

FINAL INVESTIGATION REPORT



SERIOUS INCIDENT OF TCAS – RA AIRBLUE FLIGHT ABQ 200, AIRBUS 321 AIRCRAFT REG. NO. AP-BMW ON 29TH NOVEMBER, 2017

Dated: 30th March, 2023

SCOPE

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ABBREVIATIONS

AAIB	Aircraft Accident Investigation Board
ACAS	Airborne Collision Avoidance System
ACC	Area Control Centre
ADS-B	Automatic Dependant Surveillance - Broadcast
AGL	Above Ground Level
AIAP	Allama Iqbal International Airport, Lahore
AIP	Aeronautical Information Publication
ATC	Air Traffic Control
ATM	Air Traffic Management
BBIAP	Benazir Bhutto International Airport
CPA	Closest Point of Approach
DMOD	Distance Modification
ENR	En-route
FL	Flight Level
ft	Feet
hrs	Hours
ICAO	International Civil Aviation Organization
IMC	Instrument Metrological Conditions
JIAP	Jinnah International Airport
LT	Local Time
m	Meters
MLAT	Multilateration System
MSL	Mean Sea Level
NM	Nautical Mile
OPKC	Karachi, Jinnah International Airport
OPRN	Islamabad, Benazir Bhutto International Airport
PIA	Pakistan International Airlines
PSR	Primary Surveillance Radar
R/T	Radiotelephony
R/W	Runway
RA	Resolution Advisory
s	Seconds
SARPs	Standard and Recommended Practices
SATI	Station Air Traffic Instructions
SDD	Situation Data Display
SL	Sensitivity Level
SSR	Secondary Surveillance Radar
STAR	Standard Arrival Route
STCA	Short Term Conflict Alert
TA	Traffic Advisory
TCAS	Traffic Alert and Collision Avoidance System
UTC	Universal Time Co-ordinated
VSM	Vertical Separation Minimum

INTRODUCTION

The incident was reported to Aircraft Accident Investigation Board (AAIB), Pakistan, by M/s Airblue vide Air Traffic Incident Report (Near Collision) dated 29th November, 2017. Ministry of Aviation, Government of Pakistan issued Memorandum and Corrigendum authorizing AAIB, Pakistan to investigate the incident. The investigation has been conducted by AAIB, Pakistan. All corresponding timings are mentioned in Universal Time Coordinated (UTC).

SYNOPSIS

On 29th November, 2017, Airblue flight ABQ 200, Airbus 321 aircraft, Reg. No. AP-BMW was operating from Jinnah International Airport (JIAP), Karachi (OPKC) to Benazir Bhutto International Airport (BBIAP), Islamabad (OPRN) on route Karachi – Airway J112 – MOLTA – Airway J142 – MATIN – Airway J121 – Islamabad. Pakistan International Airlines (PIA) flight PIA 313 Airbus 320 aircraft, Reg. No. AP-BLV was operating from Allap, Lahore (OPLA) to JIAP, Karachi (OPKC) on route Airway J112. PIA 313 came in contact with Karachi Area Control East maintaining FL340. Karachi Area Control East passed Air Traffic Control clearance to arrival (PIA 313), which was acknowledged by PIA 313. ABQ 200 departed from Karachi at 02:30:00. While climbing FL310, ABQ 200 came in contact with Karachi Area Control East at time 02:53:00 and was asked for final requested level. Karachi Area Control East initially cleared ABQ 200 to FL310 and after confirmation of final level, re-cleared to FL350 at 02:54:00. At 03:08:20, ABQ 200 reported Traffic Alert & Collision Avoidance System – Resolution Advisory (TCAS – RA) while passing FL335↑ whereas at that time reciprocal parallel traffic PIA 313 was approximately 6.5 NM apart maintaining FL340.

All available evidences have been analysed by AAIB Pakistan. No damage to the aircraft or injuries to the passengers / crew of both the flights were reported. At the time of minimum vertical separation of 500 ft, both aircraft (ABQ 200 & PIA 313) were 05.66 NM laterally separated on parallel tack. ABQ 200 descended to FL334 and crossed parallel reciprocal traffic (PIA 313) at 04.33 NM.

The TCAS – RA alert might be erroneous; however, subject incident may be considered as loss of separation due to lack of situational awareness on the part of Air Traffic Control. Appropriate recommendations have been made for PCAA.

SECTION 1 – FACTUAL INFORMATION

1.1. History of the Flight

1.1.1. On 29th November, 2017 PIA flight PIA 313, A320 aircraft, Reg. No. AP-BLV was operating from AllAP, Lahore (OPLA) to JIAP, Karachi (OPKC) on ATS route J112.

1.1.2. Airblue flight ABQ 200, A321 aircraft, Reg. No. AP-BMW was operating from JIAP, Karachi (OPKC) to BBIAP, Islamabad (OPRN).

1.1.3. Air Traffic Services within Karachi FIR are being provided by Area Control which is divided in four sectors and each is manned by following Control Positions: -

1.1.3.1. Area Radar Controller.

1.1.3.2. Area Procedure Controller.

1.1.4. At 02:52:27, PIA 313 maintaining FL340, contacted ATC Karachi (Area Radar Controller East). The flight cleared for NAWABSHAH 2A (STAR). The flight was further informed to expect radar vectors for ILS Approach for Runway (R/W) 25L at JIAP, Karachi. PIA 313 acknowledged and read back the ATC clearance.

1.1.5. At 02:53:24, ABQ 200 flying parallel to ATS route, contacted ATC Karachi (Area Radar Controller East) and reported climbing to FL310. ATC Karachi acknowledged by instructing to climb FL310 and report position Rahim Yar Khan (RK). ATC Karachi also inquired for final level. ABQ 200 reported FL350 as final level.

