



**Final Report**  
**on**  
**Serious Incident of Airprox**  
**between two A320 aircraft**  
**VT-ITD (IGO455) and VT-ISV (IGO246)**  
**operated by M/s IndiGo**  
**near Kempegowda International Airport, Bengaluru**  
**on 7 January 2022**

AIRCRAFT ACCIDENT INVESTIGATION BUREAU  
MINISTRY OF CIVIL AVIATION  
GOVERNMENT OF INDIA



**Final Report on Serious Incident of Airprox between two A320 aircraft VT-ITD (IGO455) and VT-ISV (IGO246) operated by M/s IndiGo near Kempegowda International Airport, Bengaluru on 7 January 2022**

Date & Time of Incident	7 January 2022 & 032552 UTC	
Place of Incident	Near Kempegowda International Airport, Bengaluru	
ATS Units	Aerodrome Control and Approach Control Surveillance Units	
Type of Occurrence	Airprox	
Classification of airspace	Class D	
Applicable ATC separation	Surveillance based horizontal separation of 3 NM and vertical separation of 1000 feet	
Recorded Minimum separation	Approx 0.9 NM horizontal (lateral) and 100 feet vertical	
Light conditions	Daylight	
	<b>Aircraft 1 (IGO455)</b>	<b>Aircraft 2 (IGO246)</b>
Type of aircraft	A320- 271N ICAO Type Designator A20N	A320- 251N ICAO Type Designator A20N
Wake turbulence category	Medium	Medium
Nationality	Indian	Indian
Registration	VT-ITD	VT-ISV
Last point of departure and ATD	Kempegowda International Airport, Bengaluru (VOBL) 0325 UTC	Kempegowda International Airport, Bengaluru (VOBL) 0325 UTC
Pont of intended Landing	Netaji Subash Chandra Bose International Airport, Kolkata (VECC)	Biju Patnaik Airport, Bhubaneswar (VEBS)
Call-sign of the aircraft	IGO455	IGO246
Flight Planned Route	BIA-W47-VVZ-A465-CEA	BIA-W47-VVZ-W90
RNAV Specification	RNAV specification included “RNAV 1 all permitted sensors”	RNAV specification included “RNAV 1 all permitted sensors”
Operator	InterGlobe Aviation Ltd. (Indigo)	InterGlobe Aviation Ltd. (Indigo)
ACAS capability	TCAS II Version 7.1	TCAS II Version 7.1
Type of flight	Scheduled air services	Scheduled air services
Flight Rule	IFR	IFR
Crew on Board	Flight Crew 2 + Cabin Crew 4	Flight Crew 2 + Cabin Crew 4
Passengers on Board	176	138
Injury	None	None
Level of damage to aircraft	No damage	No damage

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## FOREWORD

In accordance with Annex 13 to the Convention on International Civil Aviation Organization (ICAO) and Rule 3 of Aircraft (Investigation of Accidents and Incidents), Rules 2017, the sole objective of the investigation of an accident or incident is to prevent accidents and incidents and not to apportion blame or liability.

**Therefore, this report is not for the purpose to determine blame or clarify questions of liability. If this report is used for purposes other than incident and accident prevention, this may give rise to erroneous interpretations.**

The report has been prepared based upon the evidence collected during the investigation and opinion obtained from the experts.

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

AAIB	Aircraft Accident Investigation Bureau, India
AAI	Airports Authority of India
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ADS-B	Automatic Dependent Surveillance–Broadcast
AI	Air India
AIP	Aeronautical Information Publication
ANSP	Air Navigation Service Provider
APP DEP	Approach Departure
Approx	Approximately
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATD	Actual Time of Departure
ATIS	Automatic Terminal Information Service
ATPL	Airline Transport Pilot Licence
ATS	Air Traffic Services
BIAL	Bangalore International Airport Limited
CAR	Civil Aviation Requirement
CB	Cumulonimbus
CCW	Current Conflict Warning
CFL	Cleared Flight Level
CPL	Commercial Pilot License
CONOPs	Concept of Operations
CSOP	Company Standard Operating Procedures
CVR	Cockpit Voice Recorder
DGCA	Director General of Civil Aviation
DFDR	Digital Flight Data Recorder
DAP	Downlink Aircraft Parameters
ETA	Expected Time of Arrival
ETD	Expected Time of Departure
FL	Flight Level
FO	First Officer

GNSS	Global Navigation Satellite System
HAL	Hindustan Aeronautics Limited (HAL)
ICAO	International Civil Aviation Organization
IATA	International Air Transport Association
IFR	Instrument Flight Rules
IIC	Investigation-in-Charge
IST	Indian Standard Time
KIA	Kempegowda International Airport
L	Left
Ltd.	Limited
LVOP	Low Visibility Operative Procedures
MATS	Manual of Air Traffic Services
MHz	Mega Hertz
NSPR	New South Parallel Runway Operations
MEL	Multi-Engine Land
min	Minute(s)
MLAT	Multilateralation
MoCA	Ministry of Civil Aviation
MSSR	Monopulse Secondary Surveillance Radar
NM	Nautical Mile
NOTAM	Notice to Airmen
PCW	Predicted Conflict Warning
PIC	Pilot In Command
PF	Pilot Flying
PSR	Primary Surveillance Radar
RNAV	Area Navigation
PM	Pilot Monitoring
PIC	Pilot In Command
R	Right
RA	Resolution Advisory
Ref	Refer / Reference
R/T	Radio Telephony
RWY	Runway
SID	Standard Instrument Departure



SMC	Surface Movement Control
SMC-1 controller	Ground Controller at SMC-1 position
SMC-2 controller	Ground Controller at SMC-2 position
SOIR	Simultaneous Operations on Parallel or Near-Parallel Instrument Runways
SOP	Standard Operating Procedures
SSR	Secondary Surveillance Radar
STAR	Standard Terminal Arrival Route
STCA	Short-Term Conflict Alert
SUP	Supervisor
T2CAS	Traffic and Terrain Collision Avoidance System
TCAS	Traffic Alert and Collision Avoidance System
TRM	Team Resource Management
TWR	Tower
TWR-1 controller	Aerodrome controller at TWR-1 position
TWR-2 controller	Aerodrome controller at TWR-2 position
TWR SUP	Tower Supervisor
VHF	Very High Frequency
UTC	Co-ordinated Universal Time
WSO	Watch Supervisory Officer

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## Table of contents

	Contents	Page Number
	Foreword	iii
	Glossary	v
	Synopsis	xi
<b>1</b>	<b>Factual information</b>	<b>1</b>
1.1	History of the flight	1
1.2	Injuries to persons	4
1.3	Damage to aircraft	4
1.4	Other damage	5
1.5	Personnel information	5
1.6	Aircraft information	8
1.7	Meteorological information	8
1.8	Aids to navigation	9
1.9	Communications	9
1.10	Aerodrome Information	10
1.11	Flight recorders	11
1.12	Wreckage and impact information	11
1.13	Medical and pathological information	11
1.14	Fire	11
1.15	Survival aspects	11
1.16	Tests and research	11
1.17	Organizational and management information	11
1.18	Additional information	13
1.19	Useful and effective techniques	16
<b>2</b>	<b>Analysis</b>	<b>16</b>
<b>3</b>	<b>Conclusions</b>	<b>22</b>

3.1	Findings	22
3.2	Probable cause (s)	24
3.3	Contributory factors	24
<b>4</b>	<b>Safety Recommendations</b>	<b>25</b>
<b>Attachments</b>		
	Attachment1-VOBL-SID-RWY-09L-RNAV1-GNSS	A1-1
	Attachment 2-VOBL-SID-RWY-09R-RNAV1-GNSS	A2-1
	Attachment3-Operational Circular 18/2021 on “Timings of Operation for Segregated Mode”.	A3-1

## Synopsis

On 07 January 2022, IGO455, Airbus A320- 271N registered as VT-ITD and IGO246, A320-251N registered as VT-ISV were being operated by M/s InterGlobe Aviation Ltd. (IndiGo) as scheduled air services from Kempegowda International Airport (KIA), Bengaluru to Netaji Subash Chandra Bose International Airport, Kolkata (VECC) and Biju Patnaik Airport, Bhubaneswar (VEBS) respectively.

Segregated parallel operations were being conducted at KIA Bengaluru in which runway 09L was used exclusively for approaches and the other runway 09R was used exclusively for departures. Both the runways were separated by 1925 m (approx. 1.04 NM). Subsequently, ATC decided to change from segregated parallel operations to single runway operations in which runway 09L was required to be used for both departures and arrivals.

The incident took place when both the aircraft IGO246 and IGO455 were allowed to depart simultaneously from parallel runways 09L and 09R respectively. Simultaneous departures from both runways did not have the approval of the DGCA India. RNAV-1 SIDs for departures from runways 09L and 09R were merging at a waypoint BL401 which was about 6 NM from runway 09R end. However, when IGO455, after departure from runway 09R, just initiated a turn to the waypoint BL401, the Approach Departure controller promptly detected the potential conflict and issued conflict avoidance instructions to both aircraft. The time IGO455, in compliance with ATC instructions, started turning right, the separation between the two aircraft reduced to 0.9 NM laterally and 100 feet vertically (Ref Figure 1 below). Subsequently, the required separation was re-established and both flights continued to their destinations as per ATC clearances.

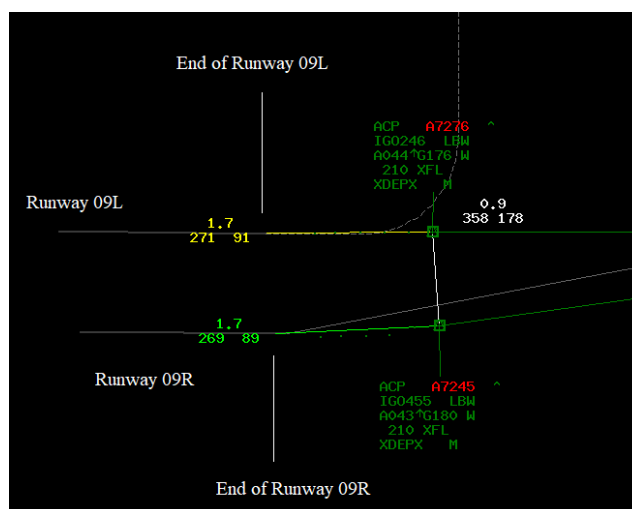


Fig-1

Director General, Aircraft Accident Investigation Bureau appointed Investigator-in-Charge vide order number INV 12011/1/2022-AAIB dated 20 January 2022, to investigate into said serious incident to find out the probable cause(s) of the Serious Incident under Rule 11 (1) of Aircraft (Investigation of Accidents and Incidents), Rules 2017. The investigation was based on the recordings of the radio communications of ATS system recorder, ATS surveillance (radar) recordings, DFDR recordings of IGO455 and IGO246, the information provided by the aircraft operator, the airport operator and the air navigation service provider, the statements and interview of the air traffic controllers and the flight crew members of both the aircraft.

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# 1. Factual Information:

## 1.1 History of the flight

### 1.1.1 Aircraft 1:

On 7 January 2022, IGO455, type A320-271N registered as VT-ITD, an IFR flight, a scheduled passenger flight operated by M/s InterGlobe Aviation Ltd. (IndiGo), was assigned SID ANIRO 7C. The aircraft departed from 09R of KIA Bengaluru at time 0325 for Netaji Subash Chandra Bose International Airport, Kolkata (VECC). There were two flight crew members on board.

### 1.1.2 Aircraft 2:

On same day, IGO246, type A320-251N, registered as VT-ISV, an IFR flight, a scheduled passenger flight operated by M/s InterGlobe Aviation Ltd. (IndiGo), was assigned SID ANIRO 7A. departed from 09L of KIA Bengaluru at the same time 0325 for Biju Patnaik Airport, Bhubaneswar (VEBS). There were two flight crew members on board.

### 1.1.3 Air Traffic Control (ATC):

ATC at KIA Bengaluru was using segregated mode of operations on parallel runways in which runway 09R was being used exclusively for departures and Runway 09L was being used exclusively for approaches. The incident took place during the transition from segregated mode of operation to single runway operations in which Runway 09L was required to be used for both arrivals and departures.

Following air traffic controllers were providing ATC when the incident took place:

- a) Aerodrome Controller North (TWR-1 controller) was responsible for operations on the north runway 09L.  
He was also WSO having overall responsibility of tactically managing ATS Units during the shift.
- b) Aerodrome Controller South (TWR-2 controller) was responsible for operations on the south runway 09R.
- c) Ground Controller North (SMC-1 controller) was responsible for traffic on the manoeuvring area under his jurisdiction. He was imparting OJT to a trainee controller at SMC-1 position.  
He was also Tower Supervisor having overall responsibility of smooth functioning of all the ATS Units in Aerodrome Control Tower.
- d) Ground Controller South (SMC-2 controller) was responsible for traffic on the manoeuvring area under the area of his jurisdiction.

