	TRENT 895-17 (Rolls -Royce)
Date of Manufacture LH	06 April 2001
Engine Sl. No. LH	51301
Last major inspection (LH)	11 November 2020
List of Repairs carried out after last major inspection till date of incidence:	None
Total Engine Hours/Cycles LH	70041Hours /8392 Cycles
Date of Manufacture RH	17.04.2002
Engine Sl. No. RH	51382
Last major inspection (RH)	06.06.2013
List of Repairs carried out after last major inspection till date of incidence:	None
Total Engine Hours/Cycles RH:	70125 Hours /8480 Cycles
Aero mobile License Issued on	19 December 2022
Aero mobile License Issued on	31 December 2024

1.6.2 Aircraft Specific (A7-BOB)

Aircraft Model	Boeing 777-300ER
MSN	36161
Year of Manufacturer	30 Sep 2009
Name of Owner	BOC Aviation Limited
C of R	25 November 2021
C of A	25 November 2021
A R C issued	07 November 2023
ARC valid up to	24 November 2024
Aircraft Empty Weight	176883 KG
Maximum Takeoff weight	351,534
Date of Aircraft weighment	15 September 2021
Max Usable Fuel	142306 KG

Next Weighing due	2025
Total Aircraft Hours	65019:23 Hours
Last major inspection	02 February 2024
List of Repairs carried out after last major inspection till date of incidence:	None
Engine Type	GE90-115B
Date of Manufacture LH	June 2011
Engine Sl. No. LH	906956
Total Engine Hours/Cycles LH	48654:21 Hours / 6494 Cycle
Engine Sl. No. RH	906979
Total Engine Hours/Cycles RH:	52933:14 / 6752
Aero mobile License	Aircraft radio license SA-0001055-002

On the date of the incident, both aircraft's Certificates of Registration, Certificates of Airworthiness, Airworthiness Review Certificates, and weight schedules were valid. Prior to departure from the source airport, no snags were pending rectification, nor was the MEL invoked with respect to TCAS by either aircraft.

1.7 Meteorological Information

During the course of investigation, relevant meteorological information such as weather forecasts, satellite images, and warnings/alerts specific to the area surrounding the waypoint GOLEM was obtained from the Indian Meteorological Department

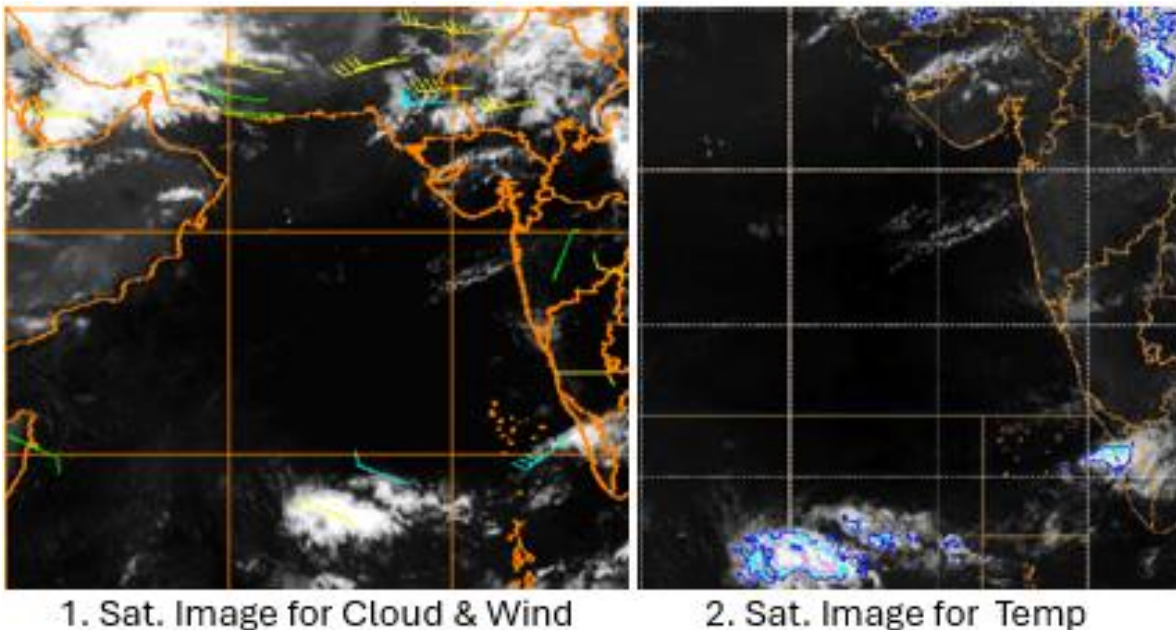


Figure 2: Satellite Images

The satellite images indicated suitable weather conditions for flight operations. Relevant Satellite images are appended in the figure 2.

METAR recorded and issued by Indian Metrological Department situated at Mumbai Airport, between 0130 UTC and 0230 UTC on 28 Oct 2022 is given below:

Table 6: Meteorological Information			
Time (UTC)	0130	0200	0230
Wind (KT)	05	06	03
Visibility (M)	2100	1900	1900
Weather	BR	BR	BR
Clouds	SCT100	FEW020 SCT100	FEW020 FEW100
Temp (°C)	26	27	27
Dew Point (°C)	23	24	24
QNH (hPa)	1011	1011	1011
Trend	NOSIG	NOSIG	NOSIG

The METAR recorded by IMD, Mumbai also indicates no significant weather. The received weather data was scrutinized by the investigation team, and it is observed that at the time of the event, there was no adverse weather forecast or warning/alert for the area surrounding the waypoint GOLEM. Furthermore, none of the flight crew members of either aircraft reported any weather-related difficulties or issues.

1.8 Aids to Navigation

All Navigational Aids available at Mumbai airport were reported to be serviceable and all navigation equipment installed on both aircraft were reported to be serviceable. There were no navigational aids related issues or lapses relevant to this Serious Incident.

1.9 Communications

1.9.1 Communication Facilities at Mumbai Occ

Communication between controllers and flight crew within the Mumbai OCC is facilitated through the following systems:

- a) Controller–Pilot Data Link Communications (CPDLC): The primary mode of communication for suitably equipped aircraft, enabling the exchange of clearances and information via text-based messages.
- b) High Frequency (HF) Radio: Provides long-range voice communication capability, covering distances up to approximately 2,000 nautical miles, including remote oceanic areas.
- c) Very High Frequency (VHF) Radio: Available in certain northern sub-sectors and along specific routes, providing supplementary voice communication where coverage permits.

