FINAL INVESTIGATION REPORT

ACCIDENT OF M/S RAWALPINDI FLYING CLUB CESSNA-172 AIRCRAFT REG NO. AP-BEJ AT BENAZIR BHUTTO INTERNATIONAL AIRPORT ISLAMABAD ON 1ST NOVEMBER, 2014

SCOPE

Safety Investigation Board (SIB), Pakistan investigations are conducted in accordance with Annex-13 to the ICAO Convention on International Civil Aviation and Civil Aviation Authority CAA), Pakistan Rules 1994 (CARs 94).

The sole objective of the investigation of an accident or incident under above stated regulations is the prevention of future accidents and incidents. It is not the purpose of such an investigation to apportion blame or liability. Accordingly, it is inappropriate that SIB reports should be used 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. This information is published to inform the aviation industry and the public of the general circumstances of civil aviation accidents and incidents.

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Synopsis

The accident was reported to Safety Investigation Board (SIB), Pakistan by the Airport Manager BBIAP, Islamabad through telex. Director General Civil Aviation Authority (DG CAA), Pakistan issued Memorandum vide letter No. HQCAA/1901/364/SIB/702 dated 5th November, 2014 and corrigendum dated 16th March, 2016, authorizing SIB to investigate the accident. After takeoff the aircraft flew two circuits and executed two uneventful touch & go landings. After third touch and go landing (at around 0439UTC), the aircraft climbed to around 100 ft AGL and then made a crash landing on right side of fair weather strip of Runway 30.

1. FACTUAL INFORMATION

1.1. **History of the Flight**. On 1st November 2014, M/s Rawalpindi Flying Club (RFC) Cessna-172L Aircraft, Reg # AP-BEJ, was on a scheduled training flight at Benazir Bhutto International Airport (BBIAP) Islamabad. The mishap aircraft was on its first flight of the day. The daily inspection was performed prior to flight. After takeoff the aircraft flew two circuits and executed two uneventful touch & go landings. After third touch and go landing (at around 0439UTC), the aircraft climbed to around 100 ft AGL and then made a crash landing on right side of fair weather strip of Runway 30 after encountering walk turbulence of preceding aircraft..

1.2. **Injuries to Persons**. Flight Instructor and one student pilot, who were occupying front seats, received minor injuries whereas one of the student pilot in the rear seat remained unhurt.

1.3. **Damage to Aircraft**. As a result of ground impact, wings, tail section, firewall and instrument panel were substantially damaged and distorted. Nose leg and propeller got separated from the aircraft. The engine mount got dislodged from its position.

Damage to the Aircraft

1.4. **Other Damages**. No other damage was observed to any person, property or equipment on ground as result of the subject accident.

1.5. **Personnel Information**. The flight carried 03 souls onboard which included 01 Flight Instructor (FI) along with one Student Pilot (SP) and one SP as passenger. The details of cockpit crew are as under:

(a) Flight Instructor:

- Date of Birth : 12th May, 1990
- CPL No : 3084 (A)
- Total Flying Experience : 478:00 hrs
- Simulator / Link Hrs : Nil
- Instructional Flying Hrs : 245:25 hrs

(b) Student Pilot:

- Date of Birth : 21st December, 1988
- Total Flying Experience : 79:35 hrs

1.5.1. The cockpit crew was fit to undertake the flight and they had valid licenses and medical fitness certificates. CAA Pakistan approved rules and regulations in respect of flight duty time limitation (FDTL) were adhered to. Therefore, the cockpit crew of mishap aircraft (MA) was not observed to be exposed to any undesired stress / fatigue prior to flight as a result of FDTL violation.

