FINAL INVESTIGATION REPORT

SERIOUS INCIDENT OF TCAS – RA REPORTED BY EMIRATES FLIGHT UAE 637, BOEING 777-31H(ER) AIRCRAFT, REG. NO. A6-ENO, ON 19-09-2019

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).

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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
ACAS	Airborne Collision Avoidance System
AIS	Aeronautical Information Service
AMSL	Above Mean Sea Level
ATC	Air Traffic Control
ATCL	Air Traffic Controller Licence
BKIAP	Bacha Khan International Airport
CARs	Civil Aviation Rules
COO	Chief Operation Officer
ELP	English Language Proficiency
FL	Flight Level
ft	Feet
GRF	Global Reporting Format
h	Hour(s)
hPa	Hectopascal
ICAO	International Civil Aviation Organization
ILS	Instrument Landing System
IOU	Incident Occurrence and Unserviceability Report
Kg(s)	Kilogram(s)
km(s)	Kilometre(s)
kt(s)	Knot(s)
L	Liter(s)
METAR	Metrological Aerodrome Report
NM	Nautical Miles
PAF	Pakistan Air Force
PCAA	Pakistan Civil Aviation Authority
RA	Resolution Advisory
R/W	Runway
SATCO	Senior Air Traffic Controller
SID	Standard Instrument Departure
SL	Sensitivity Level
TA	Traffic Advisory
TCAS	Traffic Collision and 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. All corresponding timings are mentioned in Universal Time Coordinated (UTC).

SYNOPSIS

On 19th September, 2019, Emirates Airline Flight No. UAE 637, Boeing 777-31H(ER) aircraft, Reg. No. A6-ENO, was a scheduled passenger flight from Bacha Khan International Airport (BKIAP), Peshawar to Dubai International Airport, Dubai. UAE 637 was cleared on HANGU 1A Standard Instrument Departure (SID) from Runway (R/W) 35. Since Military traffic Pakistan Air Force (PAF) Helicopter was operating East of the airfield at 2,500 ft, UAE 637 was restricted, in coordination with PAF Air Traffic Control (ATC) to maintain R/W heading until passing 3,500 feet (ft) before turning right to join SID HANGU 1A DEP climbing 10,000 ft. While turning right towards overhead Peshawar passing 4,000 ft, UAE 637 reported Traffic Collision Avoidance System (TCAS) Resolution Advisory (RA) due F-7 PG, Military fighter aircraft crossing 400 ft below. It was confirmed by PAF Controller that a formation of 2x F-7 PG fighter aircraft were cleared for initials for R/W17 at 3,500 ft despite having information of departing traffic from R/W35.

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SECTION 1 - FACTUAL INFORMATION

1.1. **History of the Flight**

1.1.1. On 19th September, 2019, Emirates Airline Flight No. UAE 637, Boeing 777-31H(ER) aircraft, Reg. No. A6-ENO, was a scheduled passenger flight from Bacha Khan International Airport (BKIAP), Peshawar to Dubai International Airport, Dubai.