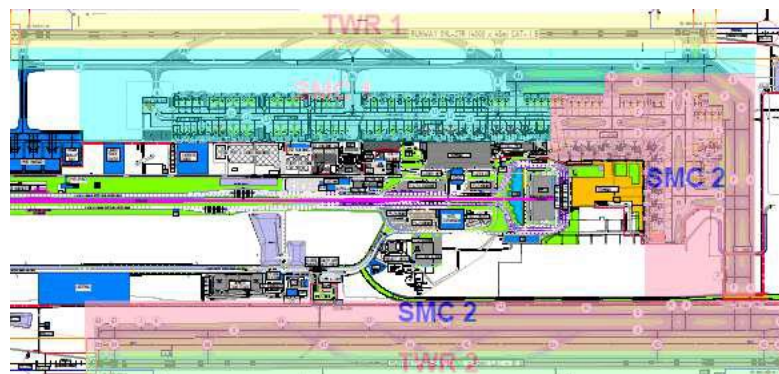


Figure-2 (Jurisdiction of Towers and SMCs)

- e) Approach Departure Controller: Using ATS surveillance systems, he was responsible for provision of approach control services. The area of his jurisdiction was an area bounded by a circle of radius 60 NM centred at BIA VOR excluding the area under jurisdiction of Yelahanka, HAL, and Approach Arrival from Ground to FL185 (Ref Figure-3).
- f) Approach Arrival Controller: Using ATS surveillance systems, he was responsible for provision of approach control services in an area of the shape of the trapezoid placed on either side of KIA runway aligned along the approach side depending upon the direction of the flow of width at runway threshold end, other end and length of 40 NM excluding the area under jurisdiction of Yelahanka and HAL. Vertical jurisdiction was from Ground level to FL115 (Ref Figure-3).

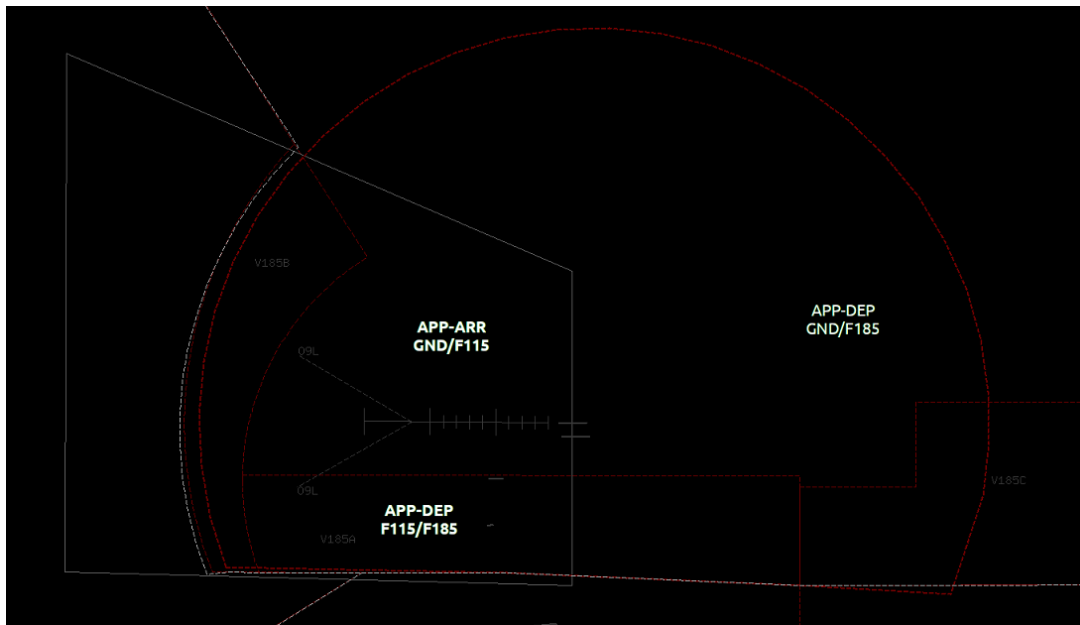


Figure 3: Jurisdiction of Approach Departure and Approach Arrival

#### 1.1.4 Sequence of the events

- 0238 Segregated mode of operations was started in which runway 09L was being exclusively used for arrivals and runway 09R was being used exclusively for departures.
- 030506 Pushback and start-up of IGO455 (Parking Stand 38) was approved by the SMC-1
- 030601 Low power Start-up of IGO246 (Parking Stand 58) was approved by SMC-1
- 030851-031232 SMC-1 issued progressive taxi instructions to IGO455, taking into consideration of conflicts of various aircraft on ground and released to SMC-2 as per coordination procedures between SMC-1 and SMC-2.  
During this period, at time 031155, Pushback and start-up of IGO246 was approved by the SMC-1
- 031254 - 031804 SMC-2 issued progressive taxi instructions to IGO455 to runway holding point H8 for departure from runway 09R (South runway).
- 031412 SMC-1 consulted Approach Departure Controller whether single RWY mode could be started, which was affirmed by the Approach Departure Controller.



031501 - 031509 IGO246 was advised by the SMC-1 to expect RWY 09L and SID was revised as ANIRO7A

031510 TWR-2 informed Approach Departure that IGO455 LAST DEPARTURE FROM RWY 09R

031525 SMC-1 advised TWR-2 that IGO455 was LAST DEPARTURE

031617 SMC-1 passed taxi instructions, "IGO246 TAXI ON L1 B4 A A11 HOLDING POINT RWY09L"

031718 - 031722 IGO246 requested SMC-1 for taxi via A10 DEPARTURE from RWY09 which was approved by the SMC-1

031922 SMC-1 advised IGO246 to MONITOR TOWER 124.35 (TWR-1)

032254 SMC-2 advised IGO455 MONITOR TWR 119.050 (TWR-2)

032313 TWR-1 instructed IGO246 to line up and wait via A10

032352 -032358 TWR-1 issued take-off clearance to IGO246 from RWY09L which was readback by the aircraft

032354 TWR-2 issued take off clearance to IGO455 which was acknowledged by the aircraft.

032417-032425 TWR-1 informed Approach departure controller that first departure IGO246 going from north runway 09L which was acknowledged by Approach Departure controller

0325 IGO 455 departed from runway 09R and IGO 246 departed from runway 09L

032507-032512 Approach Departure controller made query with TWR-1 whether both aircraft departed simultaneously, the TWR-1 informed that south controller (TWR-2) might have given take-off.

032514-032523 IGO455 contacted Approach Departure and reported passing 3900 feet on ANIRO7C departure, the controller immediately instructed to TURN RIGHT HEADING 180 IMMEDIATELY DUE TRAFFIC which was acknowledged by the flight crew of IGO455.

VHF:  
032528-032537 IGO246 contacted Approach Departure and reported passing 4200 feet on ANIRO7A departure, the controller instructed to turn left heading 360 immediately and stop climb 5000 feet which was acknowledged by the flight crew of IGO 246.

Intercom

032529-032531 TWR-1 made query with TWR-2 whether he had any departure. When TWR-2 responded “Yes”, the TWR-1 told TWR-2 controller that he should have informed to TWR-1.

032654-032715 Approach Arrival Controller called TWR-1 Controller on intercom and informed that TWR-1 and TWR-2 did not coordinate each other and both aircraft departed simultaneously which was not allowed.

The TWR 1 controller responded “YA YA CORRECT I WASN’T AWARE HE WAS GIVING DEPARTURE I THOUGHT LAST DEPARTURE ALREADY HAPPENED I TOLD APPROACH ALSO”

### 1.1.5 Location of the Incident:

Near Bengaluru Airport

Approximately 1.7 NM East of physical ends of runways 09L and 09R at Bengaluru Airport.

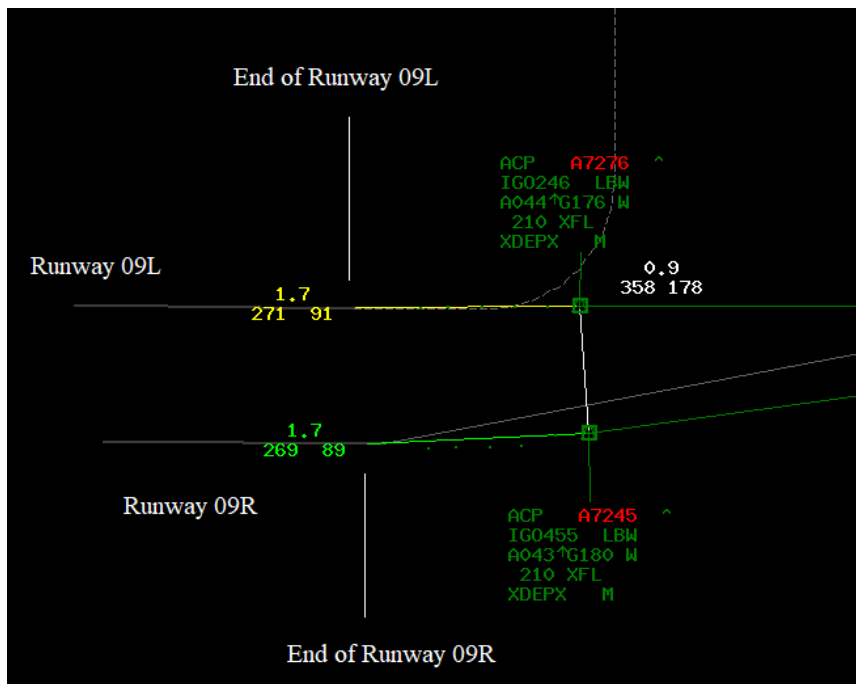


Figure 4: Location of incident

### 1.2 Injuries to persons.

NIL

### 1.3 Damage to aircraft:

NIL

#### 1.4 Other Damage

NIL

#### 1.5 Personnel information:

##### 1.5.1 Flight Crew of IGO455

	<b>Pilot-in-command</b>	<b>First Officer</b>
Licence No /Category	ATPL	CPL
Valid up	24/08/2026	09/08/2024
Date of initial Issue	25/08/2014	10/08/2009
Class of Licence	MEL	MEL
Aircraft Ratings	PA34, A320	C152, PA34, A320, BE 90/99/100/200/200GT
Date of Endorsement as PIC	25/08/2015	NA
Age	32	35
Date of Medical Exam	15/09/2021	24/05/2021
Validity of Medical	27/09/2022	31/05/2022
ICAO Language Proficiency Level	LEVEL 5	LEVEL 5
FRT0 License Validity upto	19/03/2024	09/08/2024
Date of last IR Check	27/12/2021	03/07/2021
Date of last proficiency check	27/12/2021	30/12/2021
Total Flying Experience (hours: minutes)	6970:21	2568:46
Total Flying Experience on type (hours: minutes)	A320: 6642:15	A320: 1514:31
Experience as PIC on type I (hours: minutes)	A320: 4259:41	NA
Total Flying Experience during last 180 days (hours: minutes)	211:37	353:01
Total Flying Experience during last 30 days (hours: minutes)	23:46	29:52
Total Flying Experience during last 07 days (hours: minutes)	06:05	6:02
Total Flying Experience during last 24 hours	00:00	00:00

##### 1.5.2 Flight Crew of IGO246

	<b>Pilot-in-command</b>	<b>First Officer</b>
Licence No /Category	ATPL	CPL
Valid up	23/07/2025	18/07/2022
Date of initial Issue	01/05/2015	19/07/2017
Class of Licence	MEL	MEL
Aircraft Ratings	DA40, C90A, A320,	DA40, DA42, A320
Date of Endorsement as PIC	01/08/2016	NA
Age	35	29
Date of Medical Exam	04/10/2021	18/05/2021
Validity of Medical	22/10/2022	02/06/2022
ICAO Language Proficiency Level	LEVEL 6	LEVEL 5
FRT0 License Validity upto	23/07/2025	18/07/2022
Date of last IR Check	14/08/2021	11/06/2021
Date of last proficiency check	14/08/2021	15/12/2021
Total Flying Experience (hours: minutes)	6557:38	2352:40

Total Flying Experience on type (hours: minutes)	A320: 6221:15	A320: 2090:23
Experience as PIC on type (hours: minutes)	A320: 3665:47	NA
Total Flying Experience during last 180 days (hours: minutes)	313:23	191:38
Total Flying Experience during last 30 days (hours: minutes)	51:53	27:24
Total Flying Experience during last 07 days (hours: minutes)	13:15	15:58
Total Flying Experience during last 24 hours	00:00	4:56

1.5.3 The flight crew members of IGO246 and IGO455 were in compliance with the FDTL regulations as per information provided by M/s IndiGo.