1.6. **Aircraft Information**. The mishap aircraft Registration # AP-BEJ was imported by M/s RFC with 1646 hrs since new and taken on Pakistan Civil Aviation Authority (PCAA) register on 09 Sep, 1992. Prior to the mishap flight, the daily inspection of the aircraft was carried out on 1st November, 2014 and no defect was recorded. The detailed aircraft, engine and propeller related data is appended below:

(a) Aircraft General

- Aircraft type : Cessna-172L
- Aircraft Model : 1971
- Aircraft MSN : 17259551
- Aircraft FH since New : 8119:40 Hrs on 30th Oct, 2014

(b) Aircraft Engine

- Engine Type : O-320 E2D
- Engine Make : Lycoming
- Engine Serial No : RL-19673-27E
- Engine TSO : 2091:40 Hrs on 30th Oct, 2014
- Engine Installation Date : 10 February, 2013

(c) Aircraft Propeller

- Propeller Type : McCauley, Fixed Pitch, 02 Blades
- Propeller Model : IC-160/DTM 7553
- Propeller Serial No : XJ44045
- Propeller Date of Construction : 18th Dec, 2003
- Propeller Last Overhaul : 3rd Oct, 2014
- Hours Flown after Overhaul : 93:10 Hrs on 30th Oct, 2014

1.7. **Metrological Information**. On 1st November, 2014 the weather reports of BBIAP, Islamabad before and after the accident are as follows:

Time UTC	Weather Report						
	Vis	Outlook	Wind	Clouds	Temp	QNH	RH
0300	04 KM	Mist	Calm	Nil	13/11	1018.3	84%
0400	04 KM	Haze	NE04	3Ci200	17/10	1018.9	63%
0500	04 KM	Haze	SE04	2Ci200	20/09	1019.1	50%
0600	04 KM	Haze	SW06	Nil	23/11	1019.0	47%

1.8. **Aids to Navigation**. Aircraft was equipped with serviceable ADF, VOR / DME and ILS equipment. Following navigation aids were available and serviceable at BBIAP, Islamabad prior to the crash of AP-BEJ.

OPRN AD 2.19 RADIO NAVIGATION AND LANDING AIDS

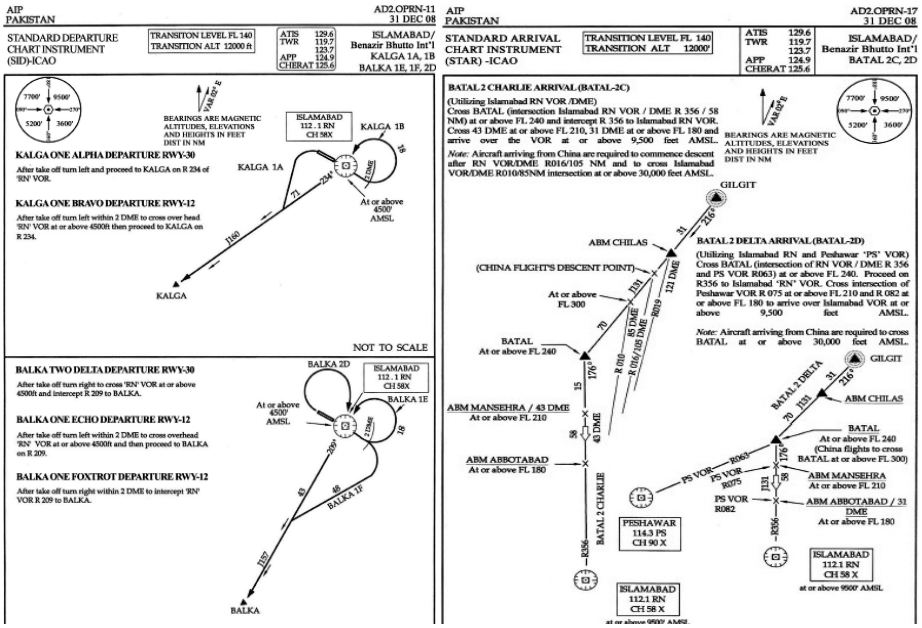
Type of aid. CAT of ILS (VAR VOR/ILS)	*ID*	*Frequency*	*Hours of operation*	*Site of transmitting antenna coordinates*	*Elevation of DME transmitting antenna*	*Remarks*
1	2	3	4	5	6	7
GP/DME 30	Dots/Dashes	335 MHZ / CH40X	H24	333639.92N 0730629.53E	-	
LLZ ILS CAT I	IRN	110.3 MHZ	H24	333728.90N 0730451.72E		
LLZ-TDME		CH-40X	H24	DITTO	513.09M	
VOR/DME	RN	112.1 MHZ / CH 58X	H24	333621.39N 0730733.37E	504.47M	
NDB	RN	344 KHZ	H24	3336.8N 07304.9E		Coverage 150NM