At the time of incident both the aircraft were in contact with Mumbai ATC through CPDLC and on HF. No abnormality or malfunction was reported in any of the communication systems. There was continuous two-way communication between the aircraft and ATC.

1.9.2 Controller-Pilot Data Link Communications (CPDLC)

CPDLC is a means of communication between controller and pilot, using data link for ATC communications. A CPDLC message is the information exchanged between an airborne system and its ground counterpart. A CPDLC message consists of a single message element or a combination of message elements conveyed in a single transmission by the initiator.

19.2.1 CPDLC between Flight QTR8E and OCC Mumbai:

The relevant transcript of CPDLC messages exchanged between Flight QTR8E with Mumbai OCC sector south on 23 – 24 March 2024 are as given below:

- i. (2024-03-24-00:48:26 QTR8E A7BOB Uplink CPDLC Connection Request
- ii. 2024-03-24-00:48:35 QTR8E A7BOB Downlink CPDLC Connection Confirm
- iii. 2024-03-24-00:56:09 QTR8E A7BOB Downlink POSITION REPORT {19 58.8N 60 22.0E 0056Z F350 BOLUR 0121Z DONSA 0324Z -41 C 300 69 0.83M KITAL 0055Z F350}
- iv. 2024-03-24-00:56:56 QTR8E A7BOB Uplink {EST BIBGO}
- v. 2024-03-24-00:57:20 QTR8E A7BOB Downlink ROGER
- vi. 2024-03-24-00:57:59 QTR8E A7BOB Downlink POSITION REPORT {19 46.2N 60 34.0E 0057Z F350 BIBGO 0245Z DONSA 0324Z -41 C 300 67 0.83M KITAL 0055Z F350}
- vii. 2024-03-24-02:33:11 QTR8E A7BOB Uplink AT {BIBGO} CONTACT {MALE CONTROL} {123.900}
- viii. 2024-03-24-02:33:31 QTR8E A7BOB Downlink WILCO
- ix. 2024-03-24-02:50:13 QTR8E A7BOB Uplink END OF SERVICE.
- x. 2024-03-24-02:50:28 QTR8E A7BOB Downlink CPDLC Disconnect Request)

Neither aircraft transmitted its estimates for Waypoint GOLEM, nor did the ATS unit seek for the same. No information regarding the breach of separation was passed to the aircraft by the Occ South Sub Sector, Mumbai ATS unit.

1.9.2.2 CPDLC between Flight ELY081 and OCC Mumbai:

The relevant transcript of CPDLC messages exchanged between of Flight ELY081 with Mumbai OCC South Sub-Sector on 23 – 24 March 2024 are as given below:

- i. 2024-03-24-01:10:11 ELY081 4XECB Uplink CPDLC Connection Request
- ii. 2024-03-24-01:10:27 ELY081 4XECB Downlink CPDLC Connection Confirm
- iii. 2024-03-24-02:16:46 ELY081 4XECB Downlink AT {EGOGI} REQUEST CLIMB TO {F370} DUE TO AIRCRAFT PERFORMANCE
- iv. 2024-03-24-02:17:38 ELY081 4XECB Uplink UNABLE DUE TO TRAFFIC
- v. 2024-03-24-02:18:28 ELY081 4XECB Uplink DESCEND TO AND MAINTAIN {F330} DUE TO TRAFFIC
- vi. 2024-03-24-02:19:15 ELY081 4XECB Downlink WILCO
- vii. 2024-03-24-02:26:34 ELY081 4XECB Uplink AT {BEDIL} CONTACT {CHENNAI CONTROL} {134.425}
- viii. 2024-03-24-02:26:50 ELY081 4XECB Downlink WILCO
- ix. 2024-03-24-02:35:04 ELY081 4XECB Uplink NEXT DATA AUTHORITY {VOMF}
- x. 2024-03-24-02:49:54 ELY081 4XECB Downlink CPDLC Disconnect Request)

No information regarding the breach of separation was passed to the aircraft by the OCC Mumbai South Sub Sector, ATS unit.

1.9.3 High Frequency (HF) Communication

HF communication systems operate between 2 and 30 MHz and are used for long-distance radio transmissions via ground waves. These systems are primarily employed in

airspace where VHF communication is either unavailable or very difficult, such as oceanic airspace.

1.9.3.1 Exchange of message on HF communication system between Flight QTR8E and OCC Mumbai:

The relevant transcript of HF messages exchanged between Flight QTR8E with Mumbai OCC South Sub sector on 23 – 24 March 2024 are as given below:

- i. (HFC/020 (VABB) 23/03
- ii. QTR8E F350 CPDLC CK SEL/GJES
- iii. VABB RB CK SEL QTR8E SEL OKVABB CONT CPDLC MNTN 6661 PRI 8879 SRY QTR8E RBVABBHLSNIO027

1.9.3.2 Exchange of message on HF communication system between Flight ELY081 and OCC Mumbai:

The relevant transcript of HF messages exchanged between Flight ELY081 with Mumbai OCC South Sub sector on 23 – 24 March 2024 are as given below:

- i. (HFB/694 (VABB) 24/03
- ii. VABB CALLED ELY081 SEL/KSLMELY081 SEL OK CPDLC VABB CONT CPDLC 6661 SRYVCAKS2340
- iii. HFB/042 (VABB) 24/03
- iv. ELY081 F350 CPDLC VUTAS0113 GOLEM0207 EGOGI0218 OLNK0234 BEDIL0239 JLBR
- v. VABB RB CK SELELY061 SEL OKVABB MNTN 8879 PRI 6661 SRY VCUB0110)

1.10 Aerodrome Information

1.10.1 General

Chhatrapati Shivaji International Airport (IATA: BOM, ICAO: VABB) is the primary international airport of the Mumbai city and operated by Mumbai International Airport Limited (MIAL).

The aerodrome is situated at an elevation of 37 ft above mean sea level and is equipped with two intersecting runways:

- a) Runway 09/27 measuring 3448 m × 60 m, and
- b) Runway 14/32 measuring 2871 m × 45 m.