**1.5.4 Air Traffic Controllers in Aerodrome Control Tower and Approach Control (surveillance) who were providing ATC services when the incident took place:**

- a) On 7 January 2022, the air traffic controllers at ATS Bengaluru reported for morning shift which started at 0200 UTC (07:30 IST). The incident took place at 032552 UTC. The duty performed by the controllers during the period 0200 to 0335 UTC, who were providing ATS and/or had Supervisory role when the incident took place, is as appended below:

WSO	0200 to 0235	On watch WSO
WSO/TWR-1	0235 to 0335	On watch at both positions WSO and TWR-1
TWR SUP/SMC-1	0200 to 0330	On watch at both positions TWR SUP and SMC-1
TWR-2	0155-0325*	*Off watch
SMC-2	0300 to 0335^	^ Previous SMC-2 controller was on watch from 0200-0300
Approach Departure	0325** to 0335	** Previous controller was on watch from 0215 to 0325
Approach Arrival	0230^^ to 0330	^^ Approach arrival sector was opened for segregated mode of operations

TWR-2 controller made off-watch at 0325 UTC but his intercom conversation continued up to 022531 UTC.

- b) A temporary exemption from the para 6 of the DGCA CAR Section 9 Series L Part VII on “Watch duty time limitations and rest requirements of air traffic services Personnel engaged in air traffic services” was granted upto 22.07.2022 on the conditions specified in the DGCA letter DGCA-21048/10/2018-ANS-ATCO dated 04.01.2022. There was no fatigue report filed by the any of the controllers.
- c) All the controllers providing aerodrome control functions and approach control surveillance services were holding valid Air Traffic Controller’s Licences and were medically fit.
- **Aerodrome Controller-North (TWR-1):** He had valid Aerodrome Control Rating of Bengaluru Airport at the time of the incident. He acquired the Aerodrome Control Rating at Bengaluru Airport on 11 May 2021. His ICAO Language Proficiency Level was six.

He was also the Watch Supervisory Officer having overall responsibility of tactically managing ATS Units during the shift. He was performing alternate day duty of twelve hours since 1<sup>st</sup> January 2022 due to his personal engagement. He used to be WSO in the shift by the virtue of being senior

most air traffic controller in the shift. Earlier, he used to perform administrative duty in ATS administrative office and used to validate his Aerodrome Control rating time to time as per regulatory requirements. On the day of the incident, he took over watch at the TWR-1 position due to shortage of qualified air traffic controllers in the shift for management of segregated mode of operations at KIA Bengaluru. The controller was on watch at TWR-1 position from 0235 to 0335 UTC. Previously, last duty performed by him on the same position TWR-1 was on 31 December 2021 from 0815 to 0915 UTC.

The controller was 52<sup>+</sup> years of age and had vast experience of providing ATC. Previously he held Aerodrome Control, Approach Control Procedural, Approach Control Surveillance, Area Control Procedural and Area Control surveillance ratings at IGIA Delhi which was one of the busiest airports of India. He was also On-the-Job Training Instructor at the IGIA Delhi. He was an instructor at the Civil Aviation Training College, Allahabad and also an instructor and examiner at National Institute of Aviation Training and Management (NIATAM) which was an ATS Training Organisation approved by DGCA India.

- **Aerodrome Controller-South (TWR-2):** He had valid Aerodrome Control Rating on the day of the incident. He acquired the Aerodrome Control Rating at KIA Bengaluru on 23 September 2019. His ICAO Language Proficiency Level was five and valid upto 10 April 2024. His age was 29+ years as on the day of the incident. The controller was on watch at TWR-2 position from 0155 to 0325 UTC. Previously, last duty performed on the same position TWR-2 was on 3 January 2022 from 1420 to 1535 UTC.
- **Ground Controller-North (SMC-1):** He was holding valid Aerodrome Control and Area Control Procedural Rating on the day of the incident. He acquired the Aerodrome Control Rating at KIA Bengaluru on 22 December 2016. His ICAO Language Proficiency Level was six. His age was 29+ years as on the day of the incident.

He was an authorised ATC Instructor for imparting training in Aerodrome Control and Area Control. At the time of incident, he was Aerodrome Control Tower Supervisor and also imparting On-the-Job training to a trainee controller at SMC-1 position when the incident took place. On the day of the incident, the controller was on watch at SMC-1 position from 0200 to 0330 UTC. Previously, last duty performed on the same position SMC-1 was on 3 January 2022 from 1100 to 1200 UTC.

- **Ground Controller - South (SMC-2):** He was holding valid Aerodrome Control Rating on the day of the incident. He acquired the Aerodrome Control Rating at KIA Bengaluru on 19 August 2020 and his ICAO Language Proficiency Level was five having validity upto 15 February 2027. His age was 33+ years on the day of the incident. On the day of the incident, the controller was on watch at SMC-2 position from 0300 to 0430 UTC. Previously, last duty performed on the same position SMC-2 was on 1 January 2022 from 2100 to 2130 UTC.
- **Trainee Air Traffic Controller at SMC-2 position:** The trainee controller was undergoing on-the-job training at SMC-1 position under the supervision of authorised instructor SMC-1. He was not holding any ATC rating at KIA Bengaluru but previously, he had held Aerodrome Control, Approach Control Procedural, Approach Control Surveillance and Area Control Procedural ratings of Guwahati Airport. He had completed more than 90 hours of OJT in aerodrome control unit prior to the date of the incident. His ICAO Language Proficiency Level was five having validity upto 16 January 2023. His age was 42<sup>+</sup> years as on the day of the incident.
- **Approach Departure Controller:** He had valid Approach Control Surveillance Rating of Bengaluru Airport at the time of the incident when he was providing approach control surveillance services. He acquired the Approach Control surveillance rating on 7 May 2019. Additionally, he was also holding valid ratings of Aerodrome Control, Approach Control Procedural, Area Control

Procedural and Area Control Surveillance Ratings of KIA Bengaluru when the incident took place. Previously he held Aerodrome Control and Area Control ratings of Delhi Airport and Aerodrome Control Rating of Bhuntar Airport. He was 42-year as on the day of the incident and his ICAO Language Proficiency Level was 6 (six). On the day of the incident, the controller was on watch at Approach Departure position from 0325 to 0435 UTC. Previously, last duty performed on the same position Approach Departure (Surveillance) position was on 3 January 2022 from 1900 to 2130 UTC. The incident took place immediately after taking over watch at Approach Departure position.

- **Approach Arrival Controller:** He had valid Approach Control Surveillance Rating of KIA Bengaluru at the time of the incident when he was providing Approach Arrival control surveillance services. He acquired the Approach Control surveillance rating on 15 March 2019. Additionally, he was also holding valid ratings of Aerodrome Control, Approach Control Procedural, Area Control Procedural and Area Control Surveillance of Bengaluru Airport when the incident took place. Previously he held Aerodrome Control, Approach Control Procedural, Approach Control Surveillance, Area Control Procedural, and Area Control surveillance ratings of Cochin Airport. He was 52-year-old as on the date of incident and his ICAO Language Proficiency Level was 6 (six). On the day of the incident, the controller was on watch at Approach Arrival position from 0230 to 0330 UTC. Previously, last duty performed on the same position Approach Control (Surveillance) position was on 4/5 January 2022 from 2330 to 0030 UTC.

## **1.6 Aircraft information:**

### **1.6.1 IGO455:**

IGO455, type of aircraft A320-271N, manufactured by M/s AIRBUS had valid certificates of airworthiness. The aircraft was equipped with TCAS II Version 7.1

### **1.6.2 IGO246:**

IGO246, type of aircraft A320-251N, manufactured by M/s AIRBUS and had valid certificates of airworthiness. The aircraft was equipped with TCAS II Version 7.1

## **1.7 Meteorological Information**


### **1.7.1 Meteorological Reports of Bengaluru Airport**

MET REPORT VOBL 070230Z WIND 110/05KT VIS 1KM RVR RWY 09R 2000M BR BKN 400FT (120M)  
T18 DP18 QNH 1019HPA 30.11 INCHES QFE 0916HPA 27.07 INCHES BECMG VIS 2000M IN BR=

MET REPORT VOBL 070300Z WIND 120/06KT VIS 2KM BR BKN 600FT (180M) T19 DP18 QNH  
1020HPA 30.13 INCHES QFE 0917HPA 27.09 INCHES BECMG VIS 3000M IN BR=

MET REPORT VOBL 070330Z WIND 130/08KT VIS 2KM BR BKN 600FT (180M) T19 DP19 QNH  
1020HPA 30.14 INCHES QFE 0917HPA 27.10 INCHES BECMG VIS 3000M IN BR=

**1.7.2 Local Forecast:**

 <b>INDIA METEOROLOGICAL DEPARTMENT</b> METEOROLOGICAL OFFICE VOBL AIRPORT LOCAL FORECAST FOR VOBL AND 100NM AROUND FROM 2022/01/06 22:00UTC TO 2022/01/07 06:00UTC					
TIME OF ORIGIN: 2022/01/06 21:09UTC					
SURFACE WIND: VRB/02KT					
<b>UPPER WINDS</b>					
16000M	230/20	-82	4500M	210/15	+03
13500M	240/20	-67	3000M	220/10	+12
12000M	240/25	-52	2100M	180/10	+15
10500M	220/30	-40	1500M	140/10	+17
9000M	250/40	-33	900M	099/02	+16
7500M	230/20	-17	600M	999/99	99
5500M	270/15	-06	300M	999/99	99
WEATHER	BR TEMPO 0700/0703:FG				
VISIBILITY	3000M IN BR BECMG 0622/0623:1500M IN BR TEMPO 0700/0703:0500M IN FG BECMG 0705/0706:6 KM:				
CLOUDS	SCT ST 1140M/-- BECMG 0622/0623:SCT ST 1080M/-- TEMPO 0700/0703:BKN ST 1050M/-- SCT SC 1260M/1410M				
FREEZING LEVEL	4800 M				
ADDITIONAL NOTES	NIL				
WARNING	VISIBILITY WILL BE 3000M BR BECMG 1500M BR FROM 0622/0623 AND LIKELY TO REDUCE 0500M IN FG WITH LOW CLOUD BASE 1050M WITH 5 OKTA OR MORE				
SUNRISE	07/06:45 IST		SUNSET	07/18:08 IST	
MOONRISE	07/10:40 IST		MOONSET	07/22:46 IST	
MOONPHASE	NEW MOON				
ALL HEIGHTS ARE ABOVE MSL					
METEOROLOGICAL OFFICER: RVG					

1.7.4 The air traffic controllers in the shift obtained briefing from Indian Meteorological Office located inside the ATS complex Bengaluru. Flight crew of both the aircraft IGO455 and IGO246 received meteorological briefing through company pre-flight documents.

**1.8 Aids to navigation:**

IGO455 and IGO246 were equipped with the standard navigation/approach aid equipment for the route to be flown. Both the aircraft with RNAV-1 capability. The RNAV specification included “RNAV 1 all permitted sensors”. There were no reported technical failures of the navigation equipment of the aircraft.

Runway 09R/27L were equipped with ILS CAT II/ CAT IIIA/ CAT IIIB and Runway 09L/27R was equipped with ILS CAT I. Other navigation aids VORs/DMEs BIA and BIB were serviceable. At the time of the incident, there was no report of unserviceability of any of the navigational aids. However, RVR runway 09L was unserviceable since 0818UTC of 03 January 2022.

**1.9 Communications:**

Both aircraft IGO246 and IGO455 were communicating with TWR-1 and TWR-2 on frequency 124.350 MHz and 119.050 MHz respectively. There was no requirement for flight crew or controllers to monitor other TWR frequency. SMC-1 and SMC-2 were operating on frequency 121.650 MHz and 127.775 MHz respectively. Approach Arrival and Approach Departure were operating on frequency 121.250 MHz and 127.750 MHz respectively. No unserviceability was reported about any of the VHF.

All ATC units were equipped with intercom for the purpose of coordination from one unit to other unit at KIA Bengaluru. However, SMC1 and TWR-1 controllers sitting in close proximity did not coordinate with each other on intercom and coordinated verbally. Therefore, the coordination done between them was not recorded. SMC-1 controller stated that the coordination regarding last departure IGO455 from runway 09R was done with TWR-1 controller. However, TWR-1 controller stated that SMC-1 controller released the

aircraft IGO246 unconditionally without intimating him about any information on last departure IGO455 from runway 09R. No evidence was made available to ascertain the coordination between them.

All the relevant VHF and intercom communications were recorded and were made available for investigation purpose.

Air Traffic Control Units at ATS Bengaluru were not equipped with any device that record background communication and aural environmental air traffic controller work stations.

In view of the above, verbal coordination between TWR-1 and SMC-1; and TWR-2 and SMC-2 were not recorded. No evidence was made available to confirm coordination done between SMC-1/TWR SUP and TWR-1/WSO. Similarly, no evidence was made available to confirm coordination done between SMC-2 and TWR-2.

### 1.10 Aerodrome information:

**Kempegowda International Airport (VOBL)** is an international airport serving Bengaluru, the capital of Karnataka, in the southern part of India. It is located about 30 kilometres North East from city near the suburb of Devanahalli. It is the third-busiest airport by passenger traffic behind the airports in Delhi and Mumbai.

