AIRCRAFT ACCIDENT REPORT 2/2015

ACCIDENT INVESTIGATION DIVISION

Civil Aviation Department
The Government of the
Hong Kong Special Administrative Region

Report on the accident to Cessna 172P
Registration B-HRH operated by the
Hong Kong Aviation Club Limited
at Shek Kong Airfield, Hong Kong
on 28 September 2013

Hong Kong
March 2015

In accordance with Annex 13 to the ICAO Convention on International Civil Aviation and the Hong Kong Civil Aviation (Investigation of Accidents) Regulations, the sole objective of this investigation is the prevention of aircraft accidents. It is not the purpose of this activity to apportion blame or liability.

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香港特別行政區政府
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13 March 2015

The Honourable C Y Leung, GBM, GBS, JP
The Chief Executive
Hong Kong Special Administrative Region
People's Republic of China

Dear Sir,

In accordance with Regulation 10(6) of the Hong Kong Civil Aviation (Investigation of Accidents) Regulations, I have the honour to submit the report by Mr. Marcus Chan, Inspector of Accidents, on the circumstances of the accident to a Cessna 172P aircraft, registration B-HRH, at the Shek Kong Airfield, Hong Kong, on 28 September 2013.

Yours faithfully,

(Norman S M LO)
Director-General of Civil Aviation

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GLOSSARY OF ABBREVIATIONS USED IN THE REPORT

AGL	Above Ground Level
ATC	Air Traffic Control
AMSL	Above Mean Sea Level
CAD	Civil Aviation Department
CG	Centre of Gravity
°C,F,M,T	Degree Celsius, Fahrenheit, magnetic, true
ELT	Emergency Locator Transmitter
Ft	Feet
ft/min	feet per minute
GFO	General Flying Order of the HKAC
HKAC	Hong Kong Aviation Club Limited
hPa	hectopascal (equivalent unit to mb)
Hrs	hours (clock time as in 12:00 hrs)
IFR	Instrument Flight Rules
Kg	kilogram(s)
KCAS	knots calibrated airspeed
KIAS	Knots indicated airspeed
kt(s)	knot(s)
Km	kilometre(s)
Lbs	Pounds
M	metre(s)
METAR	a timed aerodrome meteorological report
MHz	Megahertz
m/s	Meter per second
NOTAM	Notice to Airmen
QNH	pressure setting to indicate elevation above mean sea level
POH	Pilot’s Operating Handbook
PPL	Private Pilot's Licence
USG	U.S. Gallons
UTC	Co-ordinated Universal Time
VFR	Visual Flight Rules

Notes :

1. When abbreviations are used in this report, the full term is used in the first instance followed by the abbreviation in brackets.

2. All times in this Report are in Hong Kong Local Time, which is eight hours ahead of the Coordinated Universal Time (UTC).

ACCIDENT INVESTIGATION DIVISION

CIVIL AVIATION DEPARTMENT
HONG KONG

Aircraft Accident Report 2/2015

Registered Owner:	Hong Kong Aviation Club Limited
Operator:	Hong Kong Aviation Club Limited
Aircraft Type:	Cessna 172P
Nationality / Registration:	B-HRH
Place of Accident:	Shek Kong Airfield, Yuen Long New Territories, Hong Kong Latitude: 22° 26.2' N Longitude: 114° 04.8' E
Date and Time:	28 September 2013 at 10:00

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SYNOPSIS

On 28 September 2013, a Cessna C172P aircraft registration B-HRH of the Hong Kong Aviation Club Limited ("HKAC"), took-off from Runway 11 of Shek Kong Airfield at around 09:30 hour (hr) and departed to the New Town via the Kadoorie Gap. Due to haze and smog, the pilot decided to terminate the flight and returned to Shek Kong Airfield via the Fire Station Gap.

During the landing phase, the aircraft floated in the flare maneuver and bounced upon touch down. The aircraft then touched down again on the runway with a slight nose down attitude, resulted in a more significant bounce.

After the significant bounce, the pilot elected to go-around. The pilot applied full engine power and followed by retracting the flap from 30° to 0° directly. The aircraft sank during the flap retraction. At the same time, the aircraft veered off to the left and eventually landed on the grass area to the northern side of the runway. It stopped in an upside down position, at approximately 760 meters (m) from threshold Runway 11 and 22 m abeam the runway edge.

The nose wheel fork of the aircraft was sheared off. There were also significant damages to its wings, empennage, propellers and engine mounts. There was no fuel leakage, nor fire. The on-board Emergency Locator Transmitter (ELT) was activated. Two passengers had minor injuries. The pilot and the passengers evacuated from the aircraft without any assistance.