1.1.2. UAE 637 was cleared on HANGU 1A SID for R/W35.

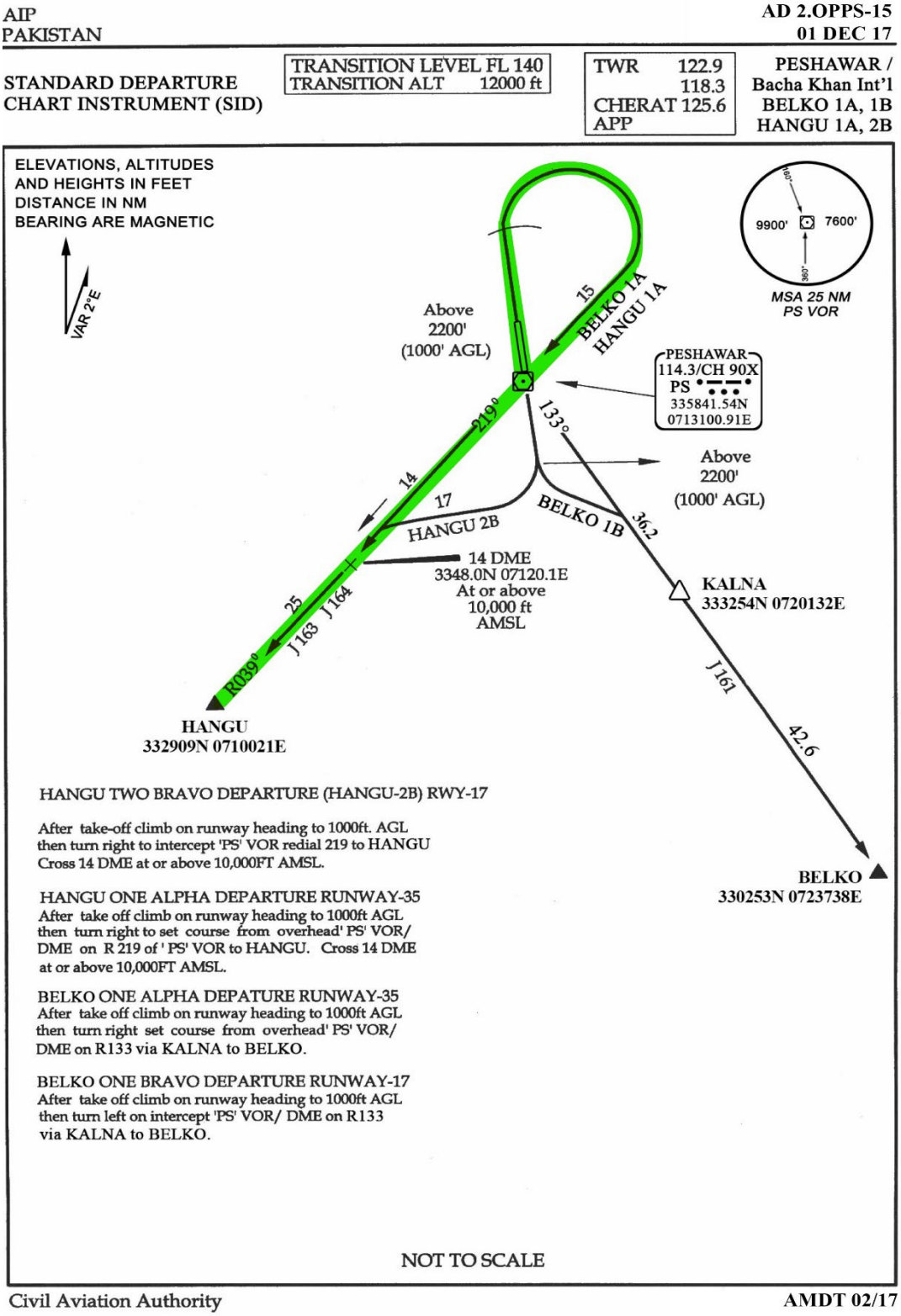


Figure 1 Standard Instrument Departure (SID) Chart

1.1.3. Military traffic, PAF Helicopter was operating northeast of the airfield at 2,500 ft.

1.1.4. UAE 637 was restricted, to maintain R/W35 heading until passing 3,500 ft due PAF Helicopter, before turning right to join SID HG 1A DEP climbing 10,000 ft in coordination with PAF ATC.

1.1.5. UAE 637, while turning right towards overhead Peshawar passing 4,000 ft, reported TCAS – RA due to an F-7 PG, Military fighter aircraft crossing 400 ft below.

1.1.6. It was confirmed by PAF Controller that a formation of 2x F-7 PG fighter aircraft were cleared for initials via R/W17 at 3,500 ft despite having information of departing traffic from R/W35.