1.9. **Communications**. Following communication aids were available and found serviceable at BBIAP, Islamabad at the time of crash of AP-BEJ.

OPRN AD 2.18 ATS COMMUNICATION FACILITIES

Service designation	*Call sign*	*Frequency*	*Hours of operation*	*Remarks*
1	2	3	4	5
APP	Islamabad APP	124.9 MHZ	H24	Primary frequency,
APP	Cherat APP	125.6 MHZ	H24	Primary frequency,
TWR	Chaklala Tower	123.7 MHZ	H24	Primary frequency,
	-	121.5 MHZ	H24	Emergency Frequency
	-	119.7MHZ	H24	Secondary Frequency
	Islamabad APP	125.5 MHZ	H24	Secondary Frequency
ATIS	ATIS	129.6 MHZ	H24	
BS	Radio Pakistan	1150 KHZ	HX	
G/A/G	Radio	5601 KHZ	H24	
G/A/G	Radio	2923 KHZ	H24	

1.10. **Aerodrome Information**. The BBIAP, Islamabad standard departure and arrival charts for runway 30 are appended below:



1.10.1. The BBIAP, Islamabad detailed aerodrome data is appended below:

AD2.OPRN-4
31 DEC 13

AIP
Pakistan

OPRN AD 2.12 RUNWAY PHYSICAL CHARACTERISTICS

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
1	2	3	4	5	6
12	118°	3292 x 46	111/F/C/W/T Bitumen	333721.41N 0730508.49E	THR 506M / 1660 FT
30	298°			333639.32N 0730642.38E	THR 505 M / 1657 FT

Designations RWY NR	Slope of RWY/SWY	SWY dimension (M)	CWY dimension (M)	Strip dimension (M)	Obstacle Free Zone
7	8	9	10	11	12
12	0.15% up till 1981 M from displaced THR 0.5% up till 762 M	229	-	-	-
30	from displaced THR then .15%	213	-	-	-

Remarks: THR RWY 12 displaced 274 m. THR RWY 30 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 12/30 not available due uneven level.

OPRN AD 2.13 DECLARED DISTANCES (M)

Designations RWY NR	TORA	ASDA	TODA	LDA	Remarks
1	2	3	4	5	6
12	3017	3246	3246	3017	-
30	3292	3505	3505	2743	-

OPRN AD 2.14 APPROACH AND RUNWAY LIGHTS

Designations RWY NR	APCH LGT type LEN INTST	THR LGT colour WBAR	VASIS (MEH) PAPI	TDZM LGT LEN	RWY Centre line LGT Length, spacing, colour, INTST	RWY EDGE line LGT Length, spacing, colour, INTST	RWY End LGT spacing colour WBAR	SWY LGT LEN (M) colour	Remarks
1	2	3	4	5	6	7	8	9	10
12	SALS 518 M LIH	GREEN	PAPI Left/3°	-	2743 M 30 M WHITE LIL	2743 M 60 M WHITE LIL. Last 600 M yellow	RED	Additional Stand by RWY edge lights.	PAPI Max range 3 NM. Strobe LGT
30	PALS 900 M LIH	GREEN	PAPI Left/3°	-			RED	Sequence flasher	-

Strobe lights will be available when RWY 12 is in use or Bad WX or on request.

1.11. **Flight Data Recorders**. Cessna-172 aircraft is not equipped with flight data recorder.