The Chief Inspector of Accidents ("CIA") ordered an Inspector's Investigation into the accident in accordance with the Hong Kong Civil Aviation (Investigation of Accidents) Regulations (Laws of Hong Kong, Chapter 448B). The fundamental purpose of this investigation is to determine the circumstances and causes of the accident with a view to the preservation of life and the avoidance of accident in future, it is not the purpose of this activity to apportion blame or liability.

It was concluded that the accident was caused by non-adherence to the balked landing procedures which subsequently led to the loss of control of the aircraft.

The investigation team has made two safety recommendations.

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1. FACTUAL INFORMATION

1.1 History of Flight

1.1.1 Pre-flight Preparation

1.1.1.1 The pilot stated that he carried out the flight preparation which included aircraft loading calculation, checking the weather reports and forecast, checking the Notice to Airmen (NOTAM) and filing of the flight notification to Air Traffic Control Center. The forecast and reported weather were within the limits for operations under Visual Flight Rules (VFR). The pilot conducted the preflight check as per the HKAC procedures. He also checked the actual fuel content with the fuel stick (Appendix 1) and performed fuel contamination check before the flight.

1.1.1.2 According to the loading record compiled by the pilot, the fuel loaded on board the aircraft was 35 US Gallon (USG). However, after the accident, a total of 38.3 USG fuel was drained from the aircraft. According to the Pilot's Operating Handbook (POH), the unusable fuel of the aircraft was 3 USG.

1.1.1.3 The latest Aircraft Weight and Center of Gravity Schedule was attached to the POH and a copy of the Schedule was also kept inside an information folder specific for the aircraft B-HRH. The aircraft basic weight was extracted from the information folder for loading calculation.

1.1.1.4 An Addendum to Weight and Centre of Gravity Schedule was also attached to the Schedule. The Addendum indicated an installation of Emergency Locator Transmitter (ELT) on the aircraft which resulted in a change of aircraft Basic Weight of additional 3.4 lbs and a change of moment arm of 0.2 inches further aft of datum.

1.1.1.5 The calculated take-off weight recorded on the load sheet was 2277.4 lbs and the Centre of Gravity (C. G.) was 42.654 inches aft of datum which were within the maximum take-off weight limits of 2400 pounds (lbs) and the C. G. Envelope for take-off. The weights of all passengers were obtained the night before.

1.1.1.6 Flight briefing and safety briefing to the passengers were carried out by the pilot. As described by the passengers, the briefings also included the plan to return to Shek Kong Airfield when encountering poor weather, the use of safety harness, life-jacket and evacuation in case of emergency situation.

1.1.1.7 Flight notification was filed for one hour flight duration with 3 hours endurance, with the Shek Kong Airfield as both the airfield of departure and landing.

1.1.2 Departure, Climb and Cruise Phases

1.1.2.1 The departure from Shek Kong Airfield and climb out via Kadoorie Gap were uneventful (Appendix 2 for local map). The visibility was reported at 7 km. The aircraft took-off at approximately 0930 hour local time from Runway 11.

1.1.2.2 After airborne and as described by the pilot and passengers, the general area was covered with haze and smog which would not be ideal for the purpose of the flight. Subsequently, the pilot decided to return to Shek Kong Airfield as per the pre-flight briefing (see paragraph 1.1.1).

1.1.2.3 Having informed his passengers of the decision, the pilot flew back to Shek Kong Airfield via the Fire Station Gap (see Appendix 2). A helicopter pilot on the ground also noticed on the radio that the Cessna aircraft reported 1,700 feet (ft) Above Mean Sea Level (AMSL) over the Fire Station Gap. The normal return route is 2,000 ft AMSL.

1.1.3 Descent, Approach and Landing Phases

1.1.3.1 As described by the pilot, he flew the aircraft onto downwind leg at the normal circuit altitude for approach to land on Runway 11 which was the same runway used for departure.

1.1.3.2 The pilot reported that the approach was normal and stable with normal flap setting at 30° and at a normal approach speed of 65 kts. The aircraft floated during flare and bounced upon the first touch down onto the runway. The second touchdown on the runway resulted in a more significant bounce. The pilot recalled that the nose attitude was “a bit low” before the second bounce which might have caused the nose wheel touching down before the

main landing wheels.

1.1.3.3 The pilot decided to execute go-around procedures as a result of the second bounce on the runway. Full engine power was applied and the engine responded normal when throttle was advanced to the full forward position according to the pilot's description during the interview right after the accident. The flap was then selected directly from 30° to 0°.

