FINAL INVESTIGATION REPORT

SERIOUS INCIDENT OF TCAS – RA REPORTED BY AIRBLUE FLIGHT ABQ 211 AIRBUS 320 AIRCRAFT REG. NO. VN-A650 (ON WET LEASE) AT ISLAMABAD ON 03-04-2018

SCOPE

At Aircraft Accident Investigation Board (AAIB), Pakistan investigations are conducted in accordance with Annex-13 to the International Civil Aviation Organization (ICAO) Convention on International Civil Aviation and Civil Aviation Rules 1994 (CARs 94).

The sole objective of the investigation and the final report of an accident or incident under above stated regulations is the prevention of future accidents and incidents of similar nature. It is not the purpose of such an investigation to apportion blame or liability. Accordingly, it is inappropriate to use AAIB Pakistan investigation reports to assign fault or blame or determine liability, since neither the investigation nor the reporting process has been undertaken for that purpose.

This report contains facts, which have been determined up to the time of publication. Such information is published to inform the aviation industry and the public about the general circumstances of civil aviation accidents and incidents.

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ABBREVIATIONS

AAIB	Aircraft Accident Investigation Board
AHQ	Air Headquarter
AOR	Area Of Responsibility
ATC	Air Traffic Control
ATS	Ait Traffic Services
BBIAP	Benazir Bhutto International Airport
CARs	Civil Aviation Rules
CPA	Closest Point of Approach
FL	Flight Level
ft	Feet
h	Hour
ICAO	International Civil Aviation Organization
IOU	Incident Occurrence and Unserviceability Report
kg(s)	Kilogram(s)
kts	Knots
L	Litre
MAC	Mid-air Collision
METAR	Metrological Aerodrome Report
NM	Nautical Mile
PAF	Pakistan Air Force
PCAA	Pakistan Civil Aviation Authority
R/W	Runway
RA	Resolution Advisory
RTF	Radiotelephony
s	Seconds
SLs	Sensitivity Levels
TA	Traffic Advisory
TCAS	Traffic Collision Avoidance System
UTC	Universal Time Coordinated

INTRODUCTION

The serious incident was reported to Aircraft Accident Investigation Board (AAIB), Pakistan, by Pakistan Civil Aviation Authority (PCAA) vide Incident Occurrence and Unserviceability Report (IOU). Ministry of Aviation, Government of Pakistan issued Memorandum and Corrigendum authorizing AAIB, Pakistan to investigate the serious incident. The investigation has been conducted by AAIB, Pakistan.

SYNOPSIS

On 3rd April, 2018 Airblue flight ABQ 211, Airbus 320 aircraft, Reg. No. VN-A650 was operating from Dubai International Airport, Dubai to Benazir Bhutto International Airport (BBIAP), Islamabad. ABQ 211 came in contact with Cherat Approach at position HANGU and was given descent to Flight Level (FL) 150. Subsequently, when ABQ 211 was 40 Nautical Miles (NM) west of position FATEH passing FL180, it was re-cleared to FL160 by Cherat Approach. Once ABQ 211 was 30NM West of position FATEH, it reported Traffic Collision Avoidance System (TCAS) – Resolution Advisory (RA) due Military traffic, a formation 02 x Fighters from Pakistan Air Force (PAF) Base Minhas to Pindi Gheb, crossing Air Traffic Services (ATS) route J-139 from North to South at FL140. Mode C of Aircraft No. 2 of formation showed a climb up to FL148 which triggered TCAS – RA of ABQ 211. At that time ABQ 211 was in descending phase out of FL166 for FL160 but initiated RA climb to FL173. At the time of incident, minimum vertical separation of 1,800 feet (ft) existed between the two aircraft. After landing, ABQ 211 submitted Air Traffic Incident Report (Near Collision) at BBIAP, Islamabad Airport. All corresponding timings are mentioned in Universal Time Coordinated (UTC).

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SECTION 1 - FACTUAL INFORMATION

1.1. **History of the Flight**

1.1.1. On 3rd April 2018, Airblue flight ABQ 211, Airbus 320 aircraft, Reg. No. VN-A650 was operating from Dubai International Airport, Dubai to BBIAP, Islamabad on route PG – G325 – HANGU – J139 – FATEH – OPRN.