1.1.6. At 02:54:00, ATC Karachi asked ABQ 200 to climb FL350 and same was acknowledged by ABQ 200.

1.1.7. The ATC shift changeover timing was 03:00:00. The outgoing shift handed over the traffic after briefing.

1.1.8. As both the aircraft (ABQ 200 & PIA 313) were on parallel track and at the time of shift changeover no immediate action was required, therefore morning Radar Controller handed over the traffic to Procedure Controller as his head set was faulty.

1.1.9. At 03:08:03, when both aircraft were 10.89 NM apart on parallel track, Air Traffic Management (ATM) System displayed Short Term Conflict Alert (STCA). On realizing the conflict ATC Karachi (Area Controller East) asked ABQ 200 to report heading for initiating radar vectors to enhance the spacing between two aircraft at 03:08:10. ABQ 200 in reply reported TCAS – RA.

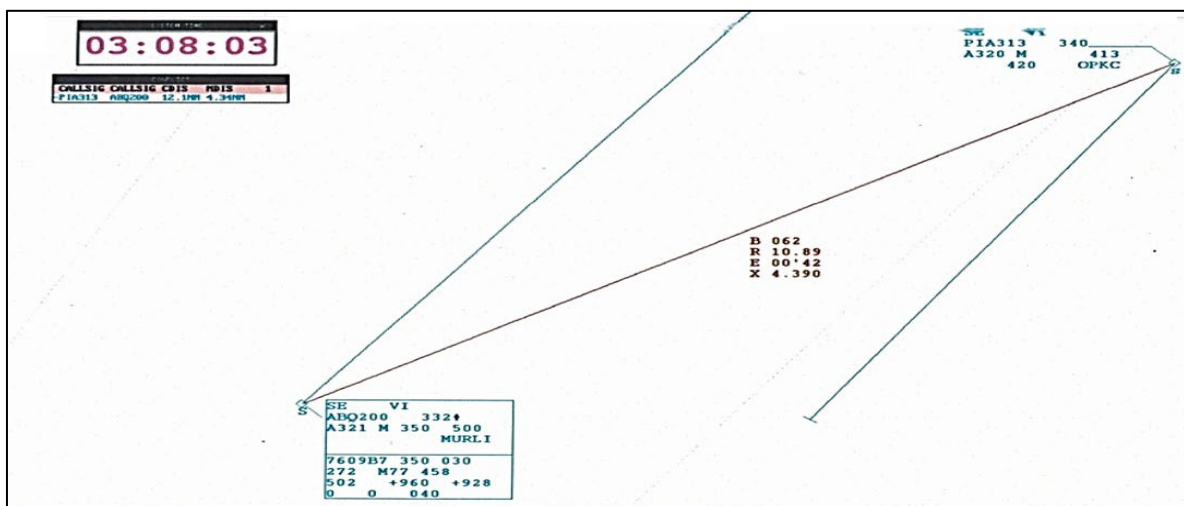


Figure 1 Radar Display Picture showing STCA

1.1.10. At 03:08:11, Radar Display Data shows that ABQ 200 in climbing phase passing FL333↑ and PIA 313 maintaining FL340. Both aircraft were 8.65 NM laterally apart on parallel track.

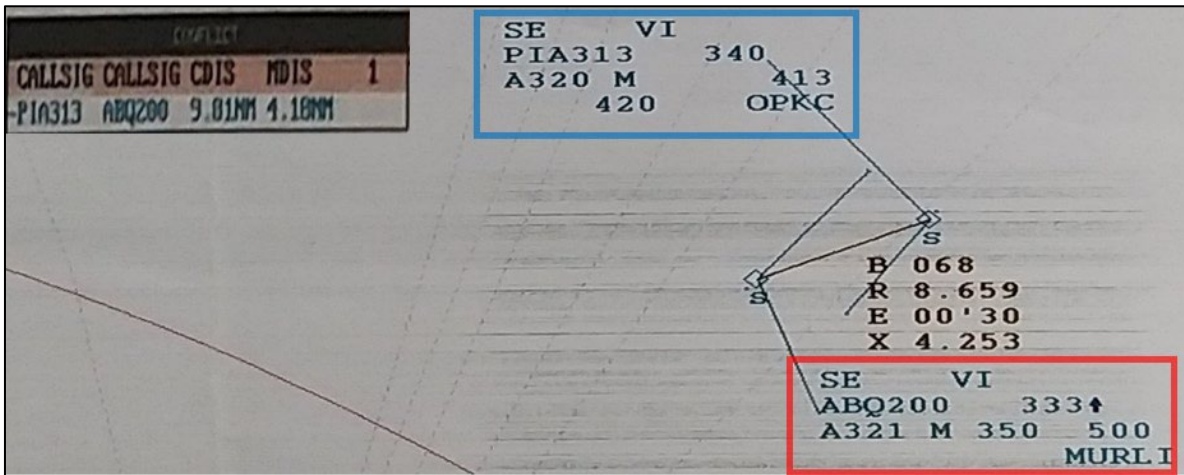


Figure 2 Radar Display Data of ABQ 200 on FL333↑

1.1.11. At 03:08:15, ATC Karachi asked ABQ 200 “Report heading”.

1.1.12. At 03:08:16, Radar Display Data shows that ABQ 200 in climbing phase passing FL334↑ and PIA 313 maintaining FL340. Both aircraft were 7.57 NM laterally apart on parallel track.