The airport is equipped with navigation aids including Category I ILS with DME and DVOR, supporting both precision and non-precision approach procedures.

Air Traffic Control (ATC) services are provided by the Airports Authority of India. During the incident, Air Traffic Services within the Mumbai FIR were being provided by the Oceanic Control Centre (OCC) – South Sector, through HF and CPDLC communication systems.

1.11 Flight Recorders

On the day of the incident, both aircraft were equipped with serviceable Solid-State Cockpit Voice Recorders (SSCVR) and Solid-State Flight Data Recorders (SSFDR). Since no TA/RA

was triggered in either aircraft, the flight recorder data were not preserved. Consequently, the SSCVR and SSFDR data of both aircraft could not be obtained for this investigation.

1.12 Wreckage and Impact Information

Nil

1.13 Medical and Pathological Information

Prior to departure from their respective departure airport, flight crew of both aircraft were medically fit to undertake their respective flights.

1.14 Fire

There was no fire.

1.15 Survival Aspects

The incident was survivable.

1.16 Tests and Research

Nil

1.17 Organizational and Management Information

1.17.1 Airports Authority of India (AAI)

Airports Authority of India (AAI) is a public sector undertaking under the Ministry of Civil Aviation. It was formed by an Act of Parliament and came into existence on 1st April 1995. AAI was constituted to provide Air Traffic Services over entire Indian Air Space comprising the provision of air traffic control service, advisory service, flight information service, alerting service, etc. It is entrusted with the responsibility of creating, upgrading, maintaining and managing civil aviation infrastructure both on the ground and air space in the country. AAI is governed by a board of directors, consisting of whole-time members, as well as part-time member. AAI provides Air Navigation Services in entire Indian air space.

On the day of Serious Incident, the Air Traffic Services at Mumbai Oceanic Control Centre South Sub Sector were provided by AAI.

1.17.2 Mumbai Oceanic Control Centre (OCC)

The Mumbai Oceanic Control Centre (OCC) provides Air Traffic Services (ATS) within the oceanic airspace of the Mumbai Flight Information Region (FIR), primarily covering the Arabian Sea. This region constitutes one of the three designated oceanic control areas within Indian airspace and extends from the western limits of radar coverage of Mumbai Area Control Centre (ACC) to the FIR boundary.

Due to the absence of continuous ground-based radar surveillance in large portions of the oceanic airspace, procedural control is predominantly applied. Air traffic controllers ensure separation between aircraft based on pilot position reports, estimated times over significant waypoints, and adherence to cleared flight profiles.

Surveillance Capability: While conventional radar coverage is not available throughout the oceanic airspace, the OCC utilizes **Space-Based Automatic Dependent Surveillance–Broadcast** (ADS-B) systems to enhance situational awareness. This enables periodic position updates of equipped aircraft operating in remote regions.

Separation Standards: Separation between aircraft is maintained in accordance with procedural separation standards prescribed by ICAO and national regulations. Typically, longitudinal separation of 10 minutes or 80 nautical miles is applied between aircraft operating on the same track, subject to communication and surveillance capabilities.

The Mumbai OCC airspace is divided into multiple sectors to manage traffic efficiently. The sectorization is as follows:

- i. **Sector O1:** L639, B342, N519, M638, P518, L301, W103
- ii. **Sector O2:** N571
- iii. **Sector O3:** P574
- iv. **Sector O4:** N563
- v. **Sector O5:** M300
- vi. **Sector O6:** P570, UL425, L894, L516, UM551, P323, G424, L875, L756, G465, N628

Sector 06 is the OCC South Sub Sector. Air Traffic Services for the concerned traffic was provided by the Mumbai Oceanic Control Centre (OCC) – South Subsector. The operational unit comprised three control positions, namely DATCO, Alpha, and Coordinator. The overall responsibility for the sector rested with the DATCO (Duty Air Traffic Control Officer). At the time of the occurrence, the DATCO was functioning as an On-the-Job Training (OJT) Instructor, and training activities were in progress within the sector.

The controllers on duty had obtained adequate rest prior to the commencement of their shift and were operating during night duty hours. The traffic density was moderate at time of incident with 15 aircraft under jurisdiction of DATCO.

All automation system, HF and CPDLC were working normal on the day of incident.

1.17.3 Controller Workstations and Systems

The OCC is equipped with controller workstations designed to enhance situational awareness and assist in maintaining safe separation:

1.17.3.1 General Purpose Work Station (GPWS): This system enables controllers to create, update, and manage flight plan data. It also facilitates the input of estimates and provides conflict detection support through trial probing, alerting controllers to potential conflicts based on projected flight levels and trajectories.

On the day of incident, DATCO-2 was working at GPWS.

1.17.3.2 Controller Coordination Work Station (CCWS): This display system provides a real-time or extrapolated representation of aircraft tracks within the Mumbai FIR based on flight plan data and position reports. It serves as a monitoring tool and enhances situational awareness through features such as Range Bearing Line (RBL), Minimum Separation (Min Sep) tools, and conflict alerts. The system also supports coordination functions, including Air Traffic

minimizes controller intervention, and improves predictability of traffic movements, particularly in areas where continuous radar surveillance is not available and separation is maintained through position reporting and estimates.

As per *The Flight Level Allocation Scheme, for West bound traffic FL320 and for East Bound Traffic FL330 was specially allocated for crossing routes*. Therefore, Flight ELY081 and Flight QTR8E both were non FLAS Flights.

1.17.5 Handover /Takeover Procedures

Details of Handover/ Takeover procedure is clearly defined in Para 4.23 of the Manual of AIR Traffic Services -Part-2 (MATs-2) pertaining to ATS Mumbai and published by AAI, Mumbai. The relevant extract from the MATs-2 is appended below:

“4.23 Handover /takeover procedures

All the ATCOs shall follow proper handover / takeover procedure given in MATS-I which is reiterated below.