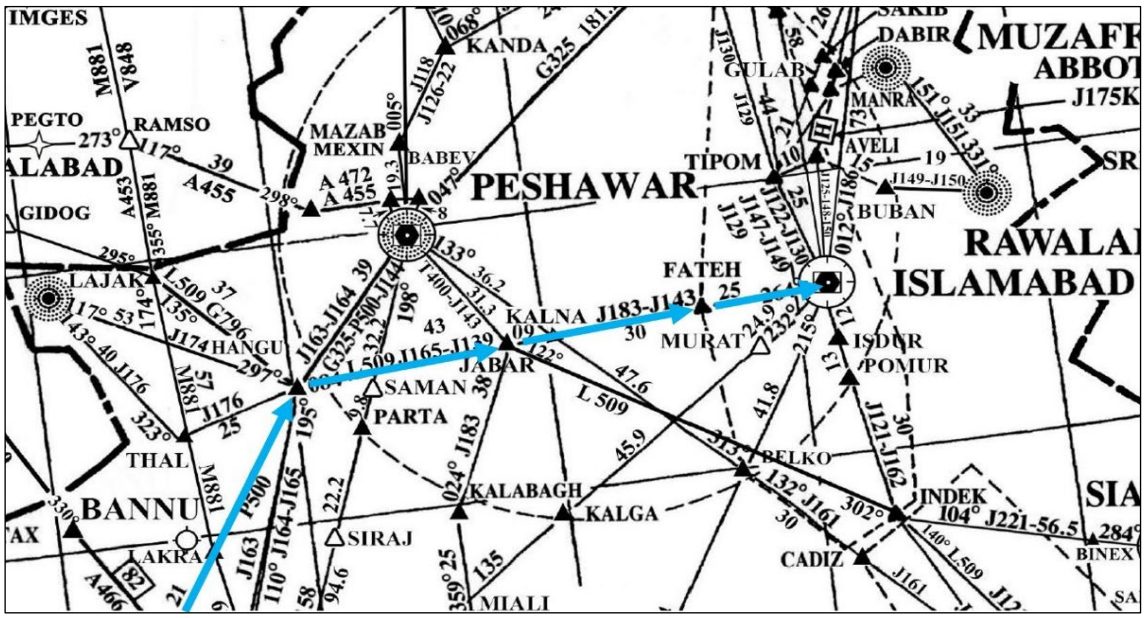

Figure 1 ABQ 211 Route plan

1.1.2. While approaching position HANGU, ABQ 211 came in contact with Cherat Approach and was given descent to FL150.

1.1.3. Military traffic, a formation of 02 x Fighters from PAF Base Minhas to Pindi Gheb was crossing ATS route J139 from North to South at FL140.