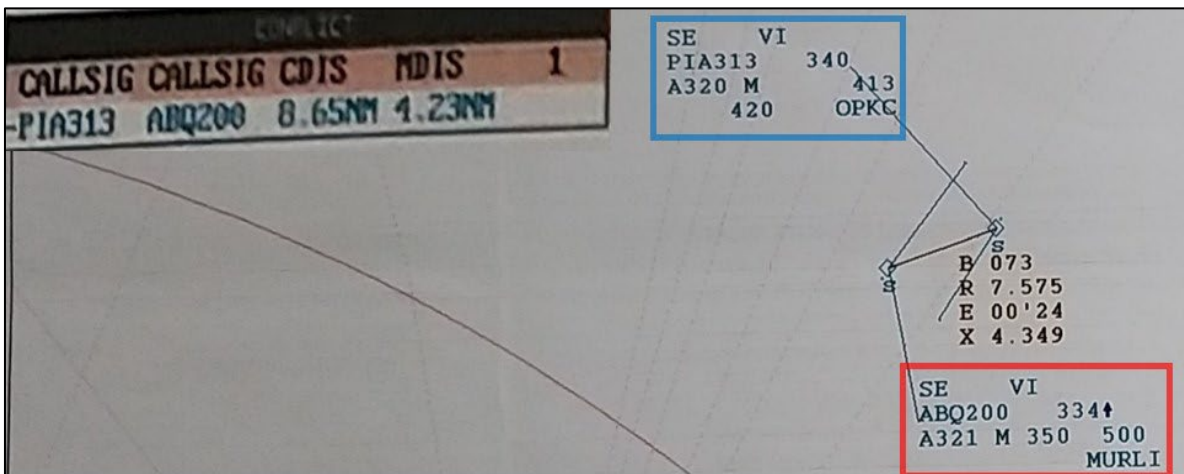


Figure 3 Radar Display Data ABQ 200 FL334↑

1.1.13. At 03:08:20, ABQ 200 reported TCAS – RA.

1.1.14. At 03:08:22, Radar Display Data shows that ABQ 200 in climbing phase passing FL335↑ and PIA 313 maintaining FL340. Both aircraft were 6.58 NM laterally apart on parallel track.

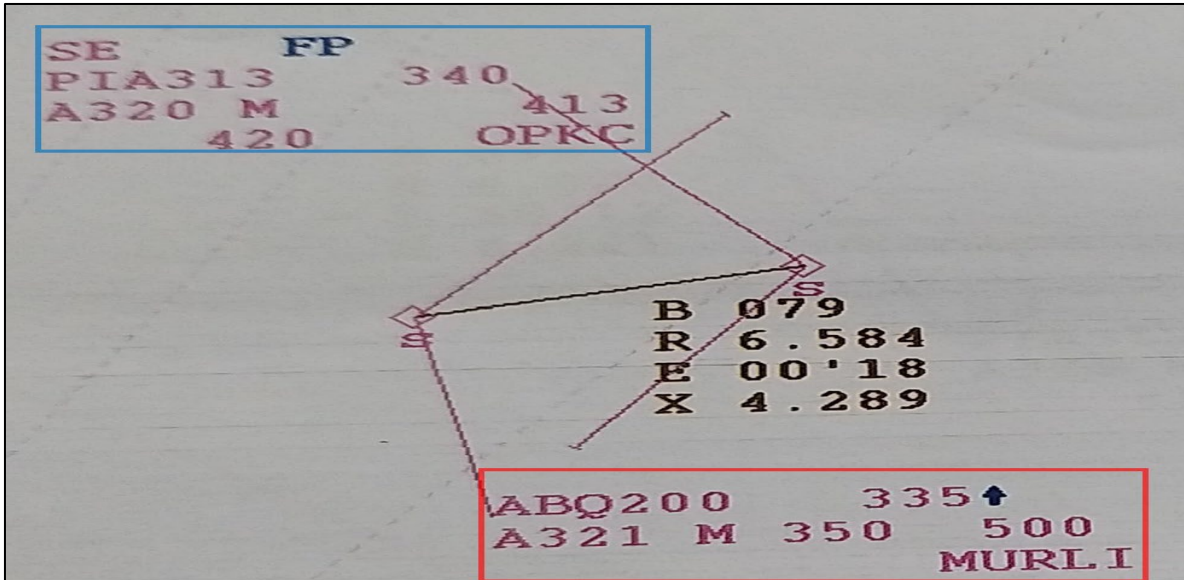


Figure 4 Radar Display Data ABQ 200 FL335↑

1.1.15. At 03:08:23, ATC Karachi (Area Controller East) passed traffic information of ABQ 200 to PIA 313. PIA 313 replied that they have the traffic visual.

1.1.16. At 03:08:31, Radar Display Data shows that ABQ 200 in descending phase passing FL334↓ and PIA 313 maintaining FL340. Both aircraft were 4.88 NM laterally apart on parallel track.