The airport has two parallel runways – north runway 09L/27R and south runway 09R/27L, separated by 1925 m (Approx 1.04 NM)

Runway 09L/27R is 4,000 by 45 metres

Runway 09R/27L is 4,000 by 45 metres.

The ATS Building, Kempegowda International Airport, Bengaluru is located almost at the Centre of the Airport. The 65.25 m high Control Tower is connected to the ATS building internally via concrete vestibule. The ATS building houses ATS Units including Approach Control Units. The Meteorological Office which is responsible for providing meteorological services, is also located inside the ATS Complex.

The Aerodrome Control Tower had two working positions for Aerodrome Controllers. TWR-1 controller facing north runway 09L/27R and TWR-2 controller facing south runway 09R/27L. SMC-1 and SMC-2 controllers sit in close proximity of TWR-1 and TWR-2 controllers. (Ref: figure 5).

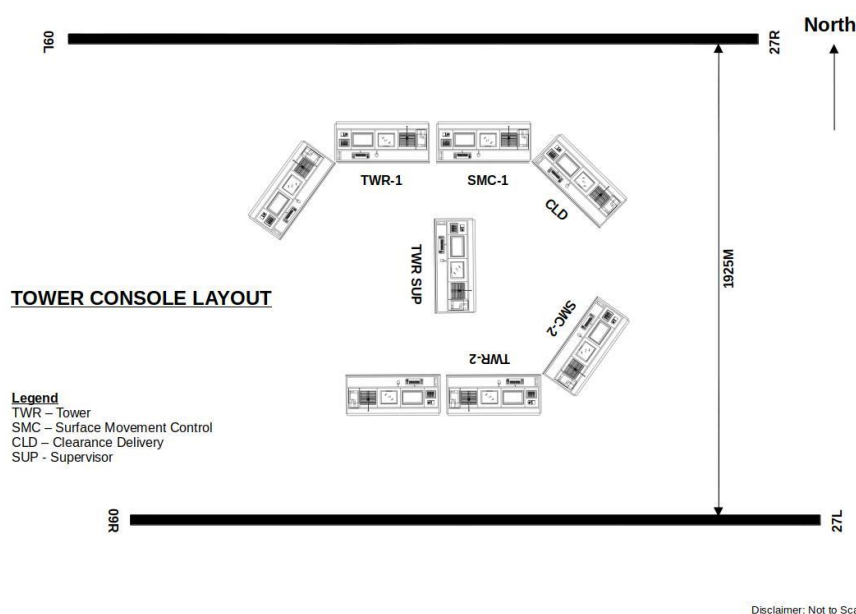


Figure: 5: Control Tower work positions layout



### **1.11 The Flight Recorders:**

Data from the Digital Flight Data Recorder (DFDR) of aircraft IGO455 (VT-ITD) and IGO246 (VT-ISV) was provided by the M/s IndiGo and the relevant parameters were analysed. However, Cockpit Voice Recorder (CVR) of both the aircraft were not made available for investigation as the relevant CVRs recordings were not preserved due to late notification of the incident.

### **1.12 Wreckage and impact information**

There was no damage to either of the aircraft.

### **1.13 Medical and pathological Information**

There was no reported adverse medical condition of the flight crew members of both aircraft. The flight crew of IGO246 did not undergo Breath Analyser (BA) Test, however, they signed a declaration as per DGCA order – 15031/4/2020-DAS dated 29.03.2020 before operating the flight from Bengaluru. The PIC of IGO455 did not undergo Breath Analyser (BA) but signed a declaration as per above mentioned DGCA letter. However, FO of IGO455 was subjected to BA test at Nagpur before undertaking the first flight.

All the air traffic controllers involved in the incident were declared medically fit by the medical assessor. Only 5% of the controllers were required to be subjected to the breath-analyser examination in the shift as per DGCA Office order DGCA-15031/4/2020- DAS dated 02.11.2021. There were 18 controllers in the shift, out of which one controller was subjected to breath-analyser Test.

### **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):**

The Air Traffic Services including Aerodrome Control services and Approach Control Surveillance services at KIA Bengaluru, were being provided by Airports Authority of India (AAI). AAI was constituted by an Act of Parliament and came into being on 1<sup>st</sup> April 1995, entrusted with the responsibility of creating, upgrading, maintaining and managing civil aviation infrastructure both on the ground and air space in the country.

AAI was responsible for providing necessary resources including manpower requirement for provision of ATS at KIA Bengaluru. AAI Corporate Headquarters, New Delhi provided following information about number of air traffic controllers at ATS Bengaluru:

Sanctioned strength of air traffic controllers	155
Number of air traffic controllers available	138
Number of ATCOs required to support segregated operations on parallel runways	186

As per information provided by ATS Bengaluru, 18 controllers were required in the shift for supporting segregated operations on parallel runways provided WSO and TWR SUP also work as controllers. On the day of the incident, there were 18 controllers including WSO and TWR Sup excluding four controllers who were either on leave for personal work or infected with COVID-19.

The Manual of Air Traffic Services – Part 1 (MATS-Part1) issued by the AAI Corporate Head Quarters provides processes, procedures and instructions that are essential for the provision of safe and efficient air traffic services within the airspaces under the jurisdiction of AAI and at airports where air traffic services are provided by AAI. As per requirement given in MATS-1, airport specific Manuals of Air traffic Services (MATS-Part 2) are developed by ATS-in-charges of various airports.

Following para of MATS-Part1 (6<sup>th</sup> Edition) provides information and instructions to air traffic controllers on recording/reporting of an incident

Para 3.20.1.5 “An accident or incident known to have occurred shall be recorded with any associated information in the logbook of the ATC unit in which it had taken place by the concerned ATCO and immediately brought to the notice of watch supervisor officer/ATS-in-charge, as applicable.”

MATS- Part 2 KIA Bengaluru: It contains information, guidance, procedures and instructions applicable to the ATS units of KIA Bengaluru airport. This manual is maintained by ATS-in-charge of the KIA Bengaluru. Following para of MATS-Part 2 (5<sup>th</sup> Edition) provided information and instructions to air traffic controllers on the provisions of ATS specific to KIA Bengaluru including segregated operations on parallel runways. Some of the provisions of MATS-2 relevant to the incident are as appended below:

**“4.6 Watch Supervisory Officer**

*Watch Supervisory Officers (WSO) leads a highly skilled workforce to ensure that the objectives of safe, orderly and expeditious Air traffic services are met effectively.*

**4.7 Duties and responsibilities of Watch Supervisory Officer**

*As overall in-charge of all ATS units during the shift duty period watch Supervisory Officer is responsible to ensure that;*

- i. All ATS units are adequately manned and if necessary, rearrange positioning of ATS personnel to maintain optimum efficiency and to meet training needs.*  
.....
- o. Inform Aircraft accidents and ATC incidents/important events pertaining to ATS which attracts media/public attention to AAI management and MoCA within 15 minutes of its occurrence.*  
.....
- x. Shall decide a change in mode from Segregated to single RWY operation and vice versa.*

**19.6 Coordination between various ATS Units at Bengaluru**

**19.6.4 Between TWR1 and TWR2**

.....

*During LVOP, when segregated mode of operation is in progress on 09 mode and RVR falls below 550m, TWR1 shall co-ordinate with TWR2 for those departures which have already joined Taxiway P/Q for South RWY to depart from RWY 09R till RVR falls below 350m. TWR1 shall positively confirm from TWR2 that there are no further departures from RWY 09R before allowing departures from RWY 09L. TWR2 shall positively confirm from TWR1 that there are no further departures from RWY09L before allowing departures from RWY09R before reverting back to segregated mode of operations.*

.....

**19.6.7 During Runway Change:**

- o TWR handling departures shall inform APP regarding the sequence and position of the last departure for present mode of operation.*  
.....
- o TWR which will be handling departures in new mode of operation shall positively coordinate with APP before lining up the first departure for the new mode of operation.*

**Chapter 25**  
**Standard Operating Procedures**

**25.1.5 GENERAL CONDITIONS**

1. The following conditions shall be adhered to:

c) No simultaneous departures from RWY 09R/RWY 09L shall be permitted during segregated Mode of operations or during change of modes.

.....

d) No simultaneous arrivals on RWY 09R/RWY 09L shall be permitted during segregated Mode of operations or during change of modes.

....

**25.1.10 RUNWAY CHANGE**

25.1.10.1 Procedure to be followed TWR handling departures shall inform APP regarding the sequence and position of the last departure (with callsign) for present mode of operation.

....

TWR which will be handling departures in new mode of operation shall positively coordinate with APP before lining up the first departure (with callsign) for the new mode of operation.

.....

**1.17.2 Bangalore International Airport Limited (BIAL)**

BIAL was formed under the Companies Act, 1956 and incorporated to build, own and operate BLR Airport for a 60-year concession period. Private promoters hold a 74% stake, while the Government holds the remaining 26% stake.

(xxxx) company and BIAL entered into an agreement dated 26th August 2014 for Consultancy Services for integrated Bangalore Terminal Control Area to facilitate operations on existing and planned New South Parallel Runway at Kempegowda International Airport Bengaluru (KIAB). (xxxx) prepared a Concept of Operations (CONOPs) for New South Parallel Runway Operations (NSPR) at KIA Bengaluru. Safety Assessment Report for KIA Bengaluru Runway 09R/27L was prepared by a consulting company engaged by BIAL.

**1.18 Additional Information**

**1.18.1 ATM Automation System:**

The air traffic controllers were providing ATS using an integrated automation system for the provision of ATS including Aerodrome Control, Approach Control Surveillance and Area control surveillance services. ATM automation system was provided with dual redundant server architecture with dual LAN for redundancy. The automation system consists of Surveillance Data Processing, Flight Data Processing, Safety Nets, Controller Working Positions & Control and Monitoring Positions. ATM system is provided with surveillance input from Bangalore - PSR/MSSR, HAL - PSR/MSSR, Bellary – MSSR, Bangalore - ADS-B, Kadapa - ADS-B and Coimbatore - ADS-B.

A-SMGCS is provided with surveillance input from two SMRs, 9 MLAT Sensors, and ADS-B coverage up to 20NM using the ADS-B data received by the MLAT Sensors. For seamless tracking of aircraft in air as well as ground, PSR/MSSR tracks from Bangalore is also integrated into the A-SMGCS.

The Safety Nets are provided in the ATM Automation System for Air Display include: Short Term Conflict Alert (STCA), Area Proximity Infringement Warning (APW), Minimum Safe Altitude Warning (MSAW), Approach Path Alert Monitor (APAM)

Short Term Conflict Alert warns controllers about possible infringement of prescribed separation between two tracks. Look Ahead Time defined in the system is 120s. Several volumes of airspace are defined as per the applicable separation. In case of conflict detection, STCA alert is displayed, involved tracks are joined by a line in yellow colour initially (giving time for controllers to react) turning to red subsequently. Alarm window pops up simultaneously highlighting the targets involved and remains in the display until acknowledged and cancelled by the controller. STCA in areas in zone 0 to 2 are inhibited.

The area 0 is inhibited from level 0 to 5000 feet. It extended up to about 4NM from Runway 09L and 09R ends. STCA inhibited area was created to avoid nuisance STCA between aircrafts landing and taking off from VOBL considering the aircrafts operating in the Yelahanka (VOYK) traffic circuit and aircraft carrying out IAL procedure at Yelahanka (VOYK).