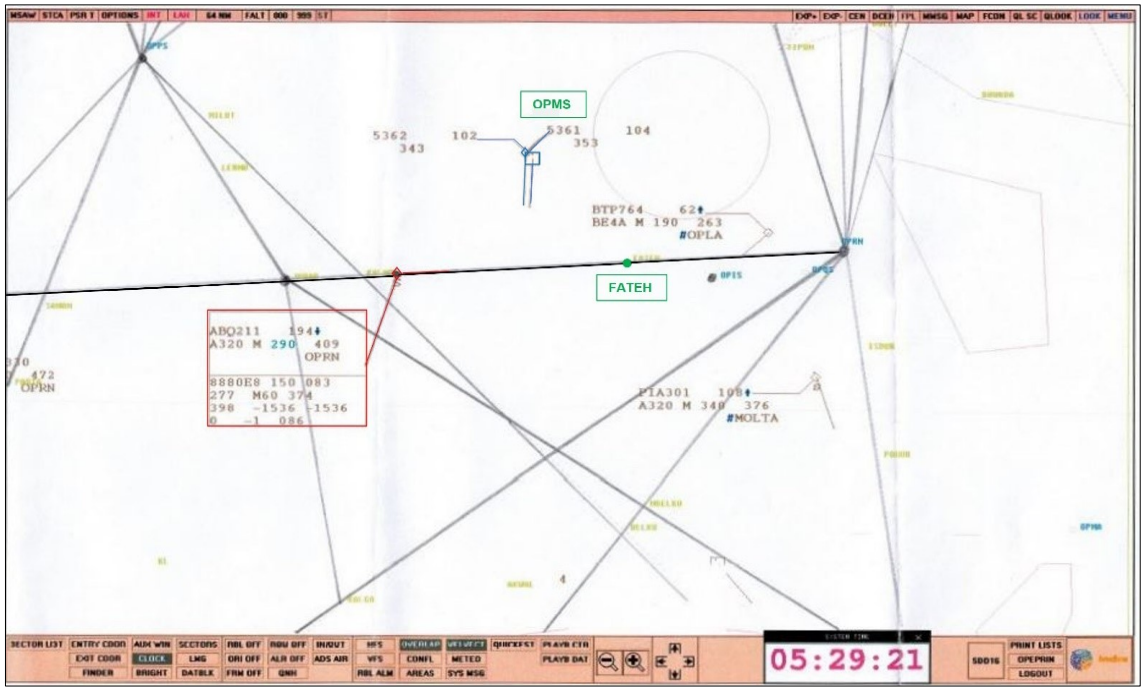

Figure 2 Military Traffic crossing Route J139 from North to South

1.1.4. At 05:29:00 hours (h) when ABQ 211 was 40 NM west of position FATEH, while passing FL180, it was re-cleared FL160 by Cherat Approach.

1.1.5. At 05:31:02 h, while ABQ 211 was 30 NM West of position FATEH descending through FL166, it reported TCAS – RA due traffic.

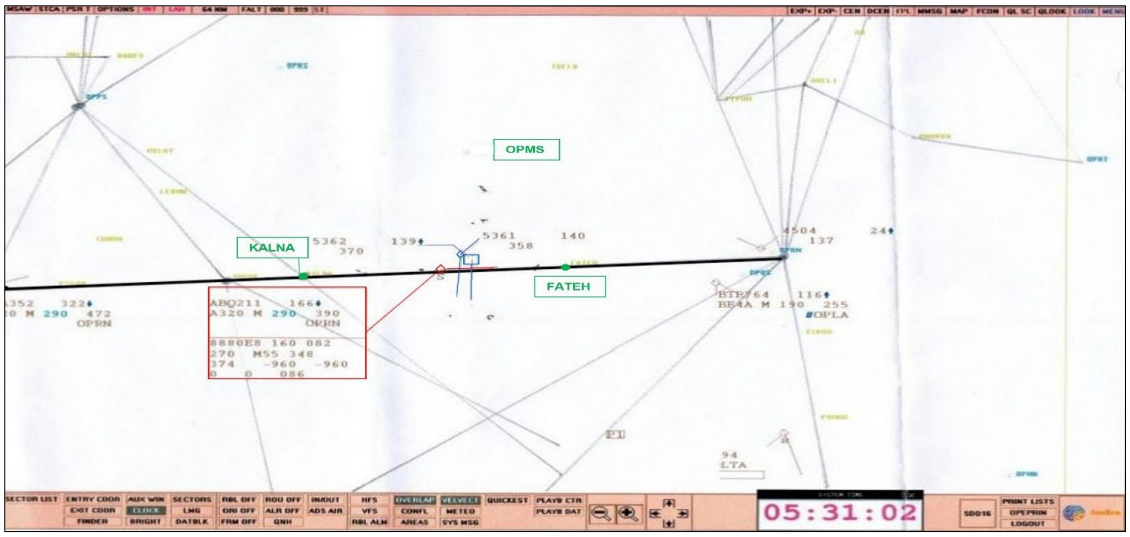

Figure 3 Activation of TCAS – RA of ABQ 211

1.1.6. At 05:31:22 h, Mode C of Fighter aircraft No 2 showed a climb up to FL148. At this time, ABQ 211 also initiated climb as a result of RA activation.