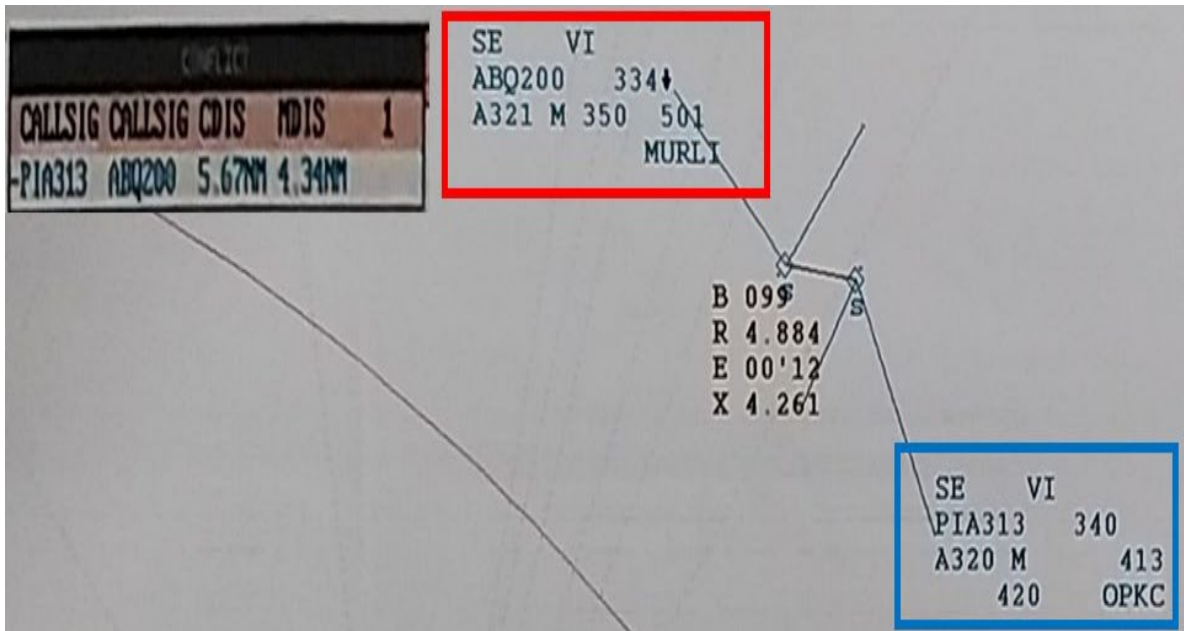


Figure 5 Radar Display Data ABQ 200 FL334↓

1.1.17. At 03:08:46, Radar Display Data shows that ABQ 200 maintaining FL334 and PIA 313 maintaining FL340. Both aircraft were 4.33 NM laterally apart on parallel track.

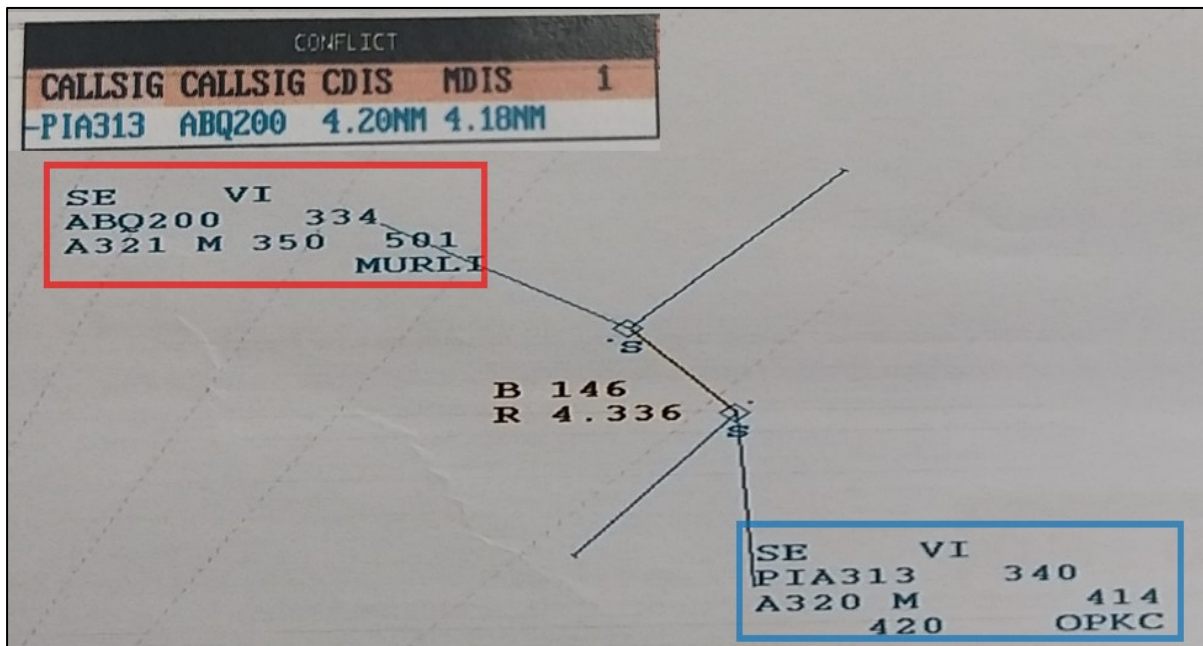


Figure 6 Radar Display Data ABQ 200 maintaining FL334

1.1.18. At 03:08:52, ABQ 200 called ATC Karachi East and again informed about TCAS – RA. Area Radar Controller East acknowledged and asked ABQ 200 to climb FL350.

1.1.19. At 03:09:49, PIA 313 reported that they were maintaining FL340 and there was a traffic which was below to them and was climbing to their level. Due to which that had a traffic advisory and the traffic is now maintaining level 600 feet (ft) below their level.

1.1.20. At 03:09:54, Radar Display Data shows that both aircraft crossed each other, ABQ 200 in climbing phase and passing FL335↑ and PIA 313 maintaining FL340.