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. Not Applicable.

1.4. Other Damage

1.4.1. Not Applicable.

1.5. Personnel Information

Controller's Details	
Date of Birth	19-22-1982
Date of appointment in PCAA	03-07-2010
Type of License and Validity	Air Traffic Controller License (ATCL) / April, 2027
English Language Proficiency (ELP) Level and Validity	Level V / 15-11-2026
Trainings / Courses	
Aerodrome / Area Control (Non-Radar)	14-12-2009 to 02-07-2010 (28 Weeks)
AIS Publishing / AIS Charting	09-11-2015 to 25-11-2015 (17 Days)
Approach Control (Non-Radar)	07-03-2016 to 29-04-2016 (08 Weeks)
Area Radar Control	15-01-2018 to 09-03-2018 (08 Weeks)
ELP Course	22-04-2019 to 03-05-2019 (02 Weeks)
Global Reporting Format (GRF) Course	12-04-2021 to 16-04-2021 (01 Week)

Table 1 Controller's Brief Description

1.6. **Aircraft Information**

Emirates Airline	
Aircraft Make & Model	Boeing 777-31H(ER)
Registration Marking	A6-ENO
Call Sign	UAE 637
Manufacturer Serial No.	41361
Operator	Emirates Airline
Sector	Peshawar – Dubai
Maximum Take-off Weight	351,000 kilograms (kgs)
Maximum Landing Weight	251,290 kg
Maximum Fuel Capacity	181,283 Litres (L)

Table 2 Aircraft Information

1.7. **Meteorological Information**

1.7.1. Weather data during this event is as provided below.

Meteorological Aerodrome Report (METAR) BKIAP, Peshawar
190430Z 31006KT 4000 HZ FEW040 FEW100 29/23 Q1012=

Table 3 METAR details BKIAP, Peshawar

METAR BKIAP, Peshawar	
190430Z	**Date and Time** Day: 19; Time: 04:30 UTC
31006KT	**Wind Direction and Speed** Wind Direction: 310° Speed: 06 knot (kt)
4000	**Visibility** 4000 meters (m)
HZ	**Haze** (HZ)
FEW040	**Clouds** Few (FEW) at 4,000 ft (1-2 oktas)
FEW100	**Clouds** Few (FEW) at 10,000 ft (1-2 oktas)
29/23	**Temperature** 29 °C, **Dew point** 23 °C
Q1012	**Altimeter setting** Air pressure is 1012 hPa

Table 4 METAR description at time

1.7.2. No significant weather was reported at the time of the incident which could have possibly contributed to the incident.

1.8. **Aids to Navigation**

1.8.1. Navigation facilities were fully functional at the time of event flight. Navigational aids for BKIAP, Peshawar are provided below.

TYPE OF AID CAT of ILS (VAR VAR/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 35	IBKB	108.3 MHz	H24	340031.00N 0713048.00E	-	-
DVOR/DME (2/2015)	PS	114.3 MHz CH90X	H24	335841.54N 0713100.91E	368.00M	-
NDB	PS	308.0 kHz	H24	335957.00N 0713010.00E	-	Coverage 150NM
GP/TDME 35	DOTS/DASHES	334.1 MHz CH20X	H24	335904.00N 0713052.00E	-	-

Table 5 Radio Navigation & Landing Aids BKIAP, Peshawar

1.9. **Communications**

1.9.1. At the time of the incident no abnormality was reported. Communication facilities at BKIAP, Peshawar are provided below.