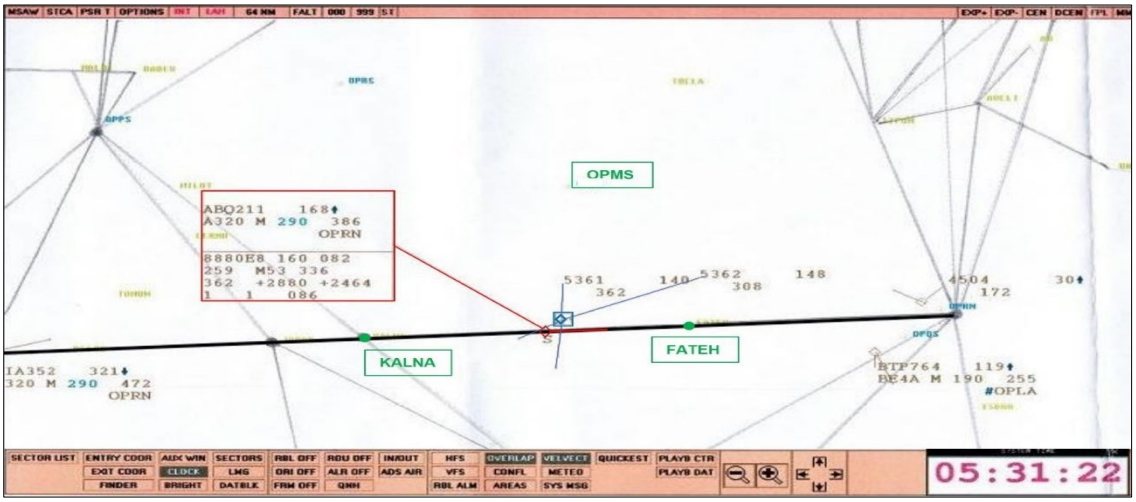

Figure 4 ABQ 211 initiated climb

1.1.7. Vertical Separation of approximately 1,800 ft existed between both the aircraft at the time of RA.

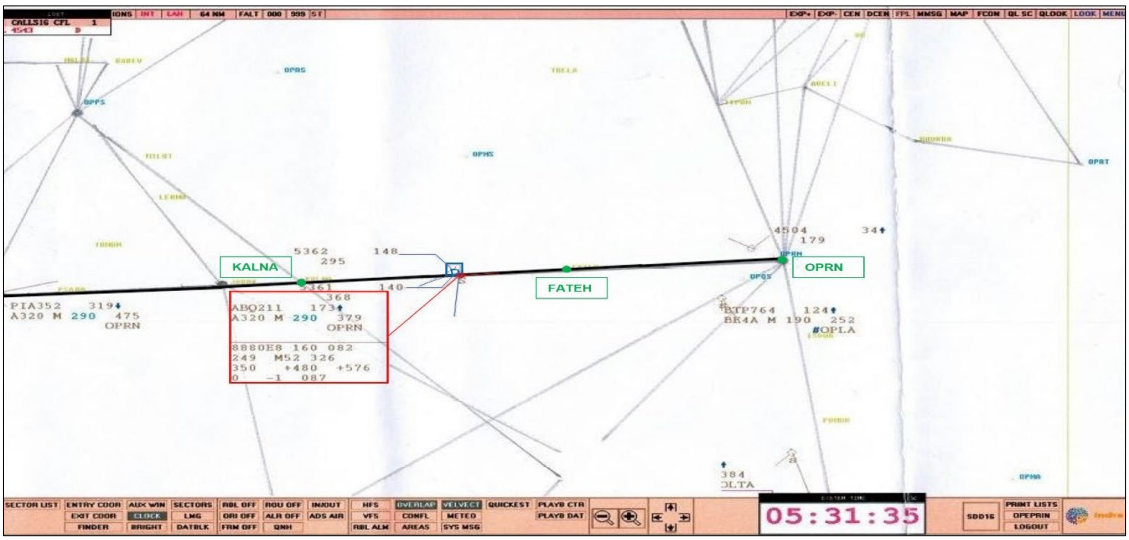

Figure 5 Vertical Separation of 1,800 ft between ABQ 211 & Military Traffic

1.1.8. At 05:31:35 h, while both the fighters were crossing the path of ABQ 211, ABQ 211 was at FL173 and Military aircraft (No. 2 of the formation) was maintaining FL148.