1.12. **Wreckage and Impact Information**. The aircraft initial impact with ground was very shallow with “extreme end of tail” first coming in contact with ground. The initial ground scar was very light with small pieces of chipped off paint around

it. The wreckage distribution diagram was prepared and distances of structural parts were measured. The location and condition of major parts of wreckage are described in following paragraphs:

1.12.1. The propeller came in contact with ground after about 40 ft from the initial ground contact point. Subsequently, there were two prominent contact points on soft ground at a distance of 45 ft and 48 ft from initial ground contact point on soft ground.

1.12.2. The crank shaft driving the propeller was sheared off from behind the propeller at a point just outside the engine casing. The propeller was lying 22 ft towards left side of general line of impact direction and 65 ft forward of first ground contact point.

1.12.3. One of the nose wheel steering rod and a small piece of structural rib from bottom of the aircraft behind nose wheel was also found close to propeller impact point.

1.12.4. Left wing tip fairing was lying at 59 ft ahead of first ground contact point and 06 ft towards left side of general line of impact direction.

1.12.5. The main structure of the mishap aircraft was intact and at a distance of 130 ft from initial contact point.

1.12.6. The top engine mount supports got dislodged from their attachment points but engine remained with the aircraft with distorted engine mount.

1.12.7. The nose leg was lying at 140 ft ahead of first ground contact point, 21 ft towards right side of general line of impact direction.

1.12.8. Nose wheel was found at 148 ft ahead of first ground contact point, 57 ft towards right side of general line of impact direction.

1.13. **Medical and Pathological Information**. All three personnel on board the mishap aircraft were taken to hospital and necessary medical evaluations were conducted and injury report was prepared.

1.14. **Fire**. Pre-impact, in-flight or post impact fire indications were neither reported by the cockpit crew of mishap aircraft nor were observed by the Investigation Team Members at the crash site.

1.15. **Additional Information.**

1.15.1. **ATC Tape Extracts.** ATC Tower / Approach Radar Tape Extracts and recordings were retrieved and analysed.

1.15.2. **Crew Resource Management (CRM).** At the time of occurrence, Student Pilot was the Pilot Flying (PF) whereas Flight Instructor was Pilot Monitoring (PM). Both the cockpit crew had valid CRM certification at the time of accident.

1.16. **Useful & Effective Investigation Techniques.** Besides employing various investigation techniques and procedures, the available evidence was

extensively utilized for development of flight profile and events leading to the accident and their analyses. Laboratory analysis of fuel and oil samples was carried out.

2. ANALYSIS

2.1. Operational Analysis

2.1.1. The conduct of operational investigation and analyses were based on all available evidences like wreckage examination / analysis, witnesses statements, equipment, weather records, Radar / ATC Tower tape extracts, personnel records and other domains pertaining to the mishap aircraft and cockpit crew. All available evidences were critically analysed in order to determine, their direct or indirect contribution into the accident or otherwise. The detailed investigation and analyses of various domains have been carried out which are appended below.

2.1.2. Flight # AP-BEJ was on a routine training flight of Rawalpindi Flying Club (RFC) which got airborne for circuit and landing practice. The cockpit crew had obtained the weather update / forecast for the duration of flight, they had logged the flight plan. The mishap aircraft (MA) got airborne at 0414:53 UTC and entered right hand circuit for runway 30. The MA flew 02 circuits and carried out 02 touch & go landings. During third circuit, MA reported position 'end of downwind runway 30' and started orbiting left hand on the instructions of ATC Tower due to arriving / departing traffic.

2.1.3. At 0432:36 UTC, the ATC tower asked mishap flight (MF) to remain in left hand orbit at the end of right downwind runway 30 maintaining circuit altitude. She was to be cleared after Stranger-12 (PAF C-130) departure. The MF acknowledged the ATC instructions.

2.1.4. At 04:33:14 UTC, the ATC tower cleared Stranger-12 for line up on runway 30 and cleared her for POMER 1A departure to cross overhead for Fateh at 260. MF was still holding at the end of right downwind runway 30.