- 1) ‘During the shift change, or whenever an air traffic controller is relieved irrespective of the duration of relieve, a mandatory 15-minute overlap period shall be provided in which the relieved ATCO shall brief the relieving ATCO of complete traffic situation. The relieving officer shall plug-in the headset and monitor the progress of the traffic. The relieved officer will brief the relieving officer of all active and pending list of traffic. The relieving ATCO shall make a log entry of having received briefing and understood the traffic situation before assuming charge of air traffic control duties in an ATC unit.’*
- 2) ‘The relieving officer shall first ‘takeover watch’ in the logbook and sign to that effect followed by the ‘handing over watch’ by the relieved officer.’*
- 3) ‘All ATC officers before taking over watch must familiarize themselves with-*
 - i. The current weather report and forecast*
 - ii. Status serviceability of all VHF channels*
 - iii. Status of serviceability of direct telephones*
 - iv. Information contained in AUP/UUP.*
 - v. Current NOTAMs and bulletins*
 - vi. Status of serviceability of inter unit and inter-center facilities*
 - vii. Status of serviceability of radio navigational aids / landing aids, visuals aids etc.*
 - viii. Status of serviceability of crash and fire alarm siren and bell (wherever applicable).*
- 4) Any un-serviceability of above facilities shall be recorded in the logbook.*
- 5) In the log book no pencil entries should be made and no overwriting resorted*

to. Should any alteration to the entry already made, becomes necessary, the previous entry should be scored out by drawing a fine line over it and new entry made and duly signed. No entry should be erased once it is made.

6) ATCOs shall sign and write their name in legible way after (HOW) Handover / (TOW) Takeover.

7) Date shall be mentioned at the start of the shift and at the change of the day."

On 23-24 March 2024, while Handing Over Watch (HOW) and Taking Over Watch, Duty ATCOs (Controller) have made their entries in a register maintained by AAI, Mumbai ATS unit. Extract of the relevant page is attached herewith.

1800	Tow	[redacted]	[redacted]
1800	How	[redacted]	DATCO-1
2200	Tow	[redacted]	DATCO-1
2200	How	[redacted]	[redacted]
2200-2400	OJT for	OJT-1	
0000-0130	OJT for	OJT-2	
0130	Tow	[redacted]	[redacted]
0130	How	[redacted]	DATCO-1
24/03 0200	Tow	[redacted]	DATCO-3
0200	How	[redacted]	DATCO-2
0206	When I took over channel first looked at CCWS-05, no MTCD Alert was shown, bth Ely 081, B77w, F350, OTHM-VRMM Est GOLEM 0207, via HF & DTR 8E, F350, Est-GOLEM 0208 (via Datalink), my attention was not attracted towards		

Figure 4: HOW and TOW Register

1.17.6 Procedural Control

Air traffic control provided through procedural control is based on the separation standards prescribed in ICAO Doc 4444 (PANS-ATM). Under this method, separation between aircraft is ensured through pilot position reports, estimates, and controller-issued clearances, rather than real-time radar surveillance.

- **Longitudinal separation** is achieved by establishing minimum time intervals between aircraft over specified reporting points or by maintaining prescribed distances using DME, GNSS, or RNAV-derived information. The Mach Number Technique is applied at higher altitudes to ensure constant spacing between aircraft operating at similar performance levels.
- **Lateral separation** is provided by assigning aircraft to different routes, tracks, or airways that are geographically separated or separated by navigation aids prescribed in Doc 4444.

- **Vertical separation** is ensured through the allocation of different flight levels in accordance with applicable vertical separation minima.

The main tool in procedural control is the Flight Progress Strip (FPS). Controllers use FPS to record clearances issued to aircraft and to represent the traffic situation. Strips are placed on the strip bay and then sorted according to criteria such as estimated time, flight level, and waypoints where routes intersect.

Effective application of procedural control relies on accurate and timely position reporting by pilots, in terms of position, time, distance, level, and estimates for subsequent waypoints. These details are reflected and continuously updated on the FPS. Any revisions to estimates beyond prescribed tolerances must be updated by the controller. This enables controllers to maintain an accurate traffic picture, anticipate potential conflicts, and apply the appropriate separation minima as specified in Doc 4444.

In essence, **procedural control is predictive rather than reactive**. Procedural Control is a traditional air traffic management technique used by the Airports Authority of India (AAI) at Mumbai's Oceanic Control Centre (OCC). This method is particularly important in oceanic and remote regions where radar coverage is limited.

Pilot Position Reports: Pilots provide regular reports (via HF/VHF radio or CPDLC – Controller Pilot Data Link Communications).

Flight Progress Strip (FPS): A Flight Progress Strip is a small paper or electronic record

The figure displays six Flight Progress Strips (FPS) for flight QTR8E, arranged vertically. Each strip contains the following information:

- Strip Number:** 350
- Flight Number:** QTR8E
- Altitude:** 350
- Waypoints:** KITAL 0053, BOLUR 0123, DONSA 0147, GOLEM 0212, ESMIT 0234, BIBGO 0255.
- Other Data:** L 2107, N0485, SDE1E, VRMM, VOTV, PBN/A1B1C1D1L10.
- Time:** 2403, 0022, 06.

The strips are labeled with the following aircraft identifiers: KITAL, BOLUR, DONSA, GOLEM, ESMIT, and BIBGO. The strips are also labeled with the following flight levels: 350, 350, 350, 350, 350, and 350. The strips are also labeled with the following flight numbers: QTR8E, QTR8E, QTR8E, QTR8E, QTR8E, and QTR8E.

Figure 5: FPS Flight QTR8E

used by air traffic controllers to track and manage flights, showing key details like aircraft ID, route, altitude, and times. It serves as both a working tool and a legal record of clearances and instructions. **The FPS of Flight QTR8E and ELY081 are shown in Figure 5 and 6.**

Figure 6: FPS of Flight ELY081

AAI's, Manual of Air Traffic Services- Part 2 (Enroute), Para 5 (d) of 2.12 deals with Position Reports update. According to MATs-2 (Enroute), Controllers are required to update the FPS on receipt of position reports on HF/CPDLC. The relevant extract from the same is given below:

1. ACID (sourced from FMS, i.e. as selected by pilot) 2. Selected altitude 3. Mode-C d) <u>Position Reports on HF / CPDLC and updating of FFS:</u> Even after the track to CPL correlation is achieved, the controllers shall ensure that the flight progress strips are updated with the mandatory position reports received through HF/VHF/CPDLC. e) <u>Conflict Alerts:</u> The Autotrac-3 system generates short term conflict Alert (STCA) and mid-term conflict detection (MTCD) alerts. All associated surveillance tracks (including SADS-B tracks) are candidates for STCA, whereas, MTCD alert is generated only for tracks without 'RADAR SERVICE'. MTCD alert is generated for tracks with less than 10 minutes longitudinal separation. Hence, to generate MTCD alerts, the controllers in oceanic control sectors shall ensure that 'RADAR SERVICE' for all tracks in their jurisdiction is de-selected using the following steps:
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Figure 7: Instruction regarding updating of FPS

Whereas, it is evident from the above that all Estimates were not updated in the FPS of Flight QTR8E and Flight ELY081.