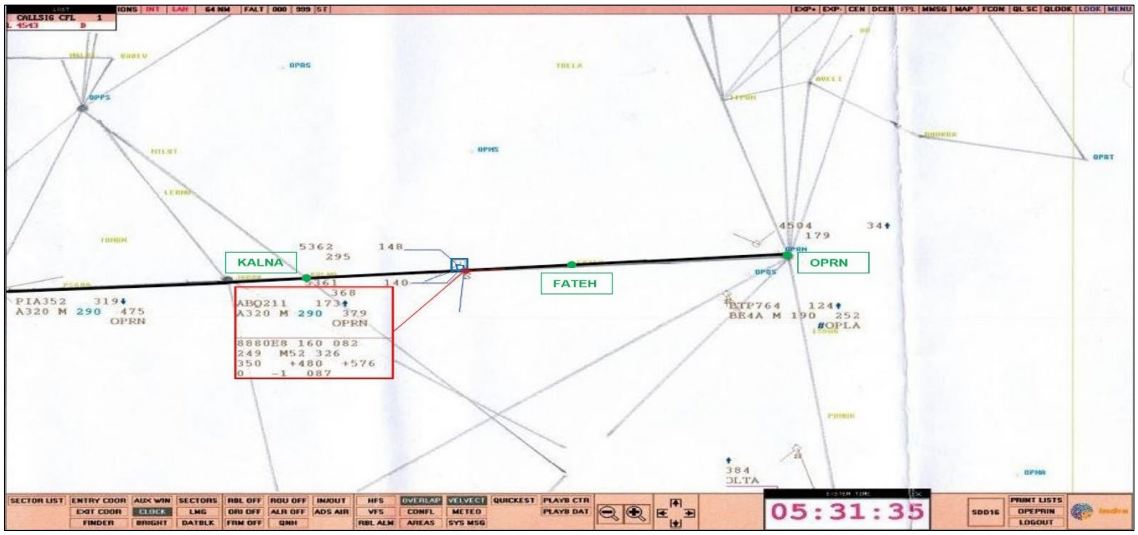

Figure 6 ABQ 211 at FL173 and Military aircraft maintaining FL148.

1.1.9. Thereafter, PAF Formation proceeded for their mission profile and ABQ 211 continued its flight to its destination and landed safely without any further incident.

1.2. Injuries to Person(s)

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

1.3. Damage to Aircraft

1.3.1. No damage was reported 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. Not Applicable.

1.6. **Aircraft Information**

ABQ 211	
Aircraft Make & Model	Airbus A320
Registration Marking	VN-A650
Manufacturer Serial No.	6457
Operator	Airblue
Sector	Dubai to Islamabad
Maximum Take-off Weight	77,000 kilograms (kgs)
Maximum Landing Weight	64,500 kgs
Maximum Fuel Capacity	27,200 Liters (L)
Altitude	FL160

Table 1 Aircraft Information

1.7. **Meteorological Information**

1.7.1. No significant weather was reported at BBIAP, Islamabad at the time of the incident.

Meteorological Aerodrome Report (METAR) BBIAP, Islamabad
OPRN 030500Z 27004KT 7000 NSC 24/14 Q1015 NOSIG RMK A2998=

Table 2 METAR details BBIAP, Islamabad

METAR BBIAP, Islamabad	
OPRN	**(Station ID)** BBIAP, Islamabad
030500Z	**(Date and Time)** Day 03, Time 05:00 UTC
27004KT	**Wind Direction & Speed-** Wind Direction: 270°, Speed: 04 knots (kts)
7000	**Visibility-** 7,000 meters (m).
NSC	**No significant cloud** (NSC)
24/14	**Temperature:** 24°C, **Dewpoint:** 14°C
Q1015	**Altimeter setting-** Air pressure 1015 hpa
NOSIG	**No significant change** is expected to the reported conditions within the next 2 hours
RMK	**Remarks**
A2998	**Altimeter setting-** Air pressure is 29.98 inches of mercury

Table 3 METAR description at time 030500Z

1.8. **Aids to Navigation**

1.8.1. Navigational aids for BBIAP, Islamabad are provided below.

TYPE OF AID (CAT of ILS VAR VOR/ILS)	ID	Frequency	Hours of operation	Site of transmitting antenna coordinates	Elevation of DME transmitting antenna	Remarks
1	2	3	4	5	6	7
ILS/LOC CAT I 30	IRN	110.3 MHz	H24	333728.90N 0730451.72E	522.000000 M	-
DVOR/DME (2/2015)	RN	112.1 MHz CH58X	H24	333621.39N 0730733.37E	504.47M	-
GP/TDME 30	DOTS/DASHES	335.0 MHz CH40X	H24	333639.92N 0730629.53E	-	-