1.1.3.4 During the interview, the pilot did not recall the airspeed during the go-around maneuver nor did he recall any speed he aimed at for flap retraction to 0° position. He described that his attention was drawn to the obstacles ahead and then he decided to retract the flap from 30° to 0°. He had also applied a gentle push on the control column in order to arrest the pitch up tendency of the aircraft with full engine power up. He noticed the aircraft did not climb but sank instead once the flap was retracted. A warning sound, appeared to be stall warning, was heard by the pilot when the aircraft started to sink. In the subsequent interview, he expressed that he should have retracted the flap in stages, as he had been taught throughout his training, instead of directly from 30° to 0°.

1.1.3.5 He also recalled that he did not use the rudder to counter the inherent tendency of aircraft yaw with the propeller driven aircraft. The aircraft drifted to the North side of the runway during the maneuver.

1.1.4 The landing impact to the northern side of Runway 11 (see Appendix 3 for airfield layout).

1.1.4.1 According to a witness on the ground, the aircraft made a strange maneuver just before its impact on to the grass area on the northern side of the runway. Its nose attitude was very high with slight left wing down. It then rolled to the right and landed on the grass with an upside down position. The aircraft came to a stop quickly and somersaulted after the impact onto the grass area.

1.1.4.2 Inside the aircraft, the pilot closed the engine throttle and cut off the fuel with the mixture lever upon touch down. Subsequently, he heard two loud "bang" noises coming from the underneath of the aircraft before the aircraft came to a stop and somersaulted in a gentle manner.

1.1.4.3 The pilot switched off the Master Switch and confirmed that all passengers were fine and then ordered an evacuation. According to passengers' description, the evacuation was carried out orderly and followed the pre-flight briefing conducted by the pilot.

Emergency calls were made according to the HKAC Emergency Plan.

1.2 Injuries to Persons

Injuries	Crew	Passengers	Others
Fatal	-	-	-
Serious	-	-	-
Minor/none	1	3	-

Remarks: Two passengers who seated in the front right hand and rear left hand side, suffered minor bruise and scratches. Both of them chose not to take further detail medical examination.

1.3 Damages to Aircraft

The aircraft sustained substantial structural damages (See Appendix 4). More details are stipulated in paragraph 1.12.

1.4 Other Damages

A small section of the runway boundary fence of Shek Kong Airfield abeam the runway was deformed with the left wing of the aircraft resting on it.

1.5 Personnel Information

Pilot

Licence	:	Private Pilot's Licence (Aeroplanes) issued on 21 May 2009
Aircraft rating	:	All single engine aeroplanes (landplanes) of which the maximum

		total weight authorized does not exceed 5700 kg
Medical certificate	:	4 September 2013
Flying Experience	:	151 hours (Total all types included 47 hours on Cessna 172)
Annual Flight Review (AFR)	:	Last conducted on 6 July 2013. Remark: The HKAC required every club member to be checked out once every year by its flying instructors. This check out flight has been referred as Annual Flight Review (AFR) and it was stipulated in the General Flying Order No. 14.
Certificate of Experience	:	6 July 2013 (valid to 5 August 2014)
Last Flown		31 August 2013

Passengers

Three and none of them has any experience in light aircraft flying.

1.6 Aircraft Information

1.6.1 Aircraft and Engine

Manufacturer:	Cessna Aircraft Company
Type:	C172P
Aircraft serial number:	17274935
Year of manufacture:	1981
Nationality / Registration Mark:	Hong Kong, China / B-HRH
Certificate of Registration:	Issued on 4 July 1995 in the ownership of Hong Kong Aviation Club Limited
Certificate of	Issued on 22 February 2013 in the Transport

Airworthiness:	Category (Passenger) and valid until 28 February 2014
Engine:	One Avco Lycoming O-320-D2J piston engine
Maximum Approved Gross Weight:	2,400 lbs
Total airframe hours:	6,614 hours

1.6.2 Airworthiness and Maintenance of Aircraft

1.6.2.1 The most recent scheduled maintenance check was a 50-hour Inspection carried out on 6 September 2013. At the time of that inspection, the airframe had accumulated 6595.8 flight hours. The engine had accumulated 1969.8 flight hours since overhaul.

1.6.2.2 A review of the aircraft records indicated that the aircraft had no outstanding defects prior to the accident flight. The aircraft was fully serviceable in all respects.

1.6.3 Fuel

20.6 USG (78 litres) of AVGAS fuel was uplifted prior to the accident flight. There was no record of fuel remaining before the uplift. 38 USG of fuel was drained from the aircraft after the accident.

1.7 Meteorological Information

According to the Hong Kong Observatory data, the general Hong Kong weather conditions between 09:30 hrs and 10:00 hrs were recorded as below.