1.18 Additional Information

1.18.1 Procedure of Handing Over Watch & Taking Over Watch for Instructors:

AAI's, Manual of Air Traffic Services- Part 1, Para 3.16.5 deals with procedures of handing Over Watch & Taking Over Watch (HOW & TOW) while imparting training. Extract from the same is appended below:

“3.16.5 To minimize the ATC incidents during and immediately after taking over watch for the purpose of imparting OJT, the following procedure shall be followed:

3.16.5.1 The ATC channel shall be taken over first by the instructor/ examiner and where possible in VCCS, plug in the headset at the position having override facility.

3.16.5.2 The instructor/ examiner shall assess the traffic situation and shall have complete control over the traffic situation before allowing the trainee to start OJT. It is imperative that due consideration shall be given to the level of competency of the trainee vis-a-vis complexity and density of traffic before allowing the trainee to handle R/T.

3.16.5.3 The trainee ATCO shall take briefing regarding the traffic scenario from the instructor/ examiner on channel and then begin OJT with the permission of the concerned instructor/ examiner.

3.16.5.4 During the training, instructor/ examiner who has taken over watch for imparting training shall be responsible for provisions of air traffic services to all aircraft under his jurisdiction.

3.16.5.5 The instructor/ examiner shall give complete briefing of the traffic situation to the relieving officer before handing over watch on completion of OJT.

3.16.5.6 The instructor/ examiner shall never leave the trainee unattended. If an onjob-training session is found to be unsupervised by an instructor/ examiner, the same shall be investigated by the ATS in-charge and suitable remedial actions shall be taken to prevent such occurrence.”

1.19 Useful or Effective Investigation Techniques

Nil

2. ANALYSIS

The analysis was carried out based on the available evidences such as controllers statements and interview, CPDLC /HF messages, Data stored in the Automated System (CCWS) etc.

2.1 General

2.1.1 Serviceability of the Aircraft

Based on the scrutiny of the aircraft maintenance records provided by the Organization, on the day of incident, the aircraft's Certificate of Registration, Certificate of Airworthiness, Airworthiness Review Certificate and weight schedule were valid as per the prevailing regulations. All applicable scheduled inspections were carried out on the aircraft and engines in accordance with the applicable maintenance data. All applicable and mandatory Airworthiness Directives (AD) & Service Bulletins (SB) were complied with. Prior to departure from their respective departure airport, no Minimum Equipment List (MEL) item related to TCAS was invoked on the either aircraft i.e., TCAS systems installed on the both aircraft were serviceable at the time of incident. Nil snag was pending for rectification on either aircraft.

In view of above it is concluded that the serviceability of the Aircraft was not the contributory factor to this Serious Incident.

2.1.2 Crew Qualification and aircraft Handling

The flight crews of both aircraft were appropriately licensed, qualified, and authorized by their respective airlines, namely M/s Qatar Airways and M/s EL AL Israel Airlines Ltd., to operate Flight QTR8E and Flight ELY081, respectively, on 23 March 2024. On the day of the event, their licenses and other relevant credentials were valid and up to date. Prior to departure, the flight crews of both Flights QTR8E and ELY081 were medically fit to operate their respective flights. No crew qualification related issues relevant to this serious event were found by the investigation team during the course of the investigation.

Similarly, no issues related aircraft handling and pertaining to this serious incident were found by the investigation team during the course of the investigation.

In view of above discussion, **it is concluded that the Crew Qualification and aircraft handling were not the contributory factor to this Serious Incident.**

2.1.3 Weather

During the investigation, relevant meteorological information such as weather forecasts, satellite images, and warnings/alerts specific to the area surrounding the waypoint GOLEM was obtained from the Indian Meteorological Department. The weather data was thoroughly examined. At the time of the event, there was no adverse weather forecast or warning/alert for the area surrounding the waypoint GOLEM. The satellite images indicated suitable weather conditions for flight operations. Furthermore, none of the flight crew members of either aircraft reported any weather-related difficulties or issues.

In view of above discussion, **it is concluded that the weather was not a contributory factor to this Serious Incident.**

2.2 Air Traffic Controller's Actions

2.2.1 Duty ATCO (DATCO-1)

2.2.1.1 On the day of event, **DATCO-1 was an appropriately licensed and qualified ATCO.**

2.2.1.2 DATCO-1 was Duty ATCO and In-Charge for the OCC Mumbai South Sub-Sector between 2200 UTC- 0130 UTC, i.e., watch hour preceding the watch hour when breach of separation occurred. During the duty hour, FPS for ELY081 was generated at 2346 UTC (23 March 2024) whereas FPS for QTR8E was printed at 0022 UTC. **The Flight Progress Strip of Flight QTR8E and Flight ELY081 were well available with DATCO-1.**

2.2.1.3 On receipt of the FPS, DATCO-1 noticed the impending conflict between Flight QTR8E and Flight ELY081. DATCO-1 did not follow the primary procedural control technique; instead, DATCO-1 relied on a secondary automated system (CCWS), which was for assistance and situational awareness. **This indicates departure from the primary procedures or non-adherence to the Standard Operating Procedures of (SOP) with regard to procedural controlling of Air Traffic.**

2.2.1.4 DATCO-1 did not act in time in accordance with the prevailing procedure for identifying the conflicting traffic by putting a T-mark on their FPS. This could have reminded DATCO-1 about the impending conflict. DATCO-1 did not suitably plan to handle the impending conflict at Waypoint GOLEM between Flight QTR8E and Flight ELY081. **This indicates insufficient planning in handling potential traffic on crossing tracks.**

2.2.1.5 While imparting training, DATCO-1 did not discuss the developing conflict with the OJT-1. **This shows DATCO-1's inadequate Supervision.**

2.2.1.6 During training OJT-1 was handling and managing the updates received from CPDLC / HF and maintaining the FPS, but did not detect the developing conflict.