Table 4 Radio Navigation & Landing Aids BBIAP, Islamabad

1.8.2. There was no abnormality reported regarding Navigational Aids at BBIAP, Islamabad during the time of incident.

1.9. **Communications**

1.9.1. Communication frequencies for BBIAP, Islamabad are provided below.

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APP	Cherat Approach	125.60 MHZ	H24	Primary Frequency.
APP	Islamabad APP	124.90 MHZ	H24	Primary frequency
ATIS	ATIS	129.60 MHZ	H24	-
	Radio	2923.00 KHZ	H24	-
	Radio	5601.00 KHZ	H24	-
BS	Radio Pakistan	1150.00 KHZ	HX	-
TWRChaklala Tower	Chaklalala Tower	119.70 MHZ	H24	Secondary Frequency
TWRChaklala Tower	Chaklalala Tower	121.50 MHZ	H24	Emergency Frequency
TWRChaklala Tower	Chaklalala Tower	123.70 MHZ	H24	Primary Frequency
APP	Islamabad APP	125.50 MHZ	H24	Secondary Frequency

Table 5 Communication & Radio Navigational Aids, BBIAP, Islamabad

1.9.2. There was no abnormality reported regarding Communication facilities at BBIAP, Islamabad during the time of incident.

1.10. **Aerodrome Information**

1.10.1. Aerodrome data of BBIAP, Islamabad is provided below. At the time of incident, no abnormality was reported.

Designations RWY NR	True bearing	Dimensions of RWY (M)	Strength (PCN) and surface of RWY and SWY	THR coordinates	THR elevation and highest elevation of TDZ of precision APP RWY	Slope of RWY/SWY
1	2	3	4	5	6	7
12	118.00°	3291 x 46	111/F/C/W/T Bitumen	333721.41N 0730508.49E	THR 506.00 M / 1660.10 FT	0.150% up till 1981 M from displaced THR
30	298.00°	3291 x 46	111/F/C/W/T Bitumen	333639.32N 0730642.38E	THR 505.00 M / 1656.82 FT	0.500% up till 762 M from displaced THR then .15%

SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	RESA dimension (M)	Arresting system	Obstacle Free Zone	Remarks
8	9	10	11	12	13	14
229	-	-	-	-	-	THR RWY 12 displaced 274 m. LCN 68 for 274 m (900') in the portion of runway before displaced THR RWY 12. Fair weather strip on both sides of RWY 12 not available due uneven level.
213	-	-	-	-	-	THR RWY 30 displaced 274 m. Fair weather strip on both sides of RWY 30 not available due uneven level.

Table 6 Aerodrome Information BBIAP, Islamabad

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. Not Applicable.

1.17. **Organizational and Management Information**

1.17.1. Not Applicable.

1.18. Additional Information

1.18.1. **TCAS Working Principle –** TCAS stands for Traffic Collision Avoidance System, and its purpose is to minimize the risk of mid-air collisions between aircraft. Working independently from Air Traffic Control, TCAS uses nearby aircraft's transponder signals to alert pilots to the danger of mid-air collisions. It does so by constructing a three-dimensional map of airspace through which the aircraft is travelling. In detecting the other aircraft's transponder signals, it can foresee the potential collisions based on speeds and altitude of planes passing through the airspace in question. If TCAS detects a potential collision, it will automatically notify each of the affected aircraft. In this instance, it will automatically initiate a mutual avoidance manoeuvre. This involves the system informing the crews of the aircraft in question both audibly and visibly to either climb or descend in a manner that ensures that, when their paths cross, they do not meet.