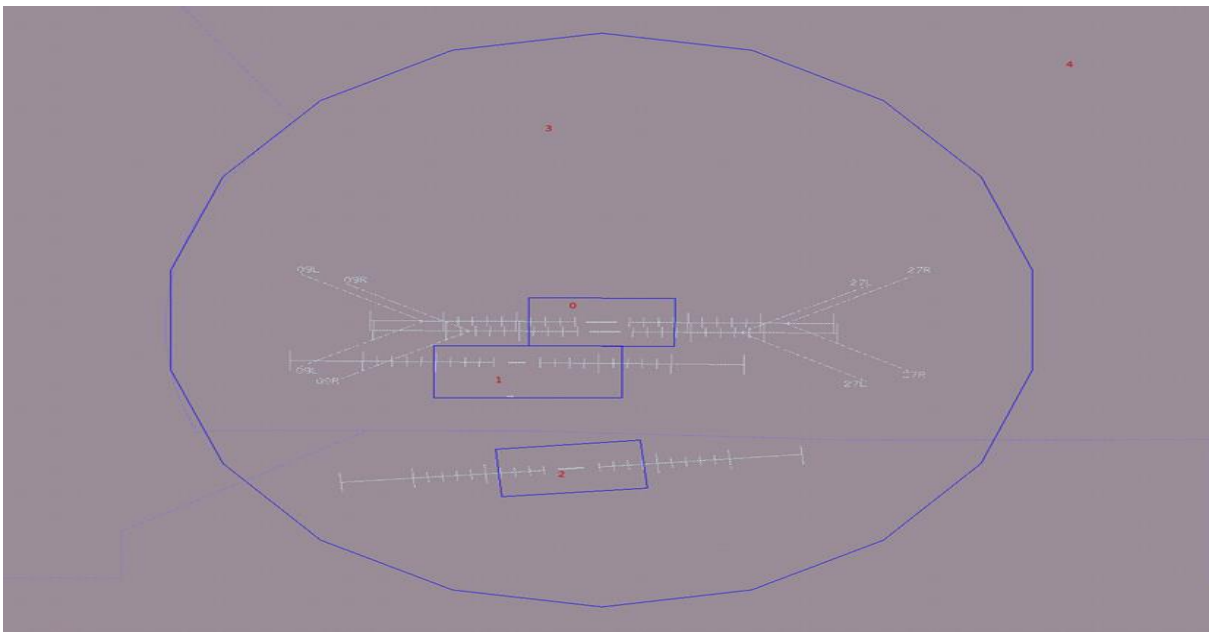


Figure 6: STCA inhibited airspace

### 1.18.2 Some of the ICAO provision on independent parallel departures:

ICAO DOC4444 (PANS ATM) para 6.7.2.2

Requirements and procedures for independent parallel departures

Independent IFR departures may be conducted from parallel runways provided:

- a) the runway centre lines are spaced by a minimum distance of 760 m (see Annex 14, Volume I);
- b) the nominal departure tracks diverge by at least:
  - 1) 15 degrees immediately after take-off; or
  - 2) 10 degrees, where:
    - i) both aircraft are flying an RNAV or RNP instrument departure; and
    - ii) the turn commences no more than 2.0 NM from the departure end of the runway;
- c) a suitable ATS surveillance system capable of identification of the aircraft within 1.0 NM from the end of the runway is available; and
- d) ATS operational procedures ensure that the required track divergence is achieved.

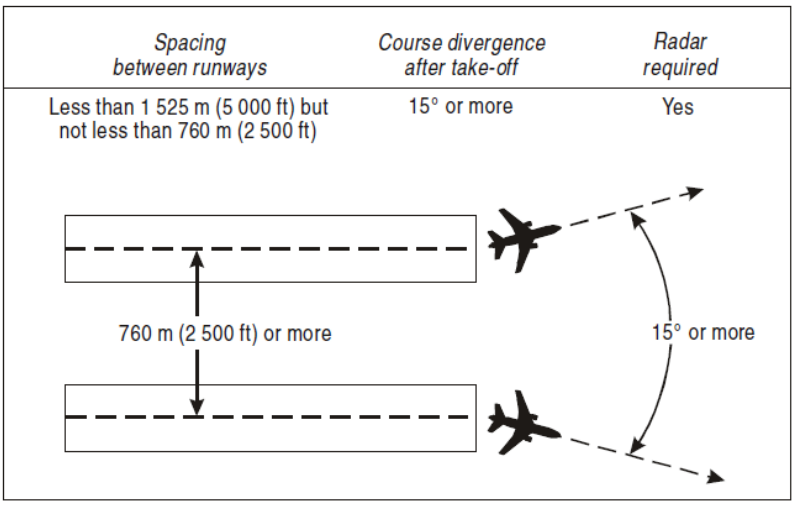
**ICAO DOC 9643 (Manual on Simultaneous Operations on Parallel or Near-Parallel Instrument Runways (SOIR))**

Independent Instrument Departures from Parallel Runways

Para 3.2 Requirements and Procedures

Para 3.2.1: Independent IFR departures may be conducted from parallel runways provided:

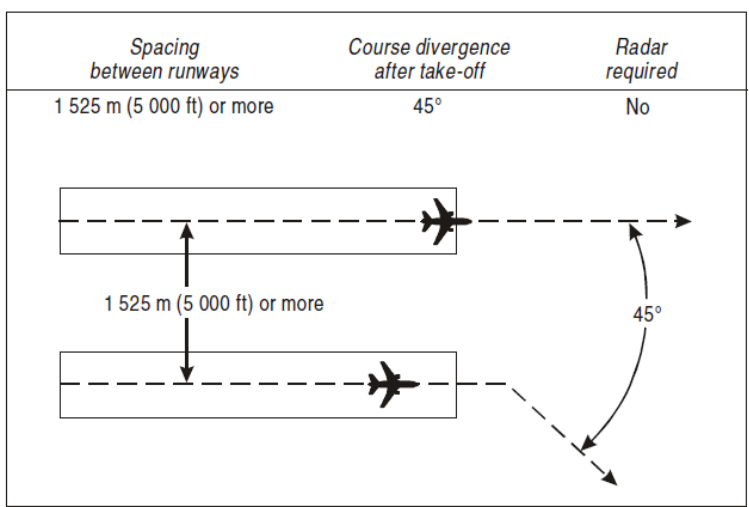
- b) the runway centre lines are spaced by the distance specified in Annex 14, Volume I;
- c) the departure tracks diverge by at least 15 degrees immediately after take-off;
- c) suitable surveillance radar capable of identifying the aircraft within 1.0 NM from the end of the runway is available; and
- d) ATS operational procedures ensure that the required track divergence is achieved.



**Independent instrument departures when parallel runway spacing is less than 1 525 m (5 000 ft) but not less than 760 m (2 500 ft)**

Figure 7

Para 3.2.2 There is no requirement, other than satisfactory two-way radio communications, for any specialized form of control or navigation aid facility for the conduct of independent instrument departures when the spacing between parallel runways is 1525 m or more and a course divergence after take-off of 45 degrees or more can be achieved. See figure 8 below:



**Independent instrument departures when parallel runway spacing is 1 525 m (5 000 ft) or more**

Figure 8

### 1.19 Useful or effective investigation techniques:

None

## 2 ANALYSIS:

### 2.1 The Incident-Introduction:

On the day of the incident, since time 0238 UTC, segregated parallel operations were being conducted at KIA Bengaluru. In this mode of operations, simultaneous operations on parallel instrument runways 09L and 09R were permitted. Runway 09L was used exclusively for approaches and the other runway 09R was used exclusively for departures.

SMC-1 approved pushback and start-up of IGO455 and issued taxi instructions for runway 09R and released to SMC-2 controller. Subsequently, SMC-2 controller issued progressive taxi instructions to IGO455 to holding position runway 09R. About 7 minutes later, pushback/start-up of IGO246 was approved by SMC-1.

SMC-1 controller who was also TWR SUP, in consultation with Approach Departure controller, started planning of traffic for transition from segregated mode of operations to single runway operations i.e., runway 09L for both arrival and departure. SMC-1 informed IGO246 for revised runway 09L and revised SID as ANIRO7A. Subsequently, SMC-1 issued taxi instructions to IGO246 to holding position runway 09L.

IGO 246 started pushback/start-up about 7 minutes later as compared to pushback/start-up time of IGO455, yet both the aircraft were approaching holding positions runway 09L and 09R respectively almost at about same time 0324 UTC because of the shorter taxi route of IGO246 to the holding position of runway 09L as compared to taxi route of IGO455 to the holding position of runway 09R. (Ref Figure 9 below)

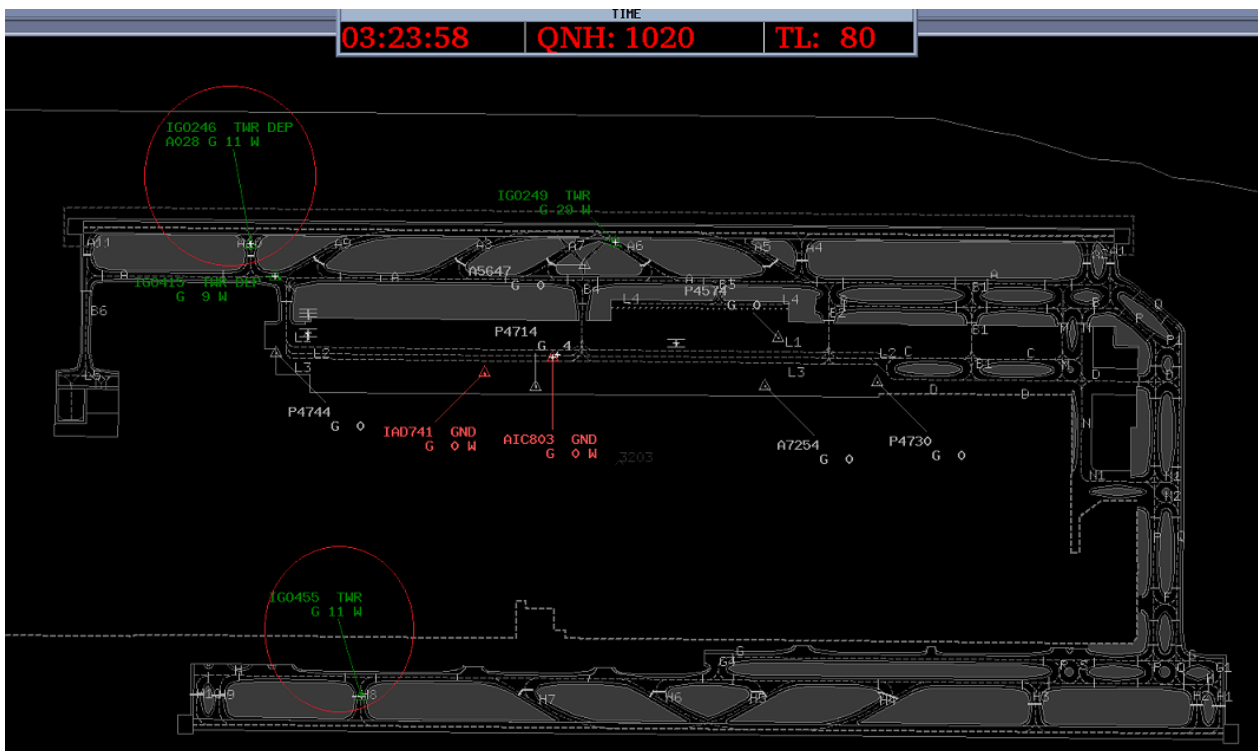


Figure 9

SMC-1 advised IGO246 to monitor TWR-1 frequency about three and half minutes earlier than release of IGO455 to TWR-2 by SMC-2 Controller. The confusion started at this point. TWR-1 controller assumed that SMC-1 had released IGO246 for RWY 09L after ensuring last departure from runway 09R. Had SMC-

1 released IGO246 to TWR-1 only after confirming the last departure from runway 09R, the incident could have been avoided. The SMC-1 controller stated that SOP contained in MATS-2 did not mandate any such requirement about sequence of release of taxiing aircraft to TWR-1 and TWR-2.

SMC-1 controller has stated that the coordination regarding last departure IGO455 from runway 09R was done with TWR-1 controller. However, TWR-1 controller stated that SMC-1 controller released the aircraft IGO246 unconditionally without intimating him about any information on last departure IGO455 from runway 09R. Since TWR-1 and SMC-1 positions were located in close proximity, all conversations between them were verbal and not through the use of the intercom. Therefore, no evidence was made available to confirm the coordination and content of coordination done between them.

TWR-1 and TWR-2 controllers issued take-off clearances to both aircraft IGO246 and IGO455 respectively, almost at about same time. Since the TWR-1 controller issued take off clearance to IGO246 without prior coordination with Approach Departure controller, he realized his error about the non-adherence to coordination procedures regarding requirement of coordination with Approach Departure controller prior to lining up, he immediately called Approach Departure controller and informed that the first departure of IGO246 from runway 09L which was acknowledged by the Approach Departure Controller. However, the Approach Departure Controller did not make any query about last departure IGO455. He, probably, assumed that TWR-1 would adhere to SOP and would release first departure from runway 09L only after last departure of IGO455 from runway 09R. TWR-1 controller also did not coordinate with TWR-2 controller about the first departure from runway 09L.

Both the aircraft IGO246 and IGO455 were airborne at same time 0325 UTC from runway 09L and 09R respectively. Both aircraft were required to follow assigned RNAV-1 SIDs. These SIDs were merging at a waypoint BL401 which was about 6 NM from runway 09R end.

As per requirement given in AIP India, all departures were required to contact Bengaluru Approach 127.75 MHZ after passing 3800 feet, unless instructed otherwise by the tower. Realizing the potential conflict between two simultaneous departures from runway 09R and 09L, the approach departure controller who had just taken over watch, instructed to IGO455 to turn right heading 180 immediately due to traffic which was acknowledged by the flight crew of IGO455. Meanwhile IGO246, passing IGO246 also contacted Approach Departure and reported passing 4200 feet. The Approach Departure controller immediately instructed to turn left heading 360 immediately and stop climb 5000 feet which was acknowledged by the flight crew of IGO246. Earlier IGO455, after departure from runway 09R, has initiated left turn to waypoint BL401 (Refer Fig 10 below).