2.2.1.7 As AAI's MATs, during training on active channel the instructor is solely responsible for managing the channel as well as training.

2.2.1.8 When Flight QTR8E and Flight ELY081 entered Mumbai FIR at 0055 UTC and 0113 UTC respectively. Subsequently they passed their estimate. Neither DATCO-1 updated the aircraft position in the Automated System (CCWS) nor detected the impending conflict at waypoint GOLEM. **This indicates lack of situational awareness of DATCO-1.**

2.2.1.9 Due to outdated aircraft positions in the Automated System (CCWS), the system responded based on the available inputs, and there was no issue with its serviceability. Consequently, the MTCD warning was not generated.

2.2.1.10 Two breaks taken by DATCO-1 between 0030 UTC and 0130 UTC, followed by the subsequent handover of watch duty at 0130 UTC, **indicates a lack of continued focus.**

2.2.1.11 Sufficient time was available to DATCO-1 to detect the conflict over waypoint GOLEM & effect a level change. Besides no specific briefing about the conflict was passed on to the relieving DATCO-2. The Watch handing over briefing given by DATCO-1 to the succeeding DATCO-2 was verbal and incomplete. **This indicates non-adherence to the Standard Operating Procedures of (SOP) regarding Watch Handing Over Briefing.**

2.2.2 Duty ATCO (DATCO-2)

- 2.2.2.1 DATCO-2 worked as coordinator between 2200 UTC to 0130 UTC. DATCO-2 took over the watch from DATCO-1 at 0130 UTC. Before taking over the watch, DATCO-2 was required to assess and ascertain the prevailing traffic condition or conflicts. But on that day, DATCO-2, without ascertaining the prevailing traffic condition took over the watch on verbal briefing. **This indicates non-adherence to the Standard Operating Procedures of (SOP) regarding Watch Taking Over Briefing.**
- 2.2.2.2 After taking over the watch, DATCO-2 was initially focused on resolving the conflict at AWY 894 with the immediate conflict as briefed by the DATCO-1. DATCO-2 did not pay attention toward the impending conflict between Flight QTR8E and Flight ELY081 at Waypoint GOLEM. **This shows lack of situation awareness.**
- 2.2.2.3 The actual breach of standard separation of 10 minutes between the Flight QTR8E and Flight ELY081 at waypoint GOLEM being at time 0156 UTC, during DATCO-2 watch hour. Due to the obsolete data, the Automated System (CCWS) did not respond accurately and no MTCD warning was generated.
- 2.2.2.4 DATCO-2, overly dependent on the Automated System (CCWS) and overlooked the estimates mentioned on the FPS. **This indicates deviation from the primary procedures or non-adherence to the Standard Operating Procedures of (SOP) regarding procedural controlling of Air Traffic.**
- 2.2.2.5 DATCO-2, **who was on channel for 30 minutes also had adequate time to detect the conflict & employ appropriate mitigation measure.**
- 2.2.2.6 DATCO-2, was unaware about the conflict at waypoint GOLEM. Hence, no specific briefing regarding the conflict between the Flight QTR8E and Flight ELY081 at waypoint GOLEM was passed on to the relieving controller (DATCO-3). **This indicates improper Handing over and taking over briefing and non-adherence to the Standard Operating Procedures of (SOP) regarding Watch Handing Over Briefing.**

2.2.3 Duty ATCO (DATCO-3)

- 2.2.3.1 DATCO-3 took over the watch from DATCO-2 at 0130 UTC, when breach of Standard separation already had begun between the Flight QTR8E and Flight ELY081 at waypoint GOLEM. Before taking over the watch, DATCO-3 was required to assess and ascertain the prevailing traffic condition or conflicts. But on that day, DATCO-3, without ascertaining the prevailing traffic condition took over the watch on verbal briefing. **This indicates non-adherence to the Standard Operating Procedures of (SOP) regarding Watch Taking Over Briefing.**
- 2.2.3.2 The ongoing conflict between Flight QTR8E and Flight ELY081 came to notice of DATCO-3, only when AC alert triggered on the automated system, at the time when DATCO-3 was resolving another conflict between ELY081/F350 and AXB398/F350 at waypoint BEDIL.
- 2.2.3.3 Ultimately, F330 was given descend to Flight ELY081, in order to resolve the conflict with flight AXB398/F350 at Waypoint BEDIL.
- 2.2.3.4 DATCO-3 reported the breach of separation between Flights QTR8E and ELY081 at GOLEM.

2.2.4 Summary

The discussion made in 2.2.1, 2.2.2 and 2.2.3 can be summarized in the following points

- a) DATCO-1, was aware of the conflict. Though sufficient time was available for the DATCO-1 to detect the conflict over waypoint GOLEM & effect a level change. DATCO-1 did not act in time as per SOPs.
- b) While imparting training, DATCO-1 did not discuss the developing conflict at waypoint GOLEM with OJT-1.
- c) DATCO-2 was on channel for 26 minutes before the breach of Standard Minimum Separation began. Despite having adequate time to detect the conflict & employ appropriate mitigation measure, DATCO-2 could not detect the conflict.
- d) DATCO's Handing Over watch and Taking Over Watch briefing was inadequate and improper. Non-adherence to AAI's written procedure related to HOW/TOW.
- e) DATCOs had deviated from the Procedural Control technique of relying/working on the FPS. Same time, over dependency of DATCOs on the Automated System (CCWS) i.e., secondary system was found.
- f) Some relevant timings related to OJT's duty/training w.r.t the Flights QTR8E and ELY081 is tabulated below:

Table 7: Sequence of event				
Time in UTC (Date)	Flight QTR8E	Flight ELY081	OJT-1, Training (0000 -0130 UTC)	OJT-2, Training (2200 -2400 UTC)
2346 UTC (23 March 2024)	-	FPS printed	Alpha	Training
0022 UTC (24 March 2024)	FPS printed	-	Training	Alpha
0056-0058 UTC (24 March 2024)	Estimates received	-	Training	Alpha
0110 UTC (24 March 2024)	-	Estimates received	Training	Alpha
0156 UTC (24 March 2024)	Breach of Standard Minimum Separation began near GOLEM		-	Alpha

In view of above discussion, **it is concluded that the actions/inactions of DATCOs are the main contributory factor to this Serious Incident.**

2.3 Circumstances Leading to this Serious Incident

On 23 March 2024, at OCC Mumbai South Sub-Sector, two ATCOs were assigned to discharge the duty of DATCO and Coordinator along with one trainee at Alpha Position. Accordingly, they carried out their respective duties at three positions—Duty Air Traffic Controlling Officer (DATCO), Coordinator, and Alpha—for two hours from 1600 UTC to 1800 UTC, followed by four hours of rest from 1800 UTC to 2200 UTC. After the rest period, the

controllers resumed their respective duty positions at 2200 UTC. One trainee (OJT-2) was also assigned for training under DATCO -1.