Service designation	Call sign	Frequency	Hours of operation	Remarks
1	2	3	4	5
APP	Cherat APP	125.60 MHZ	H24	PAF. Primary Frequency.
ATIS	ATIS	126.70 MHZ	H24	-
G/A/G	Radio	2923.00 KHZ	-	-
G/A/G	Radio	5601.00 KHZ	-	-
GCA		118.30 MHZ	H24	-
TWR	Peshawar Tower	118.40 MHZ	H24	Standby Frequency
TWR	Peshawar Tower	121.50 MHZ	H24	-
TWR	Peshawar Tower	122.90 MHZ	H24	Primary Frequency.
TWR	Peshawar Tower	243.00 MHZ	H24	-
TWR	Peshawar Tower	121.80 MHZ	H24	-

Table 6 Communication Facilities, BKIAP, Peshawar

1.10. **Aerodrome Information**

1.10.1. At the time of the incident no abnormality was reported. Aerodrome information of BKIAP, Peshawar is provided below.

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
17	176.00°	2743 x 46	68/F/C/X/U Bitumen See remarks below	340021.62N 0713048.76E	THR 357.00 M / 1171.26 FT	0.500%
35	356.00°	2743 x 46	68/F/C/X/U Bitumen See remarks below	335853.16N 0713056.35E	THR 369.00 M / 1210.63 FT	0.500%

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
60	274	3107 x 92	90 x 92	Available		-
60	274	3107 x 92	-	Available		-

Table 7 Aerodrome Information – R/W Physical Characteristics BKIAP, Peshawar

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. **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. 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.

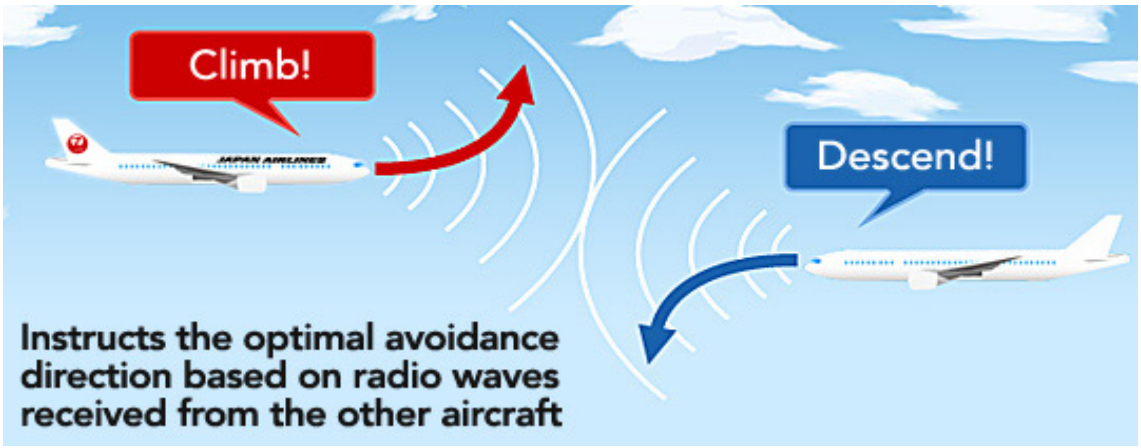


Figure 2 TCAS Working Principle

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

1.16.2.1. 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.