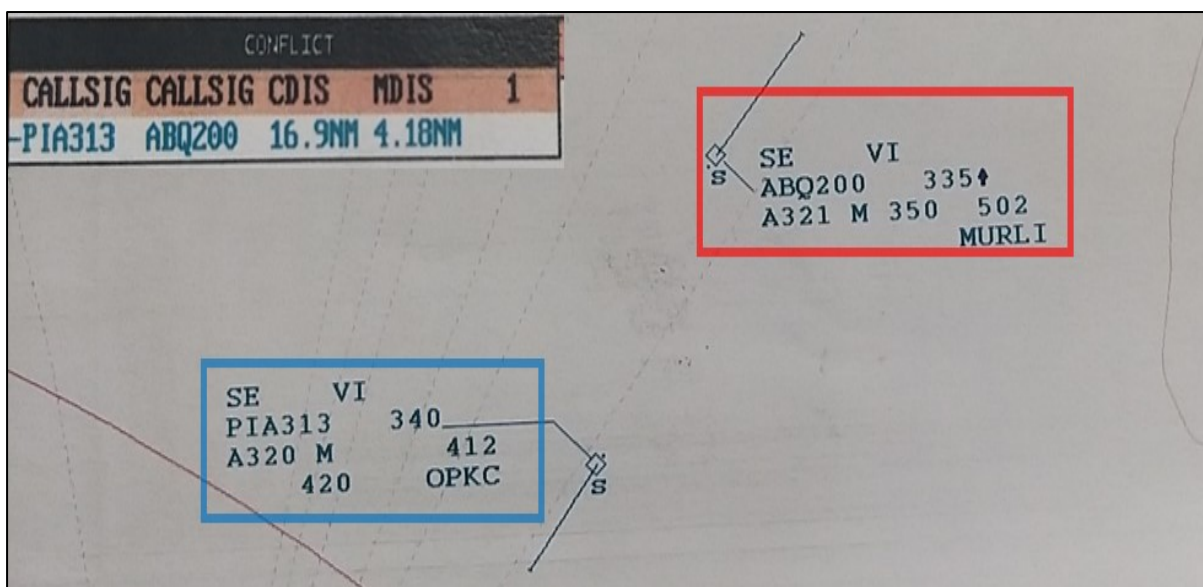


Figure 7 Radar Display Data ABQ 200 FL335↑

1.1.21. At 03:10:09 and 03:12:01, twice ABQ 200 informed ATC Karachi that they had TCAS – RA at FL334 which was acknowledged by Area Radar Controller East.

1.1.22. After the incident both flights continued to respective destinations.

1.2. Injuries to Person(s)

1.2.1. No injury was reported to any one on board both the aircraft.

1.3. Damage to Aircraft

1.3.1. No damage occurred due to this incident to any of the aircraft.

1.4. Other Damage

1.4.1. Not Applicable.

1.5. Personnel Information

1.5.1. The Air Traffic Controllers on duty were qualified and rated for their respective units.

1.6. Aircraft Information

PIA 313	
Call Sign	PIA 313
Aircraft Make & Model	Airbus 320
Registration Marking	AP-BLV
Year of Manufacture	2006
Manufacturer Serial No.	2758
Operator	Pakistan International Airlines (PIA)
Sector	Lahore to Karachi
Flight conditions	Instrument Metrological Condition (IMC) / Level Flight
Altitude	FL340
ABQ 200	
Call Sign	ABQ 200
Aircraft Make & Model	Airbus 321
Registration Marking	AP-BMW
Year of Manufacture	2016
Manufacturer Serial No.	7171
Operator	Airblue
Sector	Karachi to Islamabad
Flight conditions	IMC / Climbing Phase
Altitude	Climbing FL350 (Passing FL335↑)

Table 1- 1 Aircraft Details

1.7. Meteorological Information

1.7.1. No significant weather was reported at operating altitude at the time of occurrence of this incident of TCAS – RA.

1.8. Aids to Navigation

1.8.1. Not Applicable.

1.9. Communications

1.9.1. Not Applicable.

1.10. Aerodrome Information

1.10.1. Not Applicable.

1.11. Flight Recorders

1.11.1. Not Applicable.

1.12. Wreckage and Impact Information

1.12.1. Not Applicable.

1.13. Medical and Pathological Information

1.13.1. Not Applicable.

1.14. Fire

1.14.1. Not Applicable.

1.15. Survival Aspects

1.15.1. Not Applicable.

1.16. Test and Research

1.16.1. Airborne Collision Avoidance System (ACAS)

1.16.1.1. The objective of ACAS is to provide advice to pilots for the purpose of avoiding potential collisions. This is achieved through Resolution Advisories (RAs), which recommend actions (including manoeuvres), and through Traffic Advisories (TAs), which are intended to prompt visual acquisition and to act as a precursor to RAs.

1.16.1.2. ACAS has been designed to provide a back-up collision avoidance service for the existing conventional Air Traffic Control (ATC) system while minimizing unwanted alarms for which the collision risk does not warrant escape manoeuvres. The operation of ACAS is not dependent upon any ground-based systems.

1.16.1.3. ACAS equipment in the aircraft interrogates Mode 'A' / 'C' and Mode 'S' transponders¹ on aircraft in its vicinity and listens for their replies. By processing these replies, ACAS determines which aircraft represent potential collision threats and provides appropriate display indications (or advisories) to the flight crew to avoid collisions.

1.16.1.4. **Traffic Advisories (TAs)** - TAs alert the flight crew to potential RAs and may indicate the range, range rate, altitude, altitude rate and bearing of the intruding aircraft relative to own aircraft. TAs without altitude information may also be provided on Mode 'C' or Mode 'S' equipped aircraft that have temporarily lost their automatic altitude-reporting capability. The information conveyed in TAs is intended to assist the flight crew in sighting nearby traffic.

1.16.1.5. **Resolution Advisories (RAs)** - If the threat detection logic in the ACAS computer determines that an encounter with a nearby aircraft could soon lead to a near-collision or collision, the computer threat resolution logic determines an appropriate vertical manoeuvre that will ensure the safe vertical separation of the two aircraft. The selected manoeuvres ensure adequate vertical separation within constraints imposed by the climb rate capability and proximity to the ground of the two aircraft.