2.1.5. At 04:35:32 UTC, the ATC tower cleared MF to report finals for touch & go after completing the orbit and staying visual with lined up Stranger-12 which was about to depart. MF acknowledged this call. The distance between ground position of end of downwind runway 30 and beginning of runway 30 while following the track of MF is not more than 2.5 - 3 NM. The MF turned for base leg while ahead Stranger-12 (medium category) was still at line up point and had not started her take off roll. This moment onwards, the mutual distance between both the aircraft kept reducing.

2.1.6. At 04:37:03 UTC Stranger-12 informed ATC tower that she was ready for takeoff. The ATC tower cleared her for takeoff. During this time MF was continuing for finals Runway 30, thereby, further reducing mutual distance

2.1.7. At 0437:09 UTC MF had already set course for finals Runway 30 and was at bearing 055^0/2 NM from beginning of Runway 30. Flying on the base leg, she

was maintaining heading 200^0-220^0 and circuit altitude (2500ft), while Stranger-12 was still stationary on the runway. Upon observing the reduced mutual distance with Stranger-12, which was a potentially unsafe situation, SP twice requested permission from FI to extend the approach in order to increase the mutual distance. The FI replied in negative and asked the SP to continue approach. The mutual separation between both the flights was continuously reducing and had now reached to approximately 1.7 NM.

2.1.8. At 0438:10 UTC MF reported that she was turning finals for touch & go. At this time Stranger-12 was still maintaining her previous position on the runway. MF should have discontinued approach as she was likely to encounter Wake Turbulence of Stanrager-12 (Light aircraft landing behind medium category aircraft taking off).

2.1.9. At 04:38:16 UTC Stranger-12 informed ATC tower that she was rolling for takeoff. MF had completed turn half way to finals by this time, heading 260^0 / 0.6 NM from beginning of runway 30. The mutual separation between both the flights had reduced to 1.2NM.

2.1.10. At 0438:39 UTC Stranger-12 had taken off and she was 1NM ahead of the beginning of runway 30, climbing and passing through 1800 ft. At this time MF was 0.5NM from beginning of runway 30 and the mutual distance between both the flights was increasing to 1.5 NM and they were less than 1 minute apart in terms of time.

2.1.11. At 0438:59 UTC MF entered runway 30 for landing while Stranger-12 was climbing through 2200 ft. The MF made an uneventful landing on runway 30 abeam club taxiway and after carrying out necessary checks inside the cockpit, opened full power for subsequent take off.

2.1.12. At 0439:19 UTC MF was 0.5 NM ahead of the beginning of runway 30 and got airborne, while Stranger-12 at this stage was climbing through 2600 ft. The mutual distance between both the flights had increased to 2 NM now. The MA after getting airborne experienced right wing drop and banked beyond 90^0. Flight Instructor took over the controls from student pilot and gave inputs to regain the control of aircraft. He managed to straighten out the aircraft in wings level flight but soon the MA had sudden left wing drop along with simultaneous nose drop. The aircraft had achieved 90 ft height above ground level during climb after takeoff.

2.1.13. At 0439:26 UTC MF was 0.8 NM ahead of the beginning of runway 30 continuously losing altitude and the Flight Instructor applying controls to avoid the first impact of nose of MA with the ground. The MA continued to lose altitude and impacted ground in mild left bank and nose up attitude. The tail of MA hit the ground first. At this time Stranger-12 was climbing through 2700 ft and the mutual distance between both flights was 2.4 NM.

2.1.14. In accordance with Rawalpindi Flying Club Operational procedures Chapter 8 Pages 17-18 and JAA ATPL Training Manual a light aircraft landing behind medium category aircraft has to be separated by 5 NM in order to avoid wake turbulence of preceding aircraft. Also, during departure of a light aircraft behind medium category aircraft the minimum spacing in terms of time has to

be 03 minutes. Moreover, as per RFC Local Flying Orders Section-4 Part 2, while doing circuit and landing the aircraft is to avoid take off and landing immediately behind operating heavy aircraft in order to avoid propeller wash / wake turbulence.