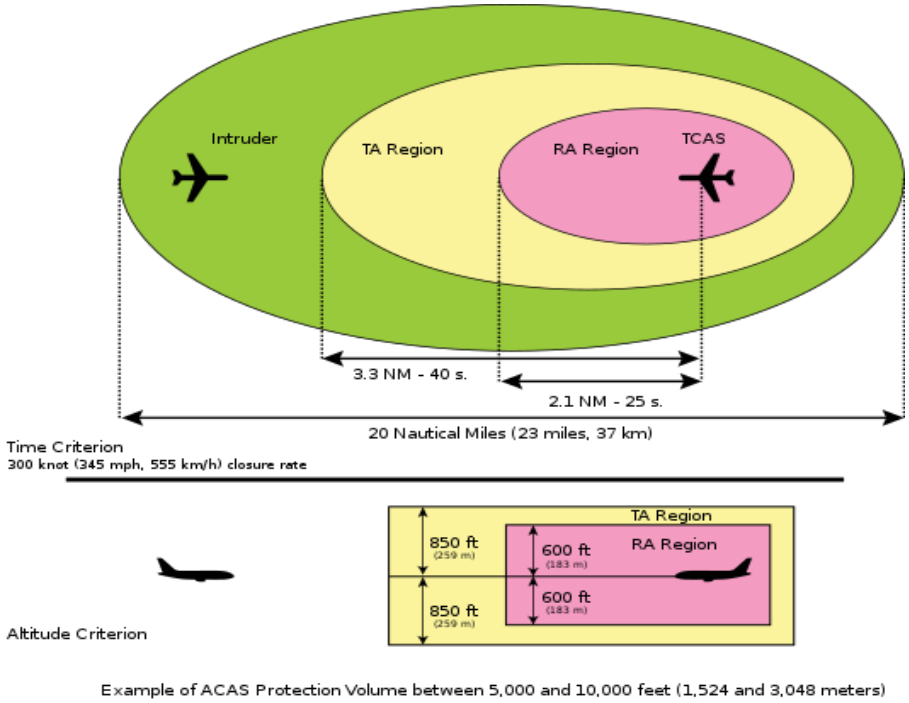
1.16.2.2. ACAS equipment in the aircraft interrogates Mode 'A' / 'C' and Mode 'S' transponders on aircraft in its vicinity and listens for their replies. By processing these replies, ACAS determines which aircraft represent potential collision threats and provides appropriate display indications (or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

1.16.2.3. **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.

1.16.2.4. **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.

1.16.2.5. 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).

1.16.2.6. **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.



Example of ACAS Protection Volume between 5,000 and 10,000 feet (1,524 and 3,048 meters)

Figure 3 TA and RA Ranges

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

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

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

(c) Solid white diamond – for proximate traffic.

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

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

Figure 4 Traffic and Resolution Advisories

1.17. Organizational and Management Information

1.17.1. Not Applicable.

1.18. Additional Information

1.18.1. Not Applicable

1.19. Use of 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 19th September, 2019, Emirates Airline Flight No. UAE 637, Boeing 777-31H(ER) aircraft, Reg. No. A6-ENO, was a scheduled passenger flight from BKIAP, Peshawar to Dubai International Airport, Dubai.

2.1.2. As per AIP Pakistan, Peshawar airport is a joint user airfield where PCAA and Military Controllers are handling commercial and military traffic respectively, working side by side in the same Aerodrome Control Tower.

2.1.3. At 04:24:15 h, UAE 637 was given Take-off clearance on SID HANGU 1A Departure from R/W35, with restriction to maintain R/W heading till passing 3,500 ft Above Mean Sea Level (AMSL) before turning right to join SID.

2.1.4. UAE 637 got airborne at 04:32:00 h. While turning right towards overhead Peshawar to HANGU passing 4,000 ft, it reported TCAS – RA due Military aircraft crossing 400 ft below.

2.1.5. One Military Helicopter maintaining 2,500 ft was operating at North Eastern side of the airfield. However, this essential traffic information was not passed to UAE 637 before departure.

2.1.6. At approximately 04:34:00 h, Tower Controller passed the traffic information to UAE 637 about PAF helicopter holding towards Northeast of airfield maintaining 2,500 ft.

2.1.7. Upon receiving the traffic information of PAF helicopter by Civil Controller, UAE 637 reported that traffic was about 400 ft below it and UAE 637 had to climb TCAS – RA. It happened approximately at 4,000 ft in the turn.

2.1.8. Later, it was confirmed that 2x F-7 PGs PAF fighter aircraft were cleared by Military Controller for initials for opposite R/W17 at 3,500 ft, despite having information of departing traffic UAE 637 from R/W35, which resulted in the activation of TCAS – RA.

2.1.9. The activation of TCAS – RA resulted due to non-communication by Military Controller to Civil Controller about Military traffic cleared for R/W17. Moreover, clearing Military traffic for opposite R/W despite having information of civil traffic departing from R/W35 is a violation of procedures resulting in a flight safety situation.