Wind direction and speed:	035°/ 7 kts (recorded at 10:00 hrs. at Shek Kong)
Visibility:	7 km to 11 km
Temperature:	26.4 Degree Celsius (°C)
Dew point:	21.5 °C

QNH (Mean Sea Level Pressure):	1010 Hecto Pascal (hPa)
Relative Humidity:	74 percent (%)

There was no record of cloud base height but the general condition was cloudy with light rain patches. 0.5 millimeter (mm) of rainfall was recorded around that period in Shek Kong.

1.8 Aids to Navigation

The flight was operated under VFR in Visual Meteorological Condition (VMC). Navigation was accomplished by visual reference to ground features.

1.9 Communications

1.9.1 It was a standard practice in Shek Kong Airfield that radio blind calls made on VHF frequency 123.6 MHz. The pilot of B-HRH maintained a listening watch on traffic and transmitted blind on radio while he operated within the Shek Kong Airfield area.

1.9.2 The Shek Kong Airfield radio communications were also monitored by Flight Operations Co-ordinator of the HKAC Briefing Office at Shek Kong. VHF communications between the aircraft and Briefing Office had been checked and radio watch monitoring was maintained.

1.10 Aerodrome Information

1.10.1 Shek Kong Airfield is a single runway military airfield operated by the People Liberation Army (PLA) of the People's Republic of China. Members of HKAC have been given permission to operate in the airfield during weekends subject to PLA operations.

1.10.2 The PLA does not provide any Aerodrome Control service for the HKAC operations at Shek Kong Airfield. Pilots are required to monitor the radio and make "blind" calls inside the traffic zone of the Shek Kong Airfield.

1.10.3 Obstacles had been notified via the NOTAM on 28 September 2013. They were cranes, 145 ft Above Ground Level (AGL), located 383 m from the Departure End of Runway 11, UTM GRID KK004838 as per the NOTAM.

1.11 Flight Recorders

The aircraft was not fitted with any flight recorder and there is no requirement for this class of aircraft to be so fitted.

1.12 Wreckage and Impact information (Appendix 4)

1.12.1 General

1.12.1.1 The wreckage was located on the northern side of the runway boundary fence of Shek Kong Airfield, approximately 760 m from the threshold of Runway 11 and 22 m abeam the runway edge. The aircraft remained intact except the nose wheel and part of its mounting which were found approximately 2 m behind the wreckage.

1.12.1.2 A crater, 0.2 m long x 0.3 m wide x 0.25 m depth, was found 3.5 m behind the wreckage while debris of right hand wing tip fairing was also rested 8.5 m from the left hand runway boundary fence and 3 m behind the aforementioned crater.

1.12.1.3 Two wheel marks caused by the nose wheel, 35 m long and the right hand main wheel, 30 m long, were observed behind the main wreckage. The depth of the nose wheel mark was deeper than that of the right hand main wheel mark.

1.12.2 Wings

1.12.2.1 The wings suffered from impact damage on the upper and bottom surfaces of both wings. The left-hand wing at the wing root area was severely damaged. Part of the left-hand wing trailing edge, near the wing root, was also twisted and detached from the aircraft.

1.12.3 Fuselage

1.12.3.1 The fuselage did not have any deformation. The front windshield and the rear cabin windows were found cracked. Left hand door was slightly distorted and had some scratch marks on the exterior of the door. The vertical fin was crushed and one-third of the fin was found bent 45 degrees to the right hand side. The engine nose fairing and the exhaust pipe had crush damages.

1.12.4 Flight Controls

1.12.4.1 The left hand flap was crushed and around one-third of the left hand flap was bent downward. The rudder was crushed and about ⅓ of the upper section of the rudder was found bent towards the right hand side. The rudder control pedals were in neutral position.

1.12.5 Landing Gears

1.12.5.1 The nose wheel was detached from the nose gear at the wheel fork. On the detached nose wheel, the right hand side of the nose fork was slightly distorted. A large amount of mud was found trapped between the distorted nose fork and the nose wheel. The nose gear oleo and the undetached part of the nose fork were surrounded by the mud.

1.12.5.2 There were no damage on both main landing gear and wheels. The left hand wheel, frontal area of the brake and leading edge of the left hand landing gear strut were heavily contaminated with mud. Only a small amount of mud was found on the left hand main wheel.

1.12.6 Engine

1.12.6.1 The engine remained intact and secured to the aircraft structure. The engine mounts trusses were deformed to the right hand, offsetting the engine alignment about 15 degrees from the centreline.

1.12.7 Propellers

1.12.7.1 Both propeller blades exhibited impact damage and were bent rearward. Local damages were found on the propeller tips. The propeller spinner was also collapsed. There was no propeller ground mark observed.

1.13 Fire

There was no fire.

1.14 Survival Aspects

1.14.1 All persons on board the aircraft survived and were able to evacuate from the aircraft on their own without any assistance. The seats and harness were all intact and in good condition.