2.1.15. The investigation of the accident established that minimum spacing criteria was violated where the separation between both the flight had reduced to below the minimum required. This caused the MF to encounter Wake turbulence of Stranger-12 resulting into loss of controls at very critical stage after takeoff. The available height to MF was too less to regain the controls before getting out of the wake turbulence.

2.2. **Technical Analysis**

2.2.1. **Onsite Wreckage Examination**.

2.2.1.1. **Engine Power**. Examination of the propeller, its broken drive shaft and impact marks on soft ground indicated that the engine was operating at sufficiently high power at the time of impact. The rotating propeller cut through the soft ground and impact / stopping force sheared off the drive shaft.

2.2.1.2. **Aircraft Fuel**. During examination of the wreckage it was observed that wing fuel tanks were damaged due to impact but sufficient quantity of fuel was still present inside the tanks. This fuel was later allowed to drain while lifting the wreckage. There was no evidence of leakage of fuel in flight or prior to impact which could have resulted into fuel starvation to the engine.

2.2.1.3. **Throttle and Mixture Control Cables.** After the impact of the propeller with ground the top attachments of the engine mount with aircraft broke away. The engine therefore, tilted forward and down but stayed with the aircraft. The throttle control and mixture control cables being at the bottom of the engine got stretched but remained intact. The condition of engine controls thus indicated their normal working before getting damaged by impact.

2.2.1.4. **Engine Ignition System**. The engine of the aircraft has four cylinders, and two spark plugs are provided in each cylinder. There are two engine driven magnetos which are independent of aircraft electrical system and generate electric current for spark plugs. Each magneto supplies one spark plug of each cylinder thus providing two independent systems for production of spark in the sparks plugs. The magnetos and associated high tension leads and end connectors were inspected and found clear of any damage.

2.2.1.5. **Aircraft Flight Controls**. All flight controls, their associated links, cables and pulleys were inspected in detail for evident of any damage or discontinuity which could result in loss of control. No such evidence was observed.

2.2.2. **Aircraft Instruments**. Mishap aircraft Air Speed Indicator (ASI), and Altimeter were shop checked after the accident. Altimeter was found serviceable but ASI was found under reading on the average by 5 MPH. It was not possible to ascertain whether this anomaly existed before the

accident or it was result of post impact damage. However, an under reading ASI would have given further margin for stalling speed to the cockpit crew. Thus the possibility of the aircraft stalling due to an over reading ASI is ruled out.

2.2.3. **Engine Strip Examination**. The engine of the mishap aircraft was strip examined by removing cylinders, engine accessories and valves.

2.2.3.1. There was no evidence of abnormal wear or mechanical damage to any part.

2.2.3.2. Carburettor filter was clear of contamination and movement of carburettor linkages was also free of restriction.

2.2.3.3. Sufficient amount of oil was recovered from engine sump and engine oil filter was also clear of contaminants.

2.2.4. **Laboratory Analysis of Aircraft Fuel.** Fuel sample was collected from the wing tanks and despatched for chemical analysis. The fuel analysis report indicated that Reid Vapour Pressure of the sample was 4.5 psi as compared to specified value of 5.5 to 7 psi. Temperature for 50% volume recovery was found to be 107ºC instead of maximum specified value of 105ºC. Rest all other test values were as per specifications. The sample was collected from damaged wing tanks about 32 hrs after the accident and then it was shifted in proper sampling bottles. Since engine operation was reported to be normal without any indication of loss of power for the entire duration of flight, therefore it was concluded that late collection and storage of fuel sample in loose lid bottle most probably contributed towards reduction of Reid Vapour Pressure and 50% Volume Recovery Temperature.

2.2.5. **Spectrometric Analysis of Engine Oil**. Spectrometric analysis of the engine oil sample collected from the engine after accident was carried out. This oil analysis did not reveal evidence of abnormal engine wear.