Figure 7 TCAS (TA) alert

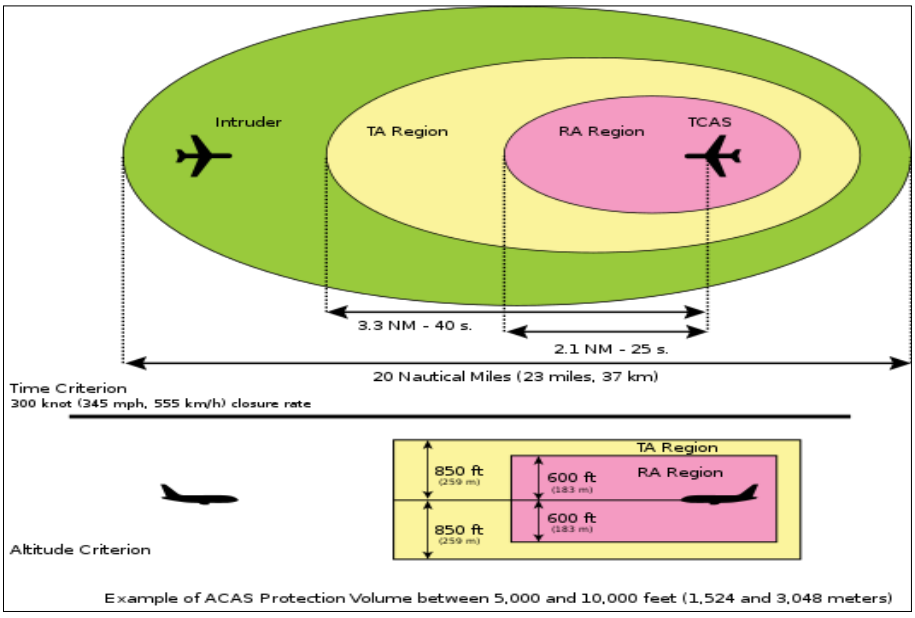

Figure 8 TCAS TA & RA ranges

1.18.2. **Airborne Collision Avoidance System (ACAS)**

1.18.2.1. 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.

1.18.2.2. ACAS equipment in the aircraft interrogates Mode 'A' / 'C' and Mode 'S' transponders 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.

1.18.2.3. **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.

1.18.2.4. **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.

1.18.2.5. 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).

1.18.2.6. **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.

1.18.3. **Traffic Display Symbology –** On the TCAS traffic display both colour and shape are used to assist the pilot in interpreting the displayed information.

1.18.3.1. Own-aircraft is depicted as a white or yellow aircraft-like symbol. Targets are displayed by different symbols, according to their threat status

1.18.3.2. Hollow white diamond – for other traffic. (No threat).

1.18.3.3. Solid white diamond – for proximate traffic.

1.18.3.4. Solid yellow or amber circle – for intruders (i.e. aircraft which trigger a TA).

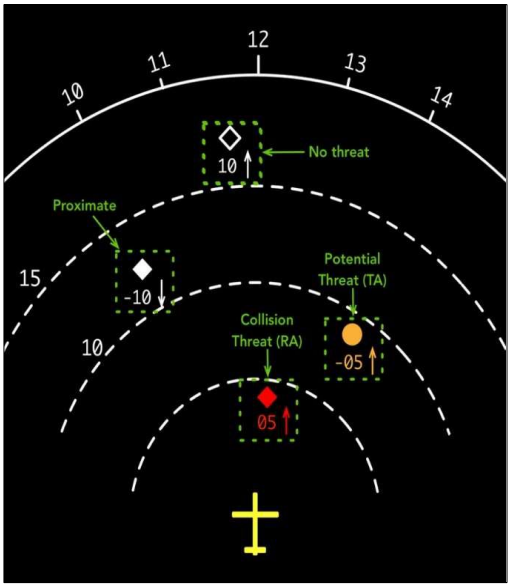

Figure 9 Traffic Display

1.18.3.5. Solid red square – for threats (i.e. aircraft which trigger an RA).

1.19. Useful & Effective Investigation Techniques

1.19.1. Standard investigation procedures and techniques were used during the course of investigation.

SECTION 2 – ANALYSIS

2.1. **General**

2.1.1. On 3rd April 2018, Airblue Flight No. ABQ 211 was a scheduled passenger flight operating from Dubai International Airport, Dubai to BBIAP, Islamabad on route PG – G325 – HANGU – J139 – FATEH – OPRN.

2.1.2. No significant weather was reported at BBIAP, Islamabad as well as surrounding areas at the time of the incident.

2.1.3. While approaching position HANGU, ABQ 211 came in contact with Cherat Approach and was given descend to FL150 in the Area of Responsibility (AOR) of Cherat Approach.

2.1.4. Military traffic, a formation of 02 x Fighter aircraft from PAF Base Minhas to Pindi Gheb was crossing ATS route J139 from North to South at FL140 for their routine mission.

2.1.5. At 05:29:00 h, when ABQ 211 was 40 NM west of position FATEH, while passing FL180, it was re-cleared FL160 by Cherat Approach to ensure separation of 2,000 ft between ABQ 211 and Military formation due to performance differences between civil and military aircraft.

2.1.6. At 05:31:02 h, while ABQ 211 was 30 NM West of position FATEH descending out of FL166, it reported TCAS – RA due Military traffic, crossing ATS route J139 from North to South.

2.1.7. However, at 05:31:22 h, Mode C of Fighter aircraft No 2 showed a climb up to FL148, which was 800 ft above the cleared level. At this time, ABQ 211 initiated climb as a result of RA activation.