1.14.2 The ELT was found activated during the evacuation and the signal had been received by Air Traffic Control at 10:00 hrs local time. The location received from the COSPAS-SARSAT was within the specified tolerance of the ELT equipment installed on the aircraft.

1.15 Tests and Research

Detailed inspection and microscopic inspection were employed to determine the failure of the nose wheel fork. The fractured surface of the failed nose wheel fork did not identify any premature failure. The microscopic inspection revealed that the unit failed as a result of brittle failure due to overload.

1.16 Organizational and Management Information

1.16.1 The Hong Kong Aviation Club (HKAC) operated from two bases, namely Kai Tak and Shek Kong Airfield. Majority of its flying activities took place at Shek Kong Airfield which included helicopters and aeroplanes flight training for Private Pilot's Licence.

1.16.2 The day-to-day operations were managed by its operations staff under the direction of the Chief Flying Instructor who was also the President of the HKAC at the time of the accident.

1.16.3 The HKAC’s Engineering Department also maintained its own aircraft and members’ aircraft. It had two licenced aircraft engineers and several technicians.

1.17 Additional Information

1.17.1 HKAC provided Private Pilot's Licence (PPL) training to the pilot of the accident aircraft.

1.17.1.1 This pilot started his PPL training on 26 May 2007 and obtained his PPL on 21 May 2009.

1.17.1.2 During the period of his PPL training, he had flown with 14 instructors and accumulated 15.7 hours of solo flying and 56.8 hours of flying under instructions. Only one instructor had made a comment about the pilot's control of the aircraft drift during take-off (27 October 2007). That instructor never again conducted training with the pilot after that exercise. There were no other recorded instructor's comments on the pilot's rudder control.

1.17.1.3 Go-around training had been conducted in a number of times during the pilot's PPL training. There were no records of any deficiency regarding the pilot's use of rudder and flap retraction procedure during the go-around maneuver.

1.17.1.4 The pilot met the requirement of five hours of flying experience within 13 months as stipulated in the CAD document, CAD54 and had a valid Certificate of Experience.

1.17.1.5 The pilot's most recent flight on the same type of aircraft (Cessna 172) was conducted on 31 August 2013. In the preceding six months before the accident, the pilot flew one to three sorties per month on various types of aircraft including the Cessna 172 aircraft. The pilot had maintained a fairly regular flying practice.

1.17.1.6 Nevertheless, the pilot expressed during the interview that he had been commented many times on his insufficient rudder control during application of engine power. Instructors' interviews were conducted but it was not able to verify the remarks made by the pilot.

1.17.2 HKAC Instructors Meeting Records

1.17.2.1 The most recent HKAC instructors' meeting was held on 2 May 2013. Meeting minutes before 2 May 2013 could not be retrieved.

1.17.2.2 The meeting minutes on 2 May 2013 recorded that student allocation with "mix-and-match" approach and flying with different instructors was not conducive to good training. HKAC had planned to assign one instructor as the primary instructor with another one as backup. It was noted that some instructors were assigned as both primary and secondary instructors for another group of students at the same time.

1.17.2.3 The meeting minutes also highlighted the obstacles restrictions on the use of Shek Kong Airfield, Runway 11. It specifically mentioned that full engine power must be applied before the "color change point" (*i.e. an apparent line on the runway due to the change of color of the runway surface and was an indication of half of the runway length*) during touch-and-go maneuver on Runway 11. However, such information was not published in the General Flying Order (GFO) of the HKAC at the time of accident.

1.17.3 Other PPL Training Records

1.17.3.1 A further inspection of eight other HKAC pilots' training records revealed similar cases of "ad-hoc" instructor assignment. Only one of those cases showed that one instructor has conducted the instructional flying throughout the student PPL training.

1.17.3.2 In all other seven cases, each student was trained by six to 13 different instructors throughout his/her PPL training.

1.17.4 Balked Landing Procedures

1.17.4.1 Balked landing procedures were described in page 4-20 of the POH, but the Quick Reference Handbook (QRH) did not contain such procedures. The POH was placed on board the aircraft whereas the QRH was the pilot's personal copy. The procedures were copied below:

1.17.4.2 *"In a balked landing (go-around) climb, reduce the flap setting to 20° immediately after full power is applied. If obstacles must be cleared during the go-around climb, reduce the wing flap setting to 10^0 and maintain a safe airspeed until the obstacles are cleared… After clearing the obstacles, the flap may be retracted as the airplane accelerate to the normal flap-up climb speed."*

1.17.4.3 During the interview with the pilot of the accident flight, he was unable to describe the above procedure and unable to point out where this procedure was located. However, he was aware that he should have raised the flaps initially to 20° after reaching 200 ft above ground, subsequently retraction to 0° in stages. He also recalled a target speed of 55 knots being taught by his instructors for go-around maneuver.