3. CONCLUSION

3.1. Operational Findings

3.1.1. The cockpit crew was fit to undertake the flight and they had valid licenses and medical fitness certificates. PCAA approved rules and regulations in respect of FDTL were adhered to.

3.1.2. MA was on a routine training flight for circuit and landing practice.

3.1.3. The cockpit crew had obtained the weather update / forecast for the duration of flight, and they had logged the flight plan for the flight.

3.1.4. The MA flew 02 circuits and carried out 02 touch & go landings. After carrying out 02 uneventful touch and go landings the MA was holding end of downwind Runway 30 following the ATC instructions in order to accommodate a departing flight (Stranger-12, PAF C-130).

3.1.5. After clearing Stranger-12 for line up at runway 30, MF was advised by ATC to report finals for touch & go after completing the orbit and staying visual with Stranger-12. MF acknowledged the ATC instructions.

3.1.6. The distance between the MF and beginning of Runway 30 while following the track of MF was not more than 2.5 - 3 NM. The MF turned for base leg while ahead Stranger-12 (medium category) was still at line up point and had not yet started her take off roll. This moment onwards the mutual distance between both the aircraft kept reducing**.**

3.1.7. Upon observing the reduced mutual distance between MF and Stranger-12, the SP twice requested FI to extend the approach in order to increase the mutual distance. The FI replied in negative and asked the SP to continue approach, thereby displaying CRM failure. The mutual separation between both the flights was continuously reducing.

3.1.8. After having observed the decreased mutual distance the MF did not discontinue approach and thus was prone to encounter wake turbulence of Stranger-12 (Light aircraft landing behind medium category aircraft taking off).

3.1.9. When Stranger-12 started her take off roll the mutual distance between both flights had reduced to as low as 1.2NM.

3.1.10. After takeoff once Stranger-12 was 1NM ahead of the beginning of runway 30, climbing and passing through 1800 ft the MF was 0.5NM from beginning of Runway 30. The mutual distance between both the flights had started to increase to 1.5 NM and they were less than 1 minute apart in terms of time.

3.1.11. The MF entered runway 30 for landing while Stranger-12 was climbing through 2200 ft. The MF made an uneventful landing on runway 30 abeam club taxiway and after carrying out necessary checks inside the cockpit, opened full power for subsequent take off.

3.1.12. The aircraft had achieved 90 ft height above ground level during climb after takeoff when it experienced right wing drop and bank beyond 90^0. Flight Instructor took over the controls from student pilot and gave input to regain the control of aircraft. He managed to straighten out the aircraft in wings level flight but soon the MA had sudden left wing drop along with simultaneous nose drop.

3.1.13. The MA continuously lost altitude: FI applied controls to prevent the nose first impact with the ground. The MA continued to lose altitude and impacted ground in mild left bank and nose up attitude. The tail of MA hit the ground first.

3.1.14. In accordance with Rawalpindi Flying Club Operational procedures Chapter 8 Pages 17-18 and JAA ATPL Training Manual a light aircraft landing behind medium category aircraft has to be separated by 5 NM in order to avoid wake turbulence of preceding aircraft. Also, during departure of a light aircraft behind medium category aircraft the minimum spacing in terms of time has to be 03 minutes. Moreover, as per RFC Local Flying Orders Section-4 Part 2, while doing circuit and landing the aircraft is to avoid take off and landing

immediately behind operating heavy aircraft in order to avoid propeller wash / wake turbulence.

3.1.15. The minimum spacing criteria was violated where the separation between both the flights had reduced to below 2NM/less than a minute (required 5 NM / 3 min). This caused the MF to encounter wake turbulence of Stranger-12 resulting into loss of controls at very critical stage after takeoff. The available height to MF was too less to regain the controls before getting out of the wake turbulence.

3.2. **Technical Findings.**

3.2.1. There was no evidence of fuel or oil starvation during the flight of the mishap aircraft.

3.2.2. The flight controls of the mishap aircraft were intact and operated normally for the entire duration of flight.

3.2.3. There was no evidence of an over reading air speed indicator.

3.2.4. There was no evidence of engine power loss or any mechanical or electrical failure in the engine.

3.3. **Cause of Occurrence**.