1.16.1.6. The RAs provided to pilot can be divided into two categories: corrective advisories, which instruct pilot to deviate from the current flight path ("CLIMB" when aircraft is in level flight); and preventive advisories, which advise the pilot to maintain or avoid certain vertical speeds ("DON'T CLIMB" when aircraft is in level flight).

1.16.1.7. **Warning Times** - In any potential collision, ACAS generates an RA nominally 15 to 35 seconds (s) before the Closest Point of Approach (CPA) of the aircraft. The ACAS equipment may generate a TA up to 20 s in advance of an RA. Warning times depend on Sensitivity Levels (SLs) of RAs.

¹ Mode A equipment transmits an identifying code only.
 Mode C equipment enables the ATCO to see the aircraft altitude or flight level automatically.
 Mode S equipment has altitude capability and also permits data exchange.

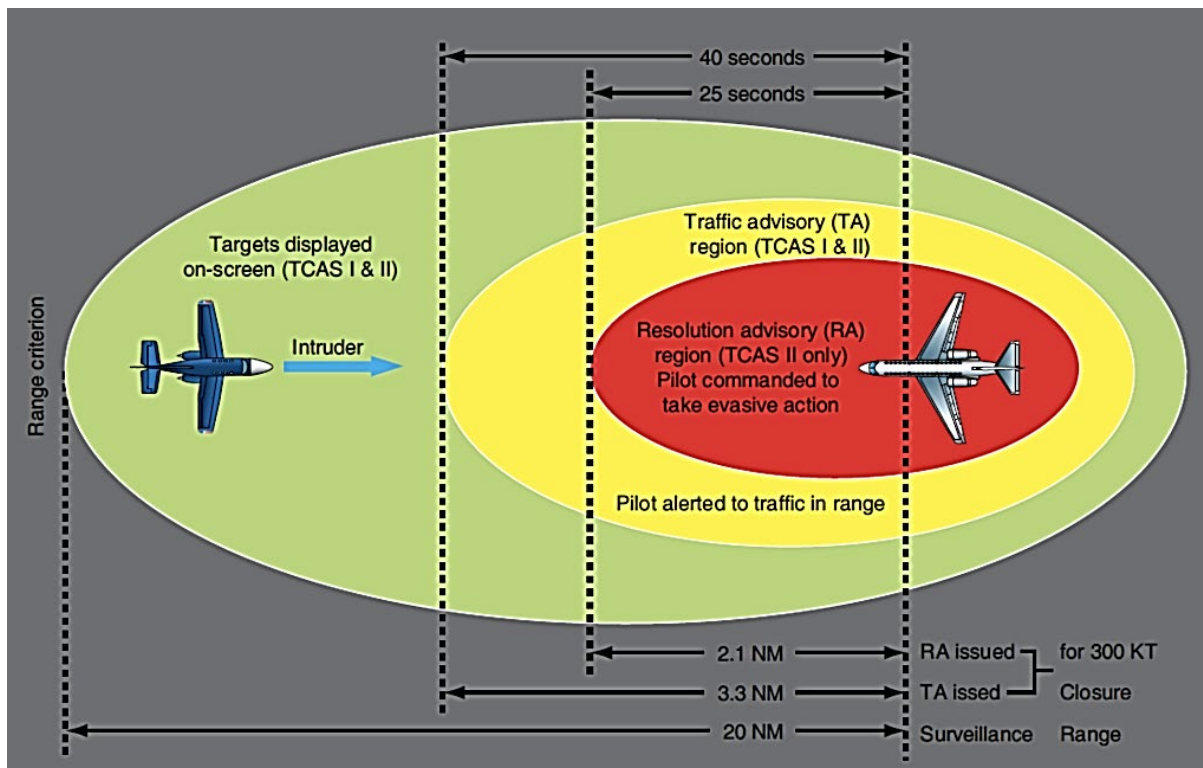


Figure 9 TA and RA ranges

1.16.1.8. ICAO Doc 9863 [Airborne Collision Avoidance System (ACAS) Manual] Section 3.2.2.1 states: -

“If the threat detection logic in the ACAS computer determines that an encounter with a nearby aircraft could soon lead to a near-collision or collision, the computer threat resolution logic determines an appropriate vertical manoeuvre that will ensure the safe vertical separation of the two aircraft. The selected manoeuvre ensures adequate vertical separation within constraints imposed by the climb rate capability and proximity to the ground of the two aircraft.”

1.16.1.9. ICAO Doc 9863 [Airborne Collision Avoidance System (ACAS) Manual] Section 4.1.2 deals with Horizontal distance thresholds for RAs. Further section 4.1.2.1 states: -

“Although ACAS advisories are primarily based on estimated time to collision, they also can be triggered when proximity becomes too small. This may interfere with some operational procedures — for example with closely spaced parallel runways. Table below shows the threshold horizontal spacing (expressed as Distance Modification (DMOD)) at different altitudes.”

Above altitude (m)	Above altitude (ft)	DMOD (m)	DMOD (NM)
6,096	20,000 MSL	2,037	1.1
3,048	10,000 MSL	1,482	0.8
1,524	5,000 MSL	1,019	0.55
716	2,350 AGL	648	0.35
305	1,000 AGL	370	0.2

Table 1 Threshold Horizontal Spacing at Different Altitudes

1.16.1.10. ACAS II is an aircraft system based on Secondary Surveillance Radar (SSR) transponder signals. ACAS II interrogates the Mode 'C' and Mode 'S' transponders of nearby aircraft (intruders) and from the replies tracks their altitude and range and issues alerts to the pilots, as appropriate. ACAS II will not detect non-transponder-equipped aircraft and will not issue any resolution advice for traffic without altitude reporting transponder.