1.18 Useful or Effective Investigation Techniques

1.18.1 A trial flight was conducted on 5 October 2013 to verify the performance of obstacles clearance. (See 2.3.1)

2. ANALYSIS

2.1 Aircraft Loading

2.1.1 There were 38.3 USG drained from the aircraft after the accident but the load sheet recorded only indicated 35 USG before the flight began. There was also an error of 3.4 lbs in the aircraft Basic Weight in the load sheet due to the unaccounted ELT modification. The discrepancy in fuel loading could have been due to unclear fuel stick markings (see picture Appendix 1).

2.1.2 The load sheet prepared by the pilot indicated that the aircraft weight (including passenger and fuel) and C.G. were within the operating limits.

2.1.3 The actual loading condition was re-calculated, taking into the considerations of the fuel consumed in the 30 minutes flight, the 38.3 USG drained from the aircraft after accident and the unaccounted ELT installation of 3.4 lbs, the aircraft should still be operated within the operating limits in take-off and landing.

2.1.4 The incorrect loading calculated by the pilot was not a contributing factor in this accident. The fuel dip stick was used only specific on this aircraft (marked with the registration mark of the aircraft).

2.2 Aircraft Handling Technique and knowledge

2.2.1 General

2.2.1.1 The analysis was based on the interviews of HKAC instructors, the pilot of the accident aircraft and the eyewitness on the ground, review of the pilot's training records and examination of post impact marks on the ground.

2.2.1.2 It was established that the aircraft veered to left was due to no rudder input during the application of full engine power (see 2.2.3).

2.2.1.3 The aircraft sank instead of climb was a result of loss of lift due to premature flap retraction to 0° and non-adherence to the balked landing procedure as described by the POH.

2.2.2 Pilot's proficiency

The HKAC had the requirement of AFR. The AFR was a standardization flight conducted by the instructors of the HKAC. It aims to maintain the flying standards and enhance the overall safety standards of its flying members. After the pilot had obtained his PPL, there was no record related to the unusual application of rudder and flap found in the pilot's Flying Instruction Record (training record on different type of aircraft and AFR).

2.2.3 Aircraft veered to the north side of the airfield

2.2.3.1 The left yawing of a single-engined aeroplane when applying full engine power was due to the gyroscopic effect of the engine and the propellers' slip stream effect. The correct use of rudder would have prevented the aeroplane from yawing to the left (to north in this case) of the runway. The application of rudder is a basic flying skill that every PPL holder should have acquired on a single-engine propeller driven aircraft. Inadequate application of rudder is a common problem of most student pilots, and even for some inexperienced pilots.

2.2.3.2 The pilot recalled that he did not apply rudder and had been commented many times of not using sufficient rudder by instructors. Such comment of insufficient rudder application was not able to be confirmed by the pilot's instructors since the training had been conducted some years ago (between 2007 and 2009).

2.2.3.3 From the pilot's PPL training records, there was one comment on the pilot's ability to maintain center-line of runway during take-off at the very early stage of his PPL training which was not uncommon. There was no further record indicating the presence of such deficiency. There was also no record of such deficiency in any subsequent AFR after the pilot had gained his PPL.

2.2.3.4 The pilot had been tested to the PPL standards which indicated that he had demonstrated adequate level of proficiency in rudder control.

2.2.3.5 The fact that the pilot did not apply rudder input during the balked landing maneuver could have been contributed by other factors.

2.2.4 Premature flap retraction to 0° position during balked landing maneuver

2.2.4.1 The flap retraction directly from 30° to 0° with no attention to maintain the minimum safety speed during balked landing maneuver had led to significant loss of lift. The aircraft descent in a high pitch up attitude as described by eye-witness on ground indicated that the aircraft was in a stall situation. The pilot also noticed that the stall warning was activated when the aircraft descended onto the grass area to the north of the Runway 11. The aircraft subsequently stalled when the effective Angle of Attack (AoA) exceeded the Critical AoA. Stall warning signal was heard by the pilot. As the aircraft stalled at a very low level, any stall recovery action would be too late to prevent its impact onto the ground.

2.2.4.2 The pilot was aware that the flap retraction procedures should have been carried out progressively in stages. That is, initially to 20° flap then 10° flap. He, however, could not identify where the procedures was described in the POH. Neither could he recall the actual aircraft speed during the balked landing maneuver and the minimum safety speed.

2.2.4.3 Go-around maneuver was practiced throughout every student's PPL training and subsequent opportunities were given during the Practice Forced Landing (PFL) in the AFR. The required manoeuver is the same as the balked landing procedure.