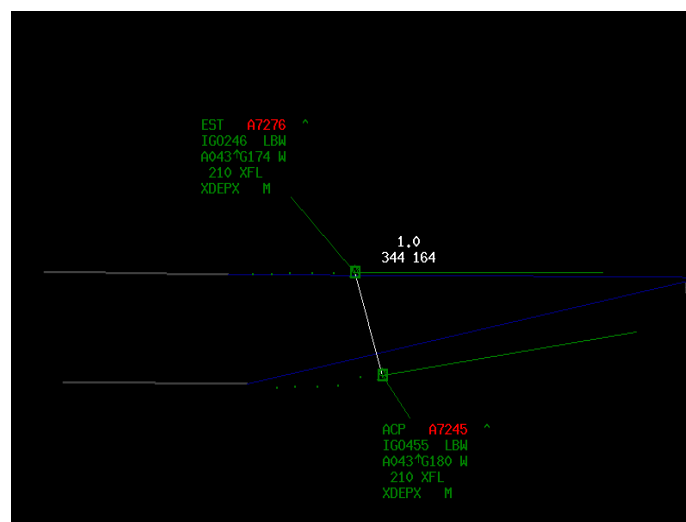


Figure 10

However, the time IGO455 executed the ATC instruction to turn right, the minimum separation between these two aircraft IGO455 and IGO246 reduced to 0.9 NM and vertical separation reduced to 100 feet (Ref Figure 1). Subsequently, the required separation was re-established and both flights continued their destinations as per ATC clearances.

Both the aircraft did not had visual contact with each other during the prevailing IMC and the Approach Departure controller also did not pass essential traffic information to the both aircraft.

## **2.2 ATCOs Staffing aspects:**

On the day of the incident, there were 18 controllers in the shift including WSO who had only Aerodrome Control rating and three controllers who had no rating of any of the ATC Units at Bengaluru. These controllers were deployed in different ATS units by the WSO. Seven controllers were deployed in Aerodrome Control Tower. Four controllers earmarked in their duty roster were on leave, out of which two controllers were infected with covid-19.

As per Operational Circular 18 of 2021 issued by ATS Bengaluru, segregated mode of operations was required to be operated between 0100 UTC to 0330 UTC during Cat-1 conditions provided there were 8 controllers in Aerodrome Control Tower and 5 radar controllers including WSO available in surveillance (Radar Units). The WSO having overall responsibility of tactically managing ATS Units during the shift and in the interest of safe and expeditious management of air traffic, decided to become one of the controllers in aerodrome control tower and support segregated mode of operations. TWR Supervisor (TWR SUP) had taken over watch at SMC-1 position at 0200 UTC. He, being an OJTI decided to impart training to a trainee controller at SMC-1 position with intention to give an exposure to him about the segregated mode of operations and subsequent change to one runway operations. The trainee controller had no rating of KIA Bengaluru.

There was no requirement at ATS Bengaluru to have independent WSO and independent TWR SUP. Thus, during the period, when WSO was on watch at TWR-1 position, the whole shift remained unsupervised. In case of any unusual situations e.g. unlawful interference or aircraft emergency etc., prompt action required for handling of situation or expeditious dissemination of information could have been delayed. Similarly, Aerodrome Control Tower remained inadequately supervised during the period when TWR SUP took over watch at SMC-1 position. This resulted into lack of supervision over the traffic situation. Had independent TWR SUP was there, he could have helped in better coordination among aerodrome controllers and possibly, the incident could have been avoided.

## **2.3 Coordination Aspects:**

There were series of coordination failures or inadequate and improper coordination which were primarily causal factor to this incident.

TWR-1 controller assumed that there was no departure from runway 09R without confirming with TWR-2 controller that there was no further departure from RWY 09R before allowing departure of IGO246 from RWY 09L. However, there was ambiguity in coordination procedures mentioned in MATS-2, whether this procedure was applicable in LVOP only as mentioned in MATS-2 or in all conditions. At the time of incident LVOP was not in progress. However, intent of this procedure was known to the TWR-1 controller.

SMC-1 controller advised TWR-2 controller that IGO455 would be the last departure from runway 09R. There was no evidence whether SMC-1 had coordinated with TWR-1 as intercom was not used for coordination between TWR-1 and SMC-1.

TWR-2 controller informed Approach Departure controller that IGO455 was last departure from runway 09R but he did not inform TWR-1 controller as SOP did not require TWR-2 controller to coordinate with TWR-1 controller before departure. Had this coordination procedure existed, possibly TWR-1 controller could have permitted the departure of IGO246 from runway 09L only after the last departure of aircraft IGO455 from runway 09R.



TWR-1 coordinated with Approach Departure controller about first departure IGO246 only after issuance of take-off clearance whereas he was required to inform Approach Departure before lining up IGO246 on runway 09L. Thus, the TWR-1 controller did not adhere to coordination procedures. However, at that time, Approach Departure controller had a narrow band of opportunity to remind TWR-1 controller about IGO455 which was in process of taking-off from runway 09R.

#### **2.4 Communication Aspects:**

When two individual human beings sitting side by side in close proximity, it is human tendency to talk directly in place of using any other medium. The TWR-1 and SMC-1 controllers were sitting in close proximity so they did coordination between them verbally without using intercom. ATC instruction did exist for usage of intercom for ATC messages. However, non-adherence to such instructions was likely to happen because of human tendency in such situation. This resulted into non-availability of any evidence of coordination done between TWR-1/WSO and SMC-1/TWR SUP who had very important role in segregated mode of operations and also during transition from one mode to other mode. Had ATC Units equipped with devices that recorded background communication and the aural environment at air traffic controller work stations, it could have recorded the communication between TWR-1/WSO and SMC-1/TWR SUP. Such facility could have helped in investigation of the incident and subsequently prevention of such incidents due to intra-units' communication errors.

#### **2.5 Teamwork aspects:**

All the controllers in the shift individually worked with intention to provide safe and efficient ATS but did not work in a team having common team goal to provide safe, orderly and expeditious ATS. WSO decided to become aerodrome controller so that segregated operations on parallel runways could be conducted. The TWR-SUP took over SMC-1 position so that he can work as SMC- controller and also impart training to trainee controller during change of runway mode of operations. The Approach Departure controller promptly took avoiding action when he observed simultaneous departures. But none of them, worked as a part of team. The TWR-2, SMC-1 and Approach Departure Controller had a window opportunity to inform TWR-1 controller about last departure from Runway 09R which had not taken-off. Further, when situation demanded, there was further breakdown of teamwork. The hand-over watch (HOW) and Taken-over Watch (TOW) at Approach Departure Position did take place at very critical moments when unexpected event of simultaneous departures from both runways taking place and a critical phase of transition from segregated mode of operations to single runway mode of operation was taking place. The TWR-2 controller made off-watch in logbook at the time when simultaneous departures from both the runways were taking place.

#### **2.6 Safety Risk Management and Safety Assurance for Segregated Operations on parallel runway at KIA Bengaluru:**

A hazard of simultaneous departures from both the runways due to human error on part of a controller or pilots do exist during segregated operation on parallel runways.

Similarly, a hazard of selection of wrong ILS frequency by flight crew did exist when ILS for runway used exclusively for departure is kept "ON" due to error on the part of the controller. Selection of wrong runway localizer was the probable cause of serious incident at IGIA Delhi on 30 January 2016 when three runway easterly mode of operations was in progress and pilot of one of the arriving aircraft selected wrong localizer frequency and made approach to a runway which was being used exclusively for departure. The serious incident was investigated by AAIB.

Further, a pilot on an instrument approach, after reaching visual conditions, may visually acquire and line up for the wrong runway which is being used exclusively for departure.

Presence of such hazards in segregated mode operations were not explicitly identified during the safety assessments for segregated mode of operations neither by BIAL nor ATS Bengaluru.

Had these hazards identified during the safety assessments, probably, risk mitigators could have been in place for reducing such incidents. Some of the risk mitigators could have been design of SIDs for independent instrument departures from both parallel runways and a comprehensive SOP and checklist for transition from one mode of operations to other mode of operations.

BIAL intimated that post implementation review of segregated mode of operations was carried out during the safety assessment done on 22.02.2021, along with commissioning of Runway 09L/27R after rehabilitation. However, hazards as mentioned above, were not identified. ATS Bengaluru did not carry out any post implementation review about possibility of any new hazard and effectiveness of risk mitigation measures identified during the initial safety assessment for segregated mode of operation.

## **2.7 Safety Nets/ Safety Barrier Aspects:**

### **a) Situational Awareness:**

#### Situational Awareness of the aerodrome and ground controllers:

It was completely ineffective in aerodrome control tower. None of the controllers anticipated the simultaneous departures from the both runways. TWR-1 had lost the situational awareness about the last departure of IGO455 from runway 09R. Similarly, TWR-2 controller, based on SOP/coordination procedures, assumed that TWR-1 controller would release the departure from runway 09L only after last departure of IGO455. The Surveillance Situation display and -A-SMGCS setting at their respective work positions were set to work independently without having any awareness about traffic in other's jurisdiction unless extra-effort was made. TWR-1 and TWR-2 were positioned in aerodrome control tower in such a way that they could not see each other visually or see other runways unless they purposely look each other or other runway. So, there was only two ways to have awareness- one through proper coordination on intercom or through a supervisor/coordinator who had overall supervision on operations during transition from one mode of operations to other mode of operations which was unlikely as both WSO and TWR SUP were busy at their respective ATC positions.

#### Situational Awareness of the Approach Departure Controllers:

The Approach Departure Controllers did not anticipate the situation of simultaneous departures from the both runways and assumed that TWR-1 would release first departure IGO246 from runway 09L only after last departure IGO455 from runway 09R. However, he observed the simultaneous departures on runways and took immediate conflict avoidance action. Thus, situational awareness of Approach Departure Controllers was very effective in prompt deconfliction of traffic.

#### Situational Awareness of the Flight Crew members of IGO246 and IGO455:

Flight crew of IGO455 and IGO246 were not aware of developing scenario of simultaneous departures as both were operating on two different ATC communication frequencies. During the interview, flight crew of both aircraft informed that they were not aware of any traffic and no visual contact with other conflicting aircraft. The Approach Departure Controller did not pass any traffic information.

### **b) Short Term Conflict Alert (STCA)**

It was an ineffective tool in the subject incident as it did not generate any alert to controller for potential/actual infringement of separation. STCA, in the airspace where infringement of separation was expected, was inhibited to avoid nuisance of frequent conflict alerts between aircrafts landing and taking off from VOBL, considering the aircrafts operating in the VOYK traffic circuit and aircraft carrying out IAL procedure at VOYK

### **c) Supervision:**

Since there was no dedicated supervisor who could have supervision in aerodrome control tower, particularly during runway change/various mode of operations of parallel runways. This safety net was

ineffective as the policy of managing segregated mode of operations without having dedicated supervisors was a fallacious policy at ATS Bengaluru.

d) **TCAS TA/RA:**

Neither TCAS of the two aircraft was activated. Since the paths of the two aircraft were not meeting the TCAS triggering criteria and the Approach Departure controller took avoiding action before such criterion was met.

**2.8 Incident Reporting Aspects:**

The TWR-1/WSO controller perceived that both the aircraft IGO455 and IGO246 were on runway 09R and 09L headings and radar controller intervention diverted the aircraft track by more than 15 degrees, so it was not a reportable incident as per provision ICAO DOC 9643 -Manual of Simultaneous Operations on parallel or near parallel Instrument Runways (SOIR) document. He compared the simultaneous parallel/near parallel runways operations of IGIA Delhi. However, while stating so, he did not consider the design of SIDs and Operational ATC procedures applicable for IGIA Delhi. There was no DGCA approval for simultaneous independent departures from both parallel runways 09L and 09R at KIA Bengaluru. Also, there was no suitable SIDs for providing inbuilt separation between simultaneous departures from both runways. Also required criterion as given in SOIR document was not met. Therefore, surveillance based horizontal separation of 3 NM and vertical separation of 1000 feet was applicable. Since the lateral and vertical separation reduced to less than applicable separation minima, therefore, it was a reportable incident.

Further the WSO/TWR-1 controller, based on his past experience had stated that many times in ATC environment due to coordination issues, pilot's wrong turn, controllers' incorrect assessment weather deviations etc when aircraft were closing with high speeds were seen converging or automated STCA were generated, avoiding headings were given by the radar controllers to resolve such conflicts, therefore, generally such events were not reportable. However, his perception is wrong. Whenever, there is breach of separation due to any reason, it is mandatory reportable incident. Thus, TWR-1/WSO stated that based on his perception about applicable separation as mentioned in ICAO SOIR document, he did not consider the event as a reportable incident.

TWR SUP/SMC-1, TWR-2 and Approach Departure controllers also did not report the incident. SMC-2 controller was not involved in the incident and stated that he had no idea about what had happened. TWR SUP/SMC-1, during the interview, perceived that there was no TCAS TA/RA, therefore, it was not reportable incident. He lacked the knowledge of criterion for generation of TCAS TA/RA. He also did not understand that TCAS RA was not only criterion for reporting of the incident. Some of controllers were of view that the unit where incident had taken place, that controller should have reported.