3.3.1. Non adherence to minimum spacing criteria between two landing / taking off aircraft in succession.

3.3.2. Lack of knowledge about above stated spacing criteria and misjudgement of the spacing with preceding aircraft by the FI.

3.3.3. CRM failure was also a contributory factor as the FI did not appreciate the judgement of SP and continued the approach.

4. OBSERVATIONS

4.1 It was observed that flying instructor's training / competence was less than required level of proficiency. The basic understanding of flying procedures / traffic pattern adjustment in the circuit lacked in respect of involved FI.

4.2 The training facilities along with training aids available at RFC were considered insufficient for Cockpit crew training and skill competence level.

4.3 As per PCAA approved RFC Operations Manual Part-A Issue June, 2006 Page 44, the FI should have 1000 hours total flying time and more than 750 instructional hours as his flying experience to be appointed as FI. The same was not complied with in case of involved FI.

4.4 The pre flight briefings / available briefing material was scrutinised and, it was observed that pre flight brief to the under training students was a weak area.

4.5 A third passenger was on board the MF (a training flight) in violation of Rule-235 of CAA Rules 1994 which are formulated to ensure safety of equipment, passengers and cargo.

4.6 In certain areas the record keeping in RFC was found insufficient.

4.7 The Ops Manual of Rawalpindi Flying Club has not been reviewed / revised since 2006.

4.8 The fuel sample was collected from damaged wing tanks about 32 hrs after the accident. The operator was not in possession of proper fuel sampling bottles. The sample was therefore, collected in readily available bottles in which lid was not sealing properly and was later shifted in proper sampling bottles. Late collection and storage of fuel sample improper sampling bottle most probably contributed towards reduction of Reid Vapour Pressure and 50% Volume Recovery Temperature.

5. SAFETY RECOMMENDATIONS

5.1. The involved FI and SP are to undergo a comprehensive refresher ground schooling related to handling of non normal situations in circuit and landing with specific emphasis on adjustments / spacing in circuit pattern.

5.2. The involved FI is to be given additional comprehensive instructional techniques ground schooling refresher on curriculum of flight instructor course with special emphasis on instructional techniques, airmanship, standard operating procedures and sound decision making in given set of conditions along with circuit and landing variations.

5.3. The involved FI is to undergo 04 hours refresher instructional techniques training flights with experienced senior flight instructors at operator level and the performance evaluations as FI are to be documented.

5.4. The involved FI is to be evaluated by Chief Flight Instructor at operator level after satisfactory performance during above recommended training flights for fitness as FI. The evaluation reports of training flight in respect of FI are to be forwarded to Flight Standards Directorate.

5.5. Chief Flying Instructor (CFI), RFC is to include periodic discussions / interactive sessions between FIs and SPs on handling of non normal situations / various adjustments in circuit pattern in the training program.

5.6. CFI, RFC is to arrange a refresher lecture on importance of CRM for the all flight instructors and students including involved FI and SP.

5.7. CFI, RFC is ensure comprehensive pre flight brief for training flight covering all important aspects of conduct, exercise and non normal situations that could be encountered during flight in accordance with applicable approved CAA, Pakistan procedures.

5.8. CFI, RFC to ensure proper record keeping for all training and flying activities including weather briefs etc.

5.9. CFI, RFC to review its training aid requirements and ensure availability of adequate training facilities.

5.10. CAA, Pakistan to study and review the FI flying experience requirement at flying clubs and ensure its compliance by the operators.

5.11. CAA, Pakistan is to ensure that all CAA approved publications at flying clubs are reviewed and updated periodically.

5.12. CAA, Pakistan is to ensure that only authorized personnel board the aircraft on training flights, in accordance with approved regulatory procedures.

5.13. CAA, Pakistan to issue necessary instructions to all operators to retain sufficient number of proper fuel sampling bottles and collect the samples immediately after the accident / incident under supervision of local airworthiness officials.