Flight Progress Strip (FPS) for ELY081 was printed at 2346 UTC and was handled by the OJT-2. Whereas Flight Progress Strip (FPS) for QTR8E was printed at 0022 UTC and was handled by OJT-1. DATCO-1 reviewed the FPS and noticed the crossing traffic with a 01-minute difference at Waypoint GOLEM. However, DATCO-1 neither took any preventive measures nor briefed/discussed anything about the developing conflict with the trainee (OJT-1) as the FPS was managed by OJT-1 under DATCO-1 supervision. As per procedural controlling techniques, after detecting conflicting traffic, the duty ATCO is required to plan or initiate a level change. However, DATCO-1 did not take precautionary measures that could have prevented the serious incident.

As a prevailing practice, a T-mark is required to be placed on the FPS to indicate traffic. However, DATCO-1 neither marked 'T' on the FPS nor instructed OJT-1 to do so. According to DATCO-1, on a previous occasion the marking of 'T' on the FPS had led to confusion in traffic handling; therefore, DATCO-1 chose to wait for the actual estimates. Had DATCO-1 marked a T on the FPS of either flight, it might have provided a clue regarding the impending conflict or served as a reminder to DATCO-1 or DATCO-2 of the pending action.

Flight QTR8E entered the Mumbai FIR at FL350 via KITAL at 0055 UTC and reported its estimates to the OCC South Sub-Sector, Mumbai ATC Unit via CPDLC: "Position Report 19 58.8N 60 22.0E 0056Z F350 BOLUR 0121Z DONSA 0324Z -41C 300 69 0.83M KITAL 0055Z F350" and subsequently, at 005759 UTC, Flight QTR8E reported its estimate via CPDLC: "Estimate BIBGO 0245, F350." However, the estimates for waypoint GOLEM were not given. Subsequently, it continued on its assigned route L894 as per the flight plan towards waypoint GOLEM at FL350.

Despite knowing the probable conflict at waypoint GOLEM, DATCO-1 neither derived the estimated time for waypoint GOLEM from Flight QTR8E nor obtained the estimate via CPDLC. This demonstrates a lack of situational awareness.

Later, Flight ELY081 entered the Mumbai FIR at FL350 via VUTAS at 0113 UTC and reported its estimates to the OCC South Sub-Sector, Mumbai ATS Unit via HF as: "F350 CPDLC VUTAS 0113, GOLEM 0207, EGOGI 0218, OLNK 0234, BEDIL 0239, JLBR."

Subsequently, it continued on its assigned route L875 as per the flight plan towards waypoint GOLEM at FL350. But DATCO-1, did not pass any specific instruction to the OJT-1, who was handling the FPS at that time. This indicates inadequate supervision.

In the OCC South Sub-Sector, Mumbai, as per the Flight Level Allocation Scheme (FLAS), specific flight levels are assigned to aircraft based on the direction of flight and designated ATS routes, thereby ensuring systematic vertical segregation. In accordance with FLAS, the designated flight level in this sector for eastbound traffic was FL330. Both Flight QTR8E and Flight ELY081 were eastbound at FL350; hence, they were non-FLAS flights and required an adjustment in their flight levels. However, neither DATCO-1 nor OJT-1 effected any change to the flight level of either aircraft. Had they adjusted the flight level of either aircraft, the serious incident could have been prevented.

The OCC South Sub-Sector, Mumbai, is equipped with an Automated System (CCWS) to assist the Duty ATCO and enhance situational awareness. This system requires aircraft position updates from the Duty ATCO for the prediction and detection of conflicts. On that day, estimates from Flight QTR8E and Flight ELY081 were received well in advance, but they were not updated in the Automated System (CCWS). As a result of obsolete data, the system did not detect the conflict, and no MTCD warning was generated. Had the position updates been entered into the Automated System (CCWS), the MTCD warning would have been generated, and the serious incident could have been averted.

At 0130 UTC, DATCO-1 handed over the watch to DATCO-2. Both DATCOs did not diligently follow the watch handover and takeover procedure as prescribed in MATs-1 and MATs-2. Had they meticulously followed the procedure, they might have detected the developing conflict at Waypoint GOLEM, and appropriate mitigation measures could have been employed and the serious incident could have been averted.

At 0156 UTC, a breach of the standard separation of 10 minutes commenced, approximately 26 minutes after DATCO-2 took over the watch. However, DATCO-2 failed to detect the developing conflict. The primary reason for this was a deviation from the basic principle of monitoring the FPS board while working under procedural control techniques, coupled with overdependence on alerts generated by the Automated System.

At 0200 UTC, DATCO-2 handed over the watch to DATCO-3. Once again, both DATCOs did not follow the watch handover and takeover procedure as prescribed in MATs-1 and MATs-2. Had they meticulously followed the procedure, they might have noticed the conflict at waypoint GOLEM, and appropriate mitigation measures could have been employed.

At approximately 0206 UTC, an AC alert was triggered on the automated System, at the time when DATCO-3 attempted to assign FL330 to Flight ELY081 while resolving the conflict between Flight ELY081 and Flight AXB398 at FL350 near waypoint BEDIL. At this point, the conflict came to the attention of DATCO-3. This clearly indicates the dependencies of DATCOs on the alert generated by the Automated System for conflict detection. By then, both flights were approaching waypoint GOLEM, and the opportunity for effective conflict resolution had already passed. The standard minimum separation had been reduced to its lowest value, i.e., 1 minute (approximately 9.1 NM) at flight level FL350. Subsequently, as required, DATCO-3 effected a flight level change for Flight ELY081 from FL350 to FL330. No TA/RA was generated in either aircraft.