2.1.10. During the course of investigation, it was revealed that there is no formal Letter of Agreement (LOA) between PAF and PCAA, however, only local Coordination Procedure between COO and SATCO Peshawar exists.

2.2. **Flight Operations**

2.2.1. Not Applicable.

2.3. **Human Factor**

2.3.1. Not Applicable.

SECTION 3 – CONCLUSIONS

3.1. Findings

3.1.1. Emirates flight UAE 637 was a scheduled passenger flight from BKIAP, Peshawar to Dubai International Airport, Dubai.

3.1.2. As per AIP Pakistan, BKIAP, Peshawar is a joint user airfield where PCAA and Military Controllers are handling commercial and military traffic respectively, working side by side in the same Aerodrome Control Tower.

3.1.3. UAE 637 was given Take-off clearance on SID HANGU 1A Departure from R/W35, with restriction to maintain R/W heading till passing 3,500 ft AMSL before turning right to join SID.

3.1.4. UAE 637 after airborne while turning right towards overhead Peshawar to HANGU passing 4,000 ft, reported TCAS – RA due Military aircraft crossing 400 ft below.

3.1.5. One Military Helicopter maintaining 2,500 ft was operating at North Eastern side of the airfield. However, this essential traffic information was not passed to UAE 637 before departure.

3.1.6. At approximately 04:34:00 h, after TCAS – RA alert reported by UAE 637, Tower Controller passed the traffic information about PAF helicopter holding towards North East of airfield maintaining 2,500 ft.

3.1.7. Upon receipt of traffic information of PAF helicopter by civil controller, UAE 637 reported that traffic was about 400 ft below and it had to climb due to TCAS – RA. This happened approximately at 4,000 ft in the turn.

3.1.8. PAF fighter aircraft were cleared by Military Controller for initials R/W17 at 3,500 ft. despite having information of departing traffic (UAE637), which probably resulted in the activation of TCAS – RA.

3.1.9. Later, it was confirmed that 2x F-7 PGs PAF fighter aircraft were cleared by Military Controller for initials for opposite R/W17 at 3,500 ft, despite having information of departing traffic UAE 637.

3.1.10. The activation of TCAS – RA resulted due to non-communication by Military Controller to Civil Controller about Military traffic for R/W17. Moreover, clearing Military traffic for opposite R/W despite having information of civil traffic departing from R/W35 is a violation of procedures resulting in a flight safety situation.

3.1.11. The Military controller failed to coordinate with Civil Controller regarding Essential Local Traffic of Fighter formation coming for Initials R/W17 at 3,500 ft which was reciprocal to the Take-off path of departing Civil Traffic (UAE 637) from R/W35 climbing 3,500 ft on R/W heading due to helicopter holding in circuit North East of the airfield at 2,500 ft.

3.1.12. During the course of investigation, it was revealed that there is no formal Letter of Agreement (LOA) between PAF and PCAA, however, only local Coordination Procedure between Chief COO and SATCO Peshawar exists.

3.2. Cause / Contributory Factors

3.2.1. Cause

3.2.1.1. The activation of TCAS – RA **(MAC – Mid Air Collision)** due to lack of communication and violation of procedures by Military Controller despite having information of departing traffic.

3.2.2. Contributory Factors

3.2.2.1. Lack of proper coordination between Military and Civil Controllers.

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. PCAA may ensure proper coordination procedures between Civil and Military Controllers through proper LOAs for adopting / exercising and practicing for safe Air Operations.

4.1.2. PCAA to educate and enhance the knowledge on the working of TCAS – RA to Military Controllers / pilots and limitations of civil aircraft (especially speed variations / rate of climb and descent) at joint user airfields.

4.1.3. PCAA to educate civil controllers on Military flying procedures, especially at joint user airfields.