The incident occurred in the jurisdiction of Approach Departure Controller and as per MATS-1, the incident should have been recorded by the Approach Departure Controller and immediately brought to the notice of watch supervisor officer/ATS-in-charge.

TWR- 1 controller should have also recorded the incident as he did not adhere to SOPs and permitted departure of IGO246 from runway 09L before confirming the last departure from runway 09R which resulted into breach of separation in the jurisdiction Approach Departure controller.

TWR-2 controller was well aware of simultaneous departures from both runways as per intercom tape transcripts. He also did not make any log entry.

In view of involvement of multi units/ sectors in the incident, WSO/TWR-1, TWR SUP/SMC-1, TWR-2 and Approach Departure controller should have made log entries. They did not report the incident, possibly due to either fear of any punitive action or preventive/ corrective / remedial action which might entail restricting, limiting or preventing the exercise of privileges of their ATC ratings. The fear of not getting involved in the incident was clearly visible when TWR-2 controller made off-watch entry in the logbook with the timing when he observed that potential conflict between two simultaneous departures.

ATS In-charge at ATS Bengaluru stated that none of the supervisors or controllers intimated to him about the incident and they also did not make any log entry in their units' logbooks. Therefore, he was unaware of the incident until it was brought to his notice by AAI Corporate Headquarters.

The flight crew of IGO246 and IGO455 also did not report the incident as they were not aware of the situation and also there was no TCAS event.

### 2.9.1 Swiss Cheese (or Reason) Model of Accident Causation:

Multiple defensive layers were built into the ATC system to protect against variations in human performance or decisions at all levels of the organization. But there were many layers of weaknesses which were aligned leading to an airprox incident. Using The Swiss-Cheese Model, following figure (Figure 11) depicts how latent conditions were present within the system which manifested through local trigger factors leading to the airprox incident but there were also some defences/barriers which prevented it from resulting into a catastrophic outcome

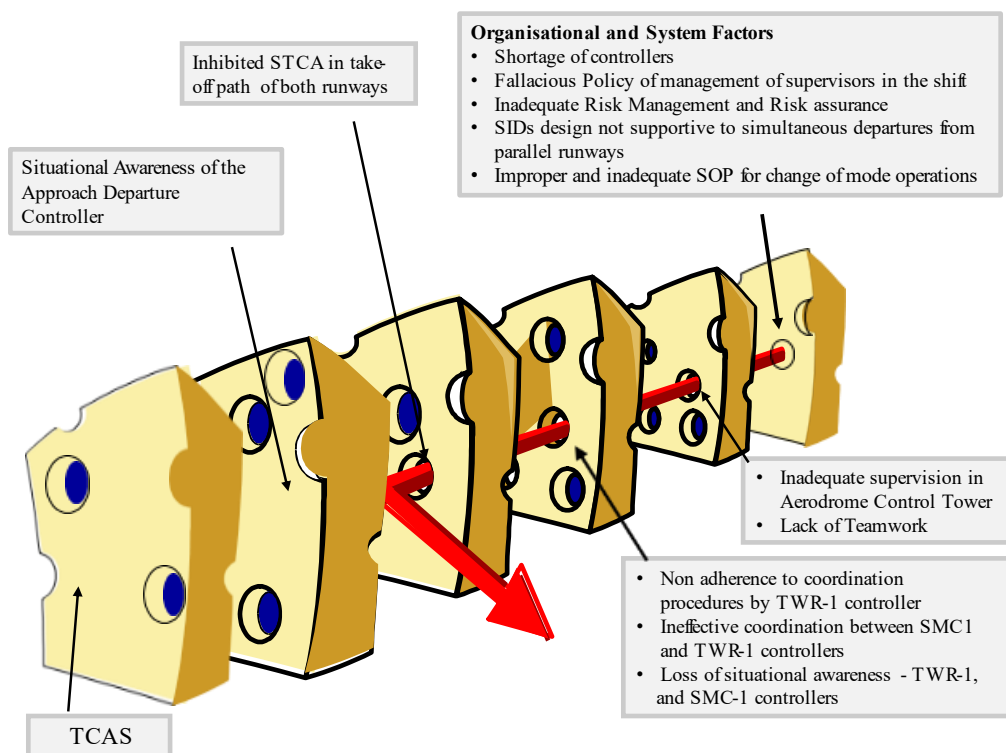


Figure 11

## 3 CONCLUSIONS:

### 3.1 Findings:

- The air traffic controllers providing aerodrome control, ground control and approach control surveillance services were holding valid Air Traffic Controller's Licences. They had valid ATC Ratings appropriate to the functions and level of service to be provided and medically fit at the time of incident.
- The flight crew of both aircraft IGO455 and IGO246 held valid licences and medical certificates.
- Both the aircraft VT-ITD (IGO455) and VT-ISV (IGO246) held valid certificates of airworthiness and equipped with ACAS II (TCAS Version 7.1)

- d) As per Meteorological report (METAR) issued at time 0230 UTC by the India Meteorological Department, the visibility was reported as 1000 m and trend forecast were becoming visibility 2000 m.
- e) KIA Bengaluru had approval of DGCA for conduct of “Segregated mode of operations” in Cat 1 conditions.
- f) During segregated mode of operations at KIA Bengaluru, simultaneous operations on parallel instrument runways 09L and 09R were permitted in which runway 09L was used exclusively for approaches and the other runway 09R was used exclusively for departures.
- g) AAI did not provide the required number of air traffic controllers at ATS Bengaluru for safe and efficient management of air traffic services at Bengaluru.
- h) On the day of the incident, only minimum number of air traffic controllers including WSO and TWR SUP were available in the concerned shift for segregated mode of operations as per requirement specified in Operations Circular 18/2021 issued by the ATS Bengaluru. The circular did not require exclusive WSO and TWR Sup for segregated mode of operations. The policy of managing segregated mode of operations without having supervisors was a fallacious policy of ATS Bengaluru.
- i) The WSO having overall responsibility of tactically managing ATS Units during the shift and in the interest of safe and expeditious management of air traffic, decided to become TWR-1 controller as he had aerodrome control rating only and decided support segregated mode of operations.
- j) TWR SUP took over watch at SMC-1 position and started imparting training to a trainee controller. The trainee controller did not had rating of any of the units at KIA Bengaluru.
- k) The segregated mode of operations started at 0238 UTC. During the segregated mode of operations, there was inadequate supervision in aerodrome control tower.
- l) The controllers were working as individuals, not as a part of team having a common goal of providing safe, orderly and expeditious ATS.
- m) TWR-1 and SMC-1 working positions were in close proximity, so the controllers working at these positions, were not communicating on intercom. Similarly, TWR-2 and SMC-2 working positions were in close proximity so they were also not communicating on intercom. Air Traffic Control Units at ATS Bengaluru were not equipped with any device that could record background communication and aural environmental air traffic controller work stations.
- n) SMC-1/TWR-SUP in coordination with WSO decided to transition from segregated mode of operations to Single Runway mode operations. He approved pushback and start-up of both aircraft IGO246 and IGO455 and assigned runway 09L and 09R respectively for departure.
- o) Both aircraft IGO246 and IGO455 were communicating with TWR-1 and TWR-2 on different frequencies so flight crew of these aircraft had no opportunity to have situational awareness about other aircraft departing from other parallel runway. Both the aircraft were not in visual contact with each other while departing or during the period when incident took place.
- p) The TWR-1 controller did not positively confirm from TWR-2 controller that there were no further departures from RWY 09R before allowing departures from RWY 09L. Further he did not coordinate with Approach Departure Controller before lining up the first departure IGO246 on runway 09L. However, he coordinated with Approach Departure Controller only after issuance of take-off clearance to IGO246 from Runway 09L.
- q) The TWR-2 controller coordinated with Approach Departure controller regarding the last departure from runway 09R and issued take-off clearance to IGO455. MATS-2 did not mandate any requirement on part of TWR-2 controller to coordinate with TWR-1 controller prior to permitting last departure

from runway 09R. Thus, there was gap in coordination procedure between TWR-1 and TWR-2 controllers.

- r) TWR-1 controller lost the situational awareness about the last departing aircraft IGO455 from runway 09R and allowed departure of IGO246 from runway 09L. TWR-2 controller had no opportunity to see visually about the departing traffic IGO246 from Runway 09L, therefore, and SMC-1 controllers also lost situational awareness about IGO246.
- s) RNAV-1 SIDs at KIA Bengaluru were not designed to support independent departures from both parallel runways. RNAV-1 SIDs for departures from both runways 09L and 09R were merging at a waypoint BL401 which was about 6 NM from runway 09R end.
- t) IGO246 and IGO455 which following SIDs for runway 09L and 09R respectively were expected to converge at waypoint BL401. The Approach Departure controller observed simultaneous departures and promptly issued conflict avoidance headings to both aircraft which deconflicted the traffic but during this process, the separation between two aircraft reduced to 0.9 NM horizontally and 100 feet vertically whereas applicable surveillance-based horizontal separation minimum was 3 NM and applicable vertical separation minimum was 1000 feet.
- u) Simultaneous departures from two parallel runways were not identified as a hazard during the Safety Assessments conducted by BIAL and AAI and therefore, risk mitigations were not in place.
- v) Short-Term-Conflict Warning was not generated as it was inhibited in the airspace from level 0 to 5000 feet up to about 4 NM in take path of aircraft departing from runway 09L and 09R to avoid nuisance of frequent conflict alerts between aircrafts landing and taking off from VOBL considering the aircrafts operating in the VOYK traffic circuit and aircraft carrying out IAL procedure at VOYK.
- w) Neither TCAS of the two aircraft was activated as the paths of the two aircraft were not meeting the TCAS triggering criteria.
- x) Both the aircraft, after clear of traffic, proceeded to their destinations as per ATC clearances.
- y) None of the controllers recorded and reported the incident.
- z) The flight crew of IGO246 and IGO455 were unaware of the incident until asked by the AAIB to submit statements.

### **3.2 Probable Cause (s):**

The serious incident is attributable to the fact that the ATC allowed simultaneous departures from two parallel instrument runways which were not permitted at KIA Bengaluru resulting into an air-proximity.

### **3.3 Contributory Factors**

The following were identified as contributing factors to the serious incident:

- a) Inadequate number of air traffic controllers for supporting segregated mode of operations on parallel runways at ATS Bengaluru;
- b) Inadequate supervision in the aerodrome control tower due to fallacious policy of management of supervisor at ATS Bengaluru.
- c) Inadequate coordination between TWR-1 and TWR-2 controllers, ineffective coordination between WSO/TWR-1 controller and TWR SUP/SMC-1 controller and inadequate coordination by TWR-1 with Approach Departure controller;
- d) Design of SIDs was not suitable for dealing with the risk due to simultaneous departures from parallel runway 09L and 09R;
- e) Lack of teamwork in the shift;

- f) Inadequate Safety Risk Management and Safety Assurance;
- g) Inadequate coordination procedures for transition from segregated parallel operations to single runway operations and vice-versa; and
- h) Absence of a comprehensive SOPs and associated checklists for safe and efficient transition from one mode of runway operations to other mode of operations.

## **4 SAFETY RECOMMENDATIONS**

### **4.1 Airports Authority of India (AAI)**

- 1) It is recommended that AAI should take appropriate action to ensure availability of adequate number of air traffic controllers for the type of operation involved at various ATS stations.
- 2) It is recommended that AAI should review the design of SIDs for different runways at KIA Bengaluru and design SIDs which may be suitable for independent instrument departures on parallel instrument runways.
- 3) It is recommended that AAI should review the airspace in which STCA have been inhibited and take appropriate action.
- 4) It is recommended that AAI should review the coordination procedures between aerodrome controllers/ground controllers/ approach controllers for safe and efficient management of segregated operations on parallel runways and prepare a comprehensive coordination procedure without any ambiguity.
- 5) It is recommended that AAI should prepare checklists when there is change from one mode of operations to other mode of operations. In order to safeguard against any possibility of human error while using manual checklist, AAI should explore a feasibility of technical solution in which alerts are generated to aerodrome controllers (TWR-1 and TWR-2) when an aircraft taking-off from or landing on a runway which is not permitted in a particular mode of operations and implement such technological solutions if feasible.
- 6) It is recommended that AAI should take appropriate action to train the air traffic controllers in Team Resource Management (TRM).
- 7) It is recommended that AAI should review the hand-over watch (HOW) /take-over watch (TOW) and on-watch/off-watch procedures during transition from one mode of operations to other mode of operations, runway changes and also during the period when some unusual event or incident is taking place.
- 8) It is recommended that AAI should examine whether any punitive action is taken when an air traffic controller reports any safety occurrence. Appropriate action may be taken for promoting a “Just Culture” in which the air traffic controllers are encouraged to report their honest errors without fear of any punitive action.
- 9) It is recommended that AAI should also conduct a campaign educating air traffic controllers not to perceive a preventive, corrective or remedial action taken after a safety occurrence as a punitive action. Sometimes, preventive, corrective or remedial actions may entail restricting, limiting or preventing the exercise of privileges of an ATC Rating which are necessary to prevent or minimize the exposure to an unmitigated safety risk.
- 10) It is recommended that AAI should implement the recommendation as given in para 3.3.3 of Chapter 3 of ICAO Annex 11 (Air Traffic Services) and para 3.3.4 of DGCA CAR Section 9 Series E Part 1 on equipage of Air Traffic control units with devices that record background communication and the aural environment at air traffic controller work stations.