1.16.1.11. Once an RA has been issued, the vertical sense (direction) of the RA is coordinated with other ACAS II equipped aircraft via a Mode 'S' link, so that two aircraft choose complementary manoeuvres. RAs aim for collision avoidance by establishing a safe vertical separation (300 - 700 ft), rather than restoring a prescribed ATC separation.

1.16.1.12. ACAS II operates on relatively short time scales. The maximum generation time for a TA is 48 s before the CPA. For an RA the time is 35 s. The time scales are shorter at lower altitudes (where aircraft typically fly slower). Unexpected or rapid aircraft manoeuvre may cause an RA to be generated with much less lead time. It is possible that an RA will not be preceded by a TA if a threat is imminent. The effectiveness of an RA is evaluated by the ACAS equipment every second and, if necessary, the RA may be strengthened, weakened, reversed, or terminated.

1.16.2. Separation Standards

1.16.2.1. Aeronautical Information Publication (AIP) Pakistan Enroute (ENR) Section (Page 1.6-1) ATS Surveillance Services and Procedures (Separation Minima based on ATS Surveillance System) states: -

“Following separation minima is applicable within Karachi and Lahore FIRs:

-

- (a) *5 NM horizontal separation within the terminal airspace using any surveillance sensor of PSR, SSR, ADS-B and / or MLAT (up to maximum of 60 NM) at or below FL255.*
- (b) *15 NM horizontal separation for use outside terminal airspace in enroute phase of flight using any of the above available surveillance sensor.”*

1.16.2.2. The Vertical Separation Minimum (VSM) specified in ICAO Doc 4444 [Procedure for Air Navigation Services – Air Traffic Management (PANS - ATM)] at para 5.3.2 states that: -

“The vertical separation minimum (VSM) shall be: -

- (a) *A nominal 300 m (1,000 ft) below FL290 and a nominal 600 m (2,000 ft) at or above this level, except as provided for in (b) below; and*
- (b) *Within designated airspace, subject to a regional air navigation agreement: a nominal 300 m (1,000 ft) below FL410 or a higher level where so prescribed for use under specified conditions, and a nominal 600 m (2,000 ft) at or above this level.”*

1.16.3. Traffic Information

1.16.3.1. ICAO Doc 4444 (PANS - ATM) defines traffic information as: -

“Information issued by an air traffic services unit to alert a pilot to other known or observed air traffic which may be in proximity to the position or intended route of flight and to help the pilot avoid a collision.”

1.16.3.2. Furthermore, ICAO Doc 4444 Section 5.10.1.1 and 5.10.1.2 states: -

“Essential traffic is that controlled traffic to which the provision of separation by ATC is applicable, but which, in relation to a particular controlled flight is not, or will not be, separated from other controlled traffic by the appropriate separation minimum.”

“Essential traffic information shall be given to controlled flights concerned whenever they constitute essential traffic to each other.”

1.16.4. Short Term Conflict Alert (STCA)

1.16.4.1. Short Term Conflict Alert (STCA) is a ground-based safety net function intended to assist the controller in maintaining standard separation between controlled flights by generating in timely manner. It is an alert of a potential infringement of separation minima [Reference Station Air Traffic Instruction (SATI) JIAP, Karachi Chapter 3 Section 3.6.4.4]. STCA has two phases: -

- (a) Prediction Phase: It generates 120 s prior to potential infringement of separation minima;
- (b) Violation Phase: It generates at the time of loss of standard separation minima.

1.16.4.2. Action to be taken by Duty Controller in case of STCA: -

- (a) In the event when an STCA Prediction is generated, the duty controller shall immediately take appropriate action to ensure that applicable separation minima are not infringed.
- (b) In the event when an STCA Violation is generated, the duty controller shall immediately take appropriate action to separate the aircraft and whenever possible, shall pass the essential traffic information to the concerned aircraft.

1.17. Organizational and Management Information

1.17.1. Not Applicable.

1.18. Additional Information

1.18.1. Not Applicable.

1.19. Useful & Effective Investigation Techniques

1.19.1. Not Applicable.

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SECTION 2 - ANALYSIS

2.1 General

2.1.1 PIA 313 was operating from AllAP, Lahore to JIAP, Karachi and came in contact with ATC Karachi (Area Radar Controller East) maintaining FL340. The aircraft was given Air Traffic Control clearance and acknowledged by aircraft.

2.1.2 ABQ 200 was operating from JIAP, Karachi to BBIAP, Islamabad and came in contact with ATC Karachi (Area Radar Controller East) in climbing phase for FL310 and was asked about their Final Level which was reported as FL350.

2.1.3 ATC Karachi instructed ABQ 200 to climb FL350 and acknowledged by the aircraft.

2.1.4 Both the aircraft (PIA 313 & ABQ 200) were reciprocal to each other on same ATS route but departure aircraft (ABQ 200) was left of route and flying parallel to the route.

2.1.5 The ATC shift changeover timings in the morning are 0300 UTC (i.e. 0800 LT). The level change to ABQ 200 from FL310 to FL350 was given by the outgoing Duty Controller, who also briefed and handed over the traffic to incoming Duty Controller.

2.1.6 The Morning Radar Controller East while taking over the duty found his head-set unserviceable. In order to get it replaced he handed over the traffic to Procedure Controller East as there was no apparent traffic conflict at that time.