2.1.8. Vertical Separation of approximately 1,800 ft existed between both the aircraft at the time of RA.

2.1.9. Standard separation as mentioned in ICAO Doc 4444 (PANS – ATM) is to be implemented between civil aircraft. However, due to significant performance difference between civil and fighter aircraft, vertical separation of 2,000 ft or more is ensured between civil and military traffic.

2.1.10. Abrupt climb of Military aircraft may have triggered the TCAS – RA of ABQ 211.

2.1.11. At 05:31:35 h, while fighter aircraft were crossing the path of ABQ 211, ABQ 211 was at FL173 while No. 2 aircraft of the PAF formation was maintaining FL148.

2.1.12. Thereafter, PAF Formation proceeded for their mission profile while ABQ 211 continued its flight to its destination and landed without any further incident.

SECTION 3 – CONCLUSIONS

3.1. Findings

3.1.1. Airblue flight ABQ 211 was a scheduled passenger flight operating from Dubai International Airport, Dubai to BBIAP, Islamabad on route PG – G325 – Hangu – J139 – FATEH – OPRN.

3.1.2. No significant weather was reported at BBIAP, Islamabad as well as surrounding areas at the time of the incident.

3.1.3. While approaching position HANGU, ABQ 211 was given descend to FL150 within the AOR of Cherat Approach.

3.1.4. A formation of 02 x Fighters from PAF Base Minhas to Pindi Gheb was on a routine mission when they crossed ATS route J139 from North to South at FL140.

3.1.5. ABQ 211 was initially cleared to FL150, thereafter it was re-cleared FL160 by Cherat Approach to ensure separation of 2,000 ft between ABQ 211 and Military formation due to performance differences between civil and military aircraft.

3.1.6. ABQ 211 was 30 NM West of position FATEH descending out of FL166 when it reported TCAS – RA due Military traffic crossing North to South.

3.1.7. No 2 of the PAF formation climbed to FL148, which was 800 ft above the cleared level. At the same time, ABQ 211 initiated climb as a result of RA activation.

3.1.8. Vertical Separation of approximately 1,800 ft existed between both the aircraft at the time of RA.

3.1.9. As per procedure in vogue, separation of 2,000 ft is to be maintained between civil and Military fighter traffic due performance difference between Civil and Military fighter aircraft.

3.1.10. Abrupt climb of Military aircraft may have triggered the TCAS – RA of ABQ 211.

3.1.11. ABQ 211 was maintaining FL173 and Military aircraft was maintaining FL148 when the path of both the aircraft crossed each other.

3.1.12. No Radiotelephony (RTF) contents were provided by Air Headquarters (AHQ) to ascertain the reason of climb of the fighter aircraft in the formation but AHQ has described its climb as **'Unintentional'.**

3.1.13. In the absence of tape extracts and Cherat Approach Controller statement, it cannot be ascertained if traffic information regarding Civil traffic had been passed to the Military aircraft by Cherat Approach.

3.1.14. Thereafter, PAF Formation proceeded for their mission profile while ABQ 211 continued its flight to its destination and landed without any further incident.

3.2. Cause / Contributory Factors

3.2.1. Cause

3.2.1.1. Activation of TCAS – RA **(MAC – Mid Air Collision)** due to non-adherence of flight level restrictions by Military aircraft.

3.2.2. Contributory Factors

3.2.2.1. Violation of ATC Clearance by Military Traffic.

3.2.2.2. Unintentional climb of No 2 Fighter in Formation

Note: Aviation Occurrence Category (ADREP Taxonomy)
*"**Mid-Air Collision (MAC):** Separation-related occurrences caused by either air traffic control or cockpit crew*

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SECTION 4 – SAFETY RECOMMENDATIONS

4.1. Safety Recommendations

4.1.1. AHQ may educate and enhance the knowledge on the working of TCAS – RA to Military Controllers and fighter pilots and limitations of civil aircraft (especially speed variations / rate of climb and descent) to ensure standard separation / spacing between the traffic at regular intervals.

4.1.2. Periodic sessions may be conducted by PAF for Fighter Pilots to strictly adhere to the ATC Clearance in order to maintain standard separation.

4.1.3. PCAA / AHQ may ensure that proper communication and traffic Information is passed to concerned aircraft on conflicting path especially during climb and descend phase.