### **4.2 Airports Authority of India (AAI) and Bengaluru International Airport Limited (BIAL)**

- 1) It is recommended that AAI and BIAL should carry out a post implementation review of segregated mode of operations for identification of new hazards if any, status of past hazards and also checking the effectiveness of risk mitigators which were placed after previous safety assessments. During such review, it is recommended that the air traffic controller(s) who have vast experience of operations on parallel /near parallel runway operations at any other airport in India, may be invited to participate.

**4.3 DGCA:**

- 1) It is recommended that DGCA should formulate means to ensure that AAI does not take any punitive action when an air traffic controller reports any safety occurrence. This will help in promoting "Just Culture" in which the reporting of honest errors is encouraged without fear of any punitive action.

Place New Delhi  
Date 17 February 2022



(KANHAYA LAL)  
Investigation-in-Charge



# Attachment-1

AIP India

AD 2 VOBL 3-101  
05 DEC 2019

STANDARD DEPARTURE CHART  
INSTRUMENT (SID)

TRANSITION ALT  
7000

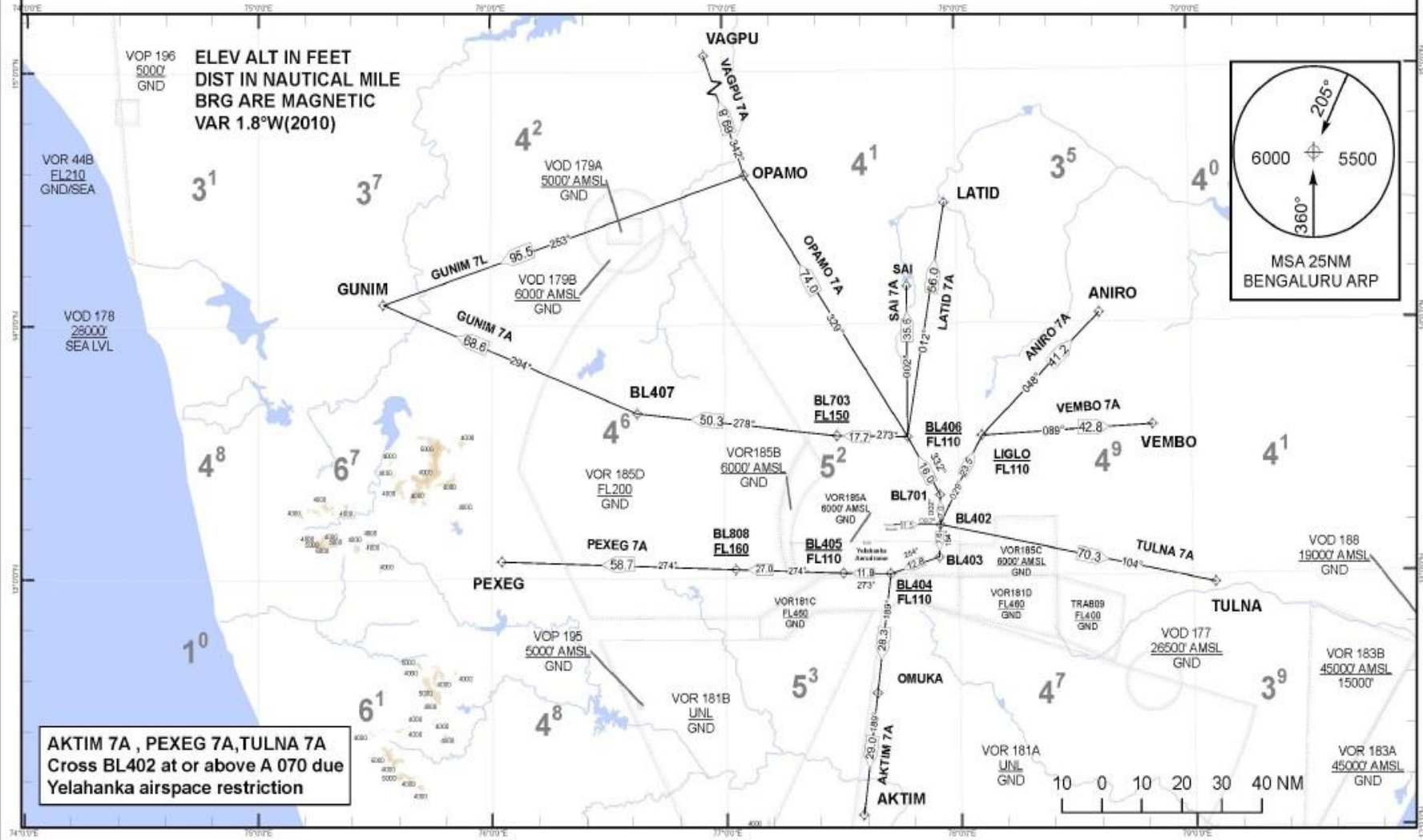
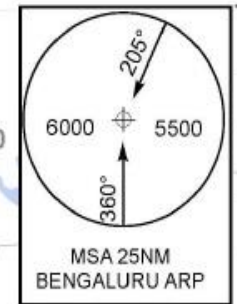
APP ARR 121.250  
APP 127.750  
TWR 124.350

BENGALURU (VOBL)  
RWY 09L

AKTIM 7A, ANIRO 7A, GUNIM 7A, VAGPU 7A,  
GUNIM 7L, OPAMO 7A, PEXEG 7A, TULNA 7A,  
VEMBO 7A, LATID 7A, SAI 7A

RNAV1(GNSS)  
SURVEILLANCE REQUIRED

ELEV ALT IN FEET  
DIST IN NAUTICAL MILE  
BRG ARE MAGNETIC  
VAR 1.8°W(2010)



AKTIM 7A , PEXEG 7A, TULNA 7A  
Cross BL402 at or above A 070 due  
Yelahanka airspace restriction

**STANDARD DEPARTURE CHART  
INSTRUMENT (SID)**

**RNAV1(GNSS)  
SURVEILLANCE REQUIRED**

**TRANSITION ALT  
7000**

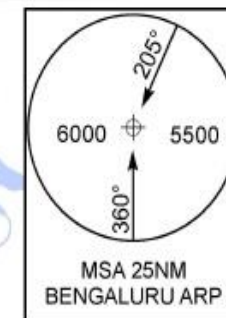
**APP ARR 121.250  
APP 127.750  
TWR 119.050**

**BENGALURU (VOBL)**

**RWY 09R**

**AKTIM 7C, ANIRO 7C, GUNIM 7C,  
VAGPU 7C, OPAMO 7C, PEXEG 7C,  
GUNIM 7M, TULNA 7C, VEMBO 7C,  
LATID 7C, SAI 7C**

**ELEV ALT IN FEET  
DIST IN NAUTICAL MILE  
BRG ARE MAGNETIC  
VAR 1.8°W(2010)**



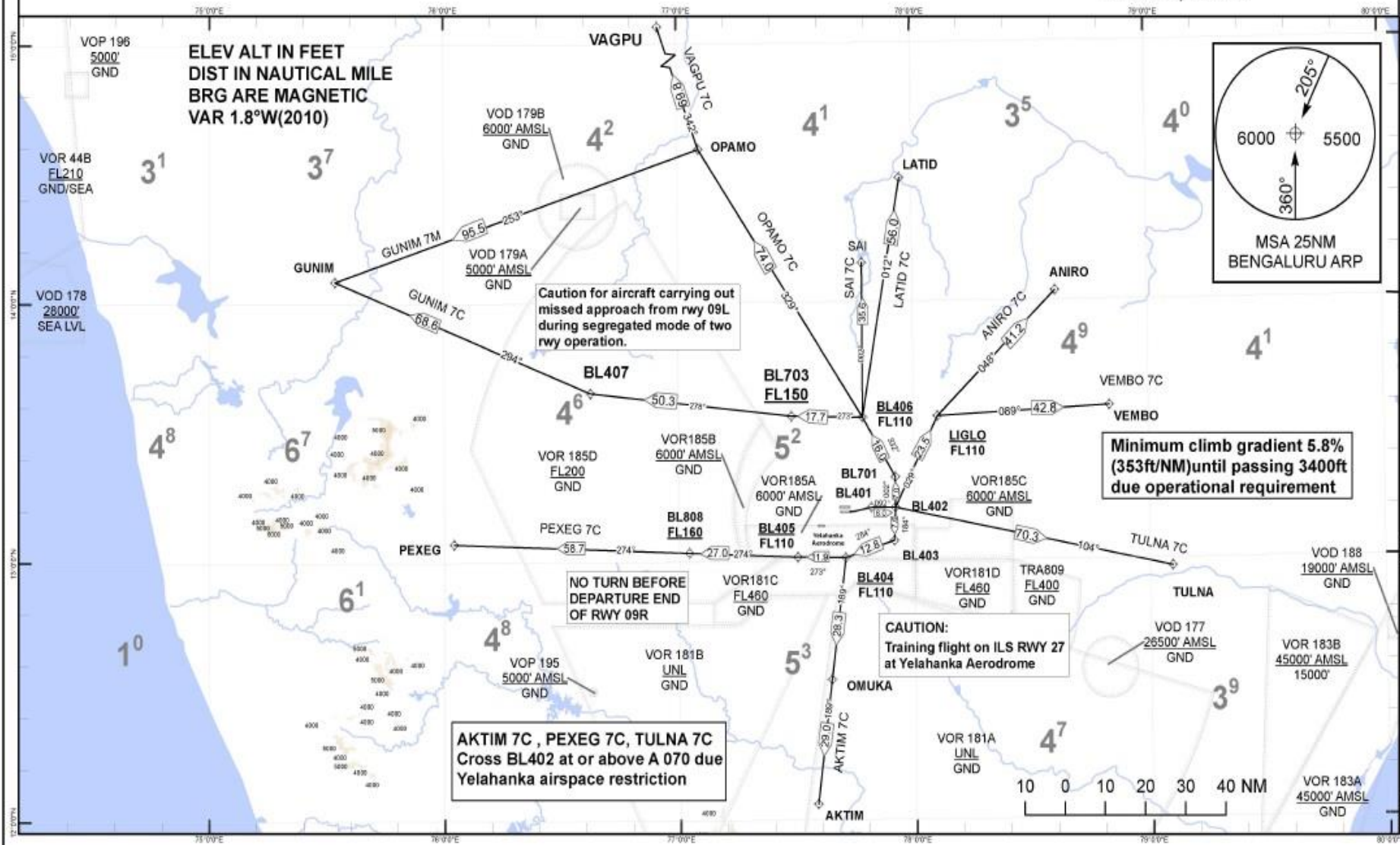
**Minimum climb gradient 5.8%  
(353ft/NM) until passing 3400ft  
due operational requirement**

**Caution for aircraft carrying out  
missed approach from rwy 09L  
during segregated mode of two  
rwy operation.**

**NO TURN BEFORE  
DEPARTURE END  
OF RWY 09R**

**CAUTION:  
Training flight on ILS RWY 27  
at Yelahanka Aerodrome**

**AKTIM 7C, PEXEG 7C, TULNA 7C  
Cross BL402 at or above A 070 due  
Yelahanka airspace restriction**





सं. भाविप्रा/बीआइए/एटीएम/ओपस-1 / 280-24

दिनांक / Date: 18.11.2021

No. AAI/BIA/ATM/OPS-1

**प्रचालन परिपत्र / Operations Circular 18/2021**  
**Subject: -- Timings for operation of Segregated mode**

In view of the increasing air traffic, there is a demand from airlines and airport operator to operate segregated mode in times of high traffic density. In co-ordination with BIAL, the following timings have been identified as having the highest traffic density:

1. Between 0100 UTC to 0330 UTC
2. Between 1130 UTC to 1530 UTC

Hence, Segregated mode shall be operated during the above-mentioned timings provided there are 3 controllers available in tower and 5 in Radar (which may include WSO)

Segregated mode of operations will be subject to weather and visibility (only during CAT-1 Conditions)

This is for information and compliance by all the Air Traffic Controllers.

This Operations Circular will be effective from the date of release of this document and shall remain in force till further notice.

सं. महाप्रबंधक (स्टील्स)  
 Jt. General Manager (ATM-OPS)  
 for  
 कृते महाप्रबंधक (स्टील्स)  
 For General Manager (ATM)  
 भाविप्रा, केअंइअ बंगलुरु/AAI, KIA Bengaluru

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