2.1.7 The ATM system had shown STCA at 03:08:03, when both the aircraft were 10.89 NM apart on parallel track. Area Procedure Controller East responded on that and asked ABQ 200 to report heading. The intention was to give a radar heading for achieving the required standard separation. Simultaneously, ABQ 200 reported TCAS – RA (At that time both aircraft were approximately 7 NM on parallel track and ABQ 200 at FL335 and PIA 313 at FL340). Area Procedure Controller passed PIA 313 traffic information about ABQ 200. PIA 313 replied that they are visual with the traffic.

2.1.8 As soon as Area Radar Controller East returned to the controlling position, he realized that ABQ 200 in climbing phase getting laterally close to PIA 313. He advised the Procedure Controller East to provide traffic information to both the aircraft, but the Procedure Controller replied that Air Blue had reported TCAS – RA. At that time ABQ 200 was maintain FL334 and flying parallel right to PIA 313.

2.1.9 PIA 313 reported that they got TA with the traffic which was maintaining 600 ft below where as ABQ 200 reported RA.

SECTION 3 - CONCLUSIONS

3.1 Findings

3.1.1 Both the flights (i.e., PIA 313 & ABQ 200) were in contact with ATC Karachi (Area Radar Controller East) on Radar display and R/T.

3.1.2 Both flights were following same route. PIA 313 inbound to JIAP, Karachi and ABQ 200 outbound from JIAP, Karachi.

3.1.3 PIA 313 was maintaining FL340. Area Radar Controller East cleared ABQ 200 to climb FL310 initially and thereafter FL350 un-restricted as ABQ 200 was flying parallel to route.

3.1.4 On the activation of the STCA Area Controller East tried to take evasive measure but at the same time ABQ 200 reported TCAS – RA and stopped climb due TCAS – RA.

3.1.5 At the time of minimum vertical separation of 500 ft, both aircraft (ABQ 200 & PIA 313) were 06.58 NM laterally separated on parallel track. They crossed each other (lateral separation 4.88 NM on parallel track) with a vertical separation of 600 ft as ABQ 200 stopped climb and then descended to FL343 due TCAS – RA.

3.1.6 ABQ 200 while climbing out of FL 330 to FL 350 received Traffic Advisory followed by Resolution Advisory to descent and same was conveyed to ATC whereas PIA 313 reported Traffic Advisory to ATC.

3.1.7 The TCAS – RA reported by the ABQ 200 might be erroneous as both aircraft were on parallel track and never on a collision course. ICAO Doc 9863 [Airborne Collision Avoidance System (ACAS) Manual] Section 3.2.2.1 states: -

“If the threat detection logic in the ACAS computer determines that an encounter with a nearby aircraft could soon lead to a near-collision or collision, the computer threat resolution logic determines an appropriate vertical manoeuvre that will ensure the safe vertical separation of the two aircraft. The selected manoeuvre ensures adequate vertical separation within constraints imposed by the climb rate capability and proximity to the ground of the two aircraft.”

3.1.8 When ABQ 200 reported RA, ABQ 200 was on parallel track to PIA 313 and were approximately 7 NM apart.

3.1.9 Further ICAO Doc 9863 section 4.1.2.1 describes Horizontal distance thresholds for RA which is 1.1 NM above FL200, whereas both aircraft crossed each other at about 4.4 NM. PIA 313 received TA which also show that ABQ 200 might have received erroneous RA.

3.1.10 The serious incident may be considered as loss of separation and not a case of TCAS – RA as referred in above stated ICAO Documents.

3.1.11 The situation does qualify for the Aircraft proximity (Safety not assured) as mentioned in AIP Pakistan ENR 1.14-1: -

*“**Safety not assured** -The risk classification of aircraft proximity in which the safety of the aircraft may have been compromised.”*

3.1.12 After the incident both flights continued to respective destinations.

3.2 Causes / Contributing Factors

3.2.1 Cause

3.2.1.1 Air Traffic Control failed to anticipate the future conflict between ABQ 200 and PIA 313 while flying parallel (offset to ATS route) and giving unrestricted climb to ABQ 200. Lack of situational awareness on part of Air Traffic Control resulted in loss of separation between both the aircraft, Mid Air Collision (MAC).

Note: *Aviation Occurrence Category (ADREP Taxonomy)*

"Mid-Air Collision (MAC): Separation-related occurrences caused by either air traffic control or cockpit crew".

3.2.2 Contributing Factors

3.2.2.1 Air Traffic Control failed to pass the traffic information to both the aircraft timely which is contrary to the ICAO Doc 4444 (PANS – ATM).

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SECTION 4 – SAFETY RECOMMENDATIONS

4.1 **Safety Recommendations**

4.1.1 **PCAA**

4.1.1.1 PCAA may issue necessary instructions to field ATS Units for adhering to the laid down procedures for the provisioning of Air Traffic Services in accordance with ICAO guidelines and best practices, with special emphasis on the aspects related to this serious incident.

4.1.1.2 PCAA may issue directions to field ATS Units for adhering to the laid down procedure for the provisioning of Air Traffic Services (Vectoring / Traffic Information) in accordance with ICAO Doc 4444 and as described in Manual of Air Traffic Service.

4.1.1.3 PCAA may issue specific directions to field ATC Units for adhering procedures in accordance with the SARPs and guidelines issued in SATIs specific to mention procedures for handing over and taking over especially before the beginning of duty.

4.1.1.4 PCAA may issue instructions at field level (Karachi, Lahore, and Islamabad) to arrange simulator sessions (on Area Control simulators) at a specified periodicity, for all the Air Traffic Controllers. This utilization of Area Control simulators be aimed to enhance and refine the skills and identify areas of additional attention / training requirements etc.