2.2.4.4 The pilot was aware that the two cranes were located beyond the end of the runway as described by NOTAM and was confident that the aircraft should have sufficient performance to climb out of the obstacles. During the post-accident interview, he expressed that he should have waited for sufficient height before retraction of flap. He also understood that the aircraft wings could be stalled by retracting the flap to 0° during that moment without sufficient airspeed. He explained that he was hoping to expedite the climb out of the obstacles by retracting the flap to 0° as the cranes appeared to be very close to him. Human factors issues were analyzed in Section 2.5.

2.3 Airport Environment – the obstacles

2.3.1 The aircraft performance analysis

2.3.1.1 The investigation team used a Cessna 152 aircraft and conducted a trial flight on 5 October 2013 to verify the performance of obstacles clearance. The results indicated that the obstacles clearance was not a problem to the flight path of the HKAC aircraft.

2.3.1.2 During a touch and go trial, the Cessna 152 aircraft (less well performed than a C172 aircraft) was kept on the runway at about 50 KIAS (rotation speed) until the change in colour of the tarmac on the runway (approximately half way down and beyond the point where the pilot execute the balked landing) before full throttle was applied and rotation was commenced. It was found that with 0° flaps, and at 60 KIAS, the aircraft was able to climb to a height of over 300 feet AMSL at the first obstacle. This was repeated with 10° flaps and at 54 KIAS (best angle of climb), the result was similar.

2.3.1.3 To test obstacle clearance on a balked landing, the aircraft with full flaps was flown over the runway at about 5 feet and minimum speed until the change in colour of the tarmac on the runway before full power was applied and the flaps were retracted in stages to the 10 degree position. At a speed of 54 KIAS under a best angle of climb, the aircraft was able to climb to a height of over 300 feet AMSL at the first obstacle.

2.3.2 The development around Shek Kong Airfield

The Shek Kong Airfield is a military airfield. Operational safety for civilian operations relies on individual operator to monitor the obstacle environment in the vicinity of the airfield.

2.3.3 Assessment of obstacles clearance

2.3.3.1 The HKAC instructors' meeting minutes on 2 May 2013 had also discussed the obstacles issue but the analyses of such information were not published and disseminated among the HKAC members. Assessment of obstacles clearance had been relied on the pilot-in-command.

2.3.3.2 The information of two cranes which the pilot perceived as obstacle threat was published in the NOTAM and the pilot was aware of them.

2.3.3.3 Further interviews of instructors revealed that the HKAC's standard practice

of a “Touch and Go” maneuver was to execute before the runway “colour change point” to ensure sufficient clearance for climbing out of obstacles on the Runway 11. The pilot was fully acquainted with such practice as well.

2.3.3.4 From the ground marks found on the grass area and the wreckage position, it indicated that the balked landing maneuver was executed in time before the “colour change point”. There would have been sufficient clearance over the cranes.

2.4 Nose Wheel Fork fracture (see Appendix 5)

2.4.1 Nose wheel position and the rudder position were in neutral position.

2.4.2 There were significant amount of mud found between the right hand side of the nose wheel and the nose wheel fork. There was much less amount of mud on the left side. Both main landing gear wheels collected more mud debris on the right hand side as compared to the left hand side. The evidence indicated that the aircraft was side-slipping and ploughing into the soil on the grass area before somersault.

2.4.3 Nose wheel was almost jammed by the mud and could hardly be rotated. Both main landing gear wheels and brakes were in good conditions.

2.4.4 Two wheel marks behind the wreckage revealed that the aircraft landed on the grass area with two wheels on ground. Those marks matched with the layout of the nose wheel and the right hand main landing gear wheel.

2.4.5 The nose wheel mark exhibited a deeper mark than the right hand main landing gear wheel mark. This indicated that the nose wheel sustained a heavier load than the right hand main landing gear wheel as the majority of the aircraft loading was taken by the nose wheel. This coincided with ground witness that the aircraft landed on the grass with a nose down and right wing down attitude.

2.4.6 The depth of the nose wheel mark increased towards the wreckage indicated that the nose gear was ploughing through into the soil until the aircraft was bogged down and overstressed the nose wheel fork, causing it fracture.

2.4.7 The microscopic inspection of the fracture surfaces of the nose wheel fork confirmed that it was fractured in overload condition.

2.4.8 The collapsed nose gear served as a pivoting point when the aircraft continued its forward motion of inertia. The remaining damages of the aircraft were considered consequential to the aircraft impact to the ground, the subsequent overturn and crushing against the runway boundary fence.