3. CONCLUSION

3.1 Findings

- 3.1.1 The aircraft had a valid Certificate of Airworthiness, Certificate of Registration and the Airworthiness Review Certificate before operating the incident flight.
- 3.1.2 TCAS system installed on the both aircraft were serviceable at the time of incident.
- 3.1.3 No TA/RA alert was generated in either aircraft. There were nil aircraft maintenance related issues pertaining to this Serious Incident.
- 3.1.5 The flight crew of both aircraft were appropriately licensed, qualified, and authorized by their respective airlines.
- 3.1.6 The flight crew qualification and aircraft handling were not a contributory factor in this Serious Incident.
- 3.1.7 The weather was not a contributory factor to this Serious Incident.
- 3.1.8 DATCO No. 1, while performing Instructor duties, did not identify or act upon the developing conflict despite availability of flight progress information. Adequate time was available to detect the conflict at waypoint GOLEM, as both aircraft were operating at the same flight level (FL350) on intersecting airways. This indicates lack of situational awareness.
- 3.1.9 DATCO-1 did not share crucial conflict related information with the OJT-1(trainee). This indicates lack of Supervision.
- 3.1.10 The Handing Over Watch and Taking Over Watch briefing procedures as documented in MATS-1 and MATS-2 was not followed by all involved ATCOs. This shows non-adherence to the documented safety essential Standard Operating Procedures.
- 3.1.11 Sufficient time (26 minutes) was also available to DATCO-2 to detect the conflict at waypoint GOLEM and to initiate preventive/corrective measures. But DATCO-2 did not detect the imminent conflict during the watch hours. This indicates lack of situational awareness.
- 3.1.12 The conflict between Flight QTR8E and Flight ELY081 came to notice, only when the Automated System detected the conflict between Flight QTR8E and ELY081 and AC alert was generated. This shows over dependencies of all ATCOs on the alerts generated by the Automated System.
- 3.1.13 MTCD warning was not generated due to non-updating of pilot position reports/ estimates in the Automated System.
- 3.1.14 Traffic density during the time of incident was moderate. However, FPS were not updated for all waypoints.
- 3.1.15 All DATCOs were appropriately licensed, qualified, and authorized to discharge their respective assigned duties.
- 3.1.16 Non-adherence to the safety critical SOPs by all DATCOs was the main contributory factor to this serious Incident.

3.2 Probable Cause of the Serious Incident

3.2.1 Probable Cause(s)

The probable cause of this serious incident is attributed to the departure from the basic requirement of Procedural Control Technique, i.e., scanning and updating of the Flight Progress Strips (FPS) for conflict detection, and over-reliance on the secondary mechanism, i.e., the alert generated by secondary Systems i.e., Automated System (CCWS), that too without updating aircraft positions as required by the system. In addition, non-adherence to the safety essential procedure as documented in the MATs-1 and MATs-2 related to Handing Over Watch and Taking Over Watch and briefing.

3.2.2 The contributory Factor(s)

The contributory factory to this Serious Incident could be the inadequate supervision during OJT that contributed to failure in conflict detection and resolution by the trainee.

4. SAFETY RECOMMENDATIONS

- 4.1 In the present event, DATCO-1 and DATCO-2 gave contradictory version of Handing Over Watch (HOW) and Taking Over Watch (TOW) briefing to the investigation team. This clearly indicates lacunae in the existing Handing Over Watch (HOW) and Taking Over Watch (TOW) briefing methodology being followed by AAI and highlights the need for improvement. Therefore, it is recommended that the Airports Authority of India (AAI) should evaluate the effectiveness of the current HOW and TOW procedures followed by ATCOs in India in light of this serious incident, and devise appropriate measures to ensure the effectiveness of HOW and TOW briefings in the interest of aviation safety.
- 4.2 In the present event, the Handing Over Watch (HOW) and Taking Over Watch (TOW) briefing was conducted verbally and no details were recorded in the logbook maintained by the Airports Authority of India (AAI). Therefore, it is recommended that the Airports Authority of India (AAI) should identify critical information/ events relating to the Handing Over Watch (HOW) and Taking Over Watch (TOW) that must be mandatorily recorded in any form of recording to enhance situational awareness and to avoid conflicting situations between ATCOs.
- 4.3 In the present event, it is observed that the DATCOs did not update the pilot position report in Automated System, which ultimately resulted in non-generation of MTCD warning. Therefore, it is recommended that the Airports Authority of India (AAI) should assess and identify the minimum mandatory data/inputs required to be entered by ATCOs into the Automated System to ensure its effective and smooth functioning.
- 4.4 The Airports Authority of India (AAI) should periodically brief and sensitized its controllers working in procedural control environment regarding the limitations and potential irregularities of secondary systems installed for situational awareness, such as the Automated System (CCWS) used in the present case. Emphasis should be placed on ensuring that controllers should meticulously follow the procedural control technique for controlling in procedure control environment and should not rely solely on system-generated alerts for conflict detection.

- 4.5 In the present event, all Flight Progress Strips (FPS) was not updated. Therefore, it is recommended that the Airports Authority of India (AAI) should ensure that Flight Progress Strips (FPS) are accurately updated at all relevant waypoints, including intermediate and conflict-critical points such as airway intersections. Timely updating of estimates at all waypoints will enhance traffic situational awareness, facilitate early conflict detection, and support effective decision-making, particularly in procedural control environments such as the Mumbai FIR.
- 4.6 In the present event, DATCO No. 1, did not discuss/supervise the developing conflict between Flight QTR8E and ELY081 with OJT. Therefore, it is recommended that Airports Authority of India should strengthen On-the-Job Training (OJT) supervision protocols to ensure that OJT Instructors maintain effective oversight of trainee controllers, particularly during traffic conflict situations.
- 4.7 In the present event, all involved ATCOs (DATCO-1, DATCO-2, and DATCO-3) disregarded one or more SOPs. Therefore, it is recommended that the Airports Authority of India should sensitized all involved ATCOs about the SOPs and safety critical lapses that lead to such Serious Incident through relevant training.