2.5 Human Factors

2.5.1 During interviews, the pilot expressed his concern on the obstacle clearance during the balked landing maneuver.

2.5.2 The pilot's intention was to clear obstacles as quickly as possible. However, his unrecognized action of flap retraction directly to 0° without paying attention to the minimum safety speed was not in accordance with the POH, and had resulted in an opposite outcome. Similarly, the pilot's attention to the correct technique in the application of rudder might have been distracted by his concern of the obstacle clearance.

2.5.3 The pilot's perceived imminent threat of the obstacles ahead might have caused a lapse in the manual flying skill of applying rudder and a mistake in following the correct procedure of balked landing maneuver.

2.5.4 The pilot had been trained and tested to execute go-around maneuver during his PPL training and also AFR after he acquired his PPL. The situations of a balked landing in this accident were different from a prepared normal practice go-around during training and testing.

2.5.5 A go-around maneuver is referred to a maneuver executed before aircraft touch down thus more distant away from and higher above the obstacles. The balked landing was executed in an unplanned condition after the aircraft had already touched down on the runway. The obstacles presented to the pilot as a much closer and higher objects during the balked landing than during a normal go-around maneuver.

2.5.6 Such psychological effect could have been overcome when appropriate training could be provided in a similar situation.

2.6 Training conducted by the HKAC

2.6.1 There were 14 changes of instructors during the pilot's PPL training from 26 May 2007 to 21 May 2009. An examination of seven other PPL training cases found a similar situation of six to thirteen instructors change.

2.6.2 The HKAC had utilized AFR to conduct go-around procedure during Practice Forced Landing (PFL) – a practice of making a safe landing other than a designated airfield in case of engine failure. Go-around procedure is an anticipated procedure after the completion of PFL and also a maneuver executed well above any obstacles in concern.

2.6.3 The obstacles perception presented to a pilot during go-around practice in a PFL was not compatible with that during balked landing at Shek Kong Airfield in terms of projected distance and height of obstacles.

2.6.4 There was no other laid down requirement of practice go-around or balked landing procedures at Shek Kong Airfield. Practices of such procedures are at the discretion of the individual pilot and instructor.

3. CONCLUSIONS

3.1 Findings

3.1.1 The aircraft had a valid Certificate of Airworthiness and was maintained and certified in accordance with the regulatory requirements.

3.1.2 The aircraft was serviceable for the proposed flight.

3.1.3 The mechanical failure of the nose wheel fork was due to overload as a consequence of the aircraft stall upon its impact on the grass area in a nose down attitude and ploughed into the mud.

3.1.4 The aircraft was operating within its weight limits and C.G. limits.

3.1.5 There were published obstacles at the end of the Runway 11 take-off path. The climb performance of the aircraft type was verified and should be able to gain sufficient clearance over the obstacles.

3.1.6 The pilot was properly licensed to conduct the flight.

3.1.7 The flight was uneventful until the go-around after bounced landings on the runway.

3.1.8 The engine responded normal during the balked landing maneuver. The aircraft experienced loss of lift during the flap retraction directly from 30° to 0° position and subsequently stalled during descent.

3.1.9 The aircraft veered to the north side of the runway as a result of no rudder input during the application of full engine power in a balked landing maneuver.

3.1.10 There was sufficient information of obstacles published in the NOTAM for evaluation of obstacles clearance. The HKAC conducted the obstacles assessment but no advice or detail of the assessment was published.

3.1.11 The pilot was trained to execute procedures in go-around maneuver procedure which was the same technique required for balked landing. There were no additional training or checking on balked landing maneuver after he had obtained his PPL.

3.2 Causes

3.2.1 Balked landing procedures as described in the Pilot's Operating Handbook (POH) was not followed, resulted in loss of lift, uncontrolled descent and subsequent stall at low altitude. (2.2.4)

3.2.2 There was a lapse in basic flying skills on rudder usage, resulted in veering off to the northern side of the runway. (2.2.3)

3.3 Contributing Factors

3.3.1 The perceived obstacles threat diverted the pilot's attention to execute the correct procedures and basic handling skills. (2.2, 2.5, 2.6)

3.3.2 The results of the obstacles assessment were not published and the importance to follow the published balked landing procedures as in the POH was not highlighted. (2.3)

3.3.3 The balked landing procedure has not been properly practiced. (2.6)

4 SAFETY RECOMMENDATIONS

4.1 Recommendation 2015-4

The HKAC should review and revise its training programme to include the execution of an unplanned balked landing maneuver in Shek Kong Airfield with special attention to its surrounding development. (3.2.1, 3.2.2)

4.2 Recommendation 2015-5

The HKAC should take up a proactive role in the assessment of the changes in obstacle environment in the vicinity of Shek Kong Airfield and provide advice to its members in order to avoid confusion and unnecessary concerns. (3.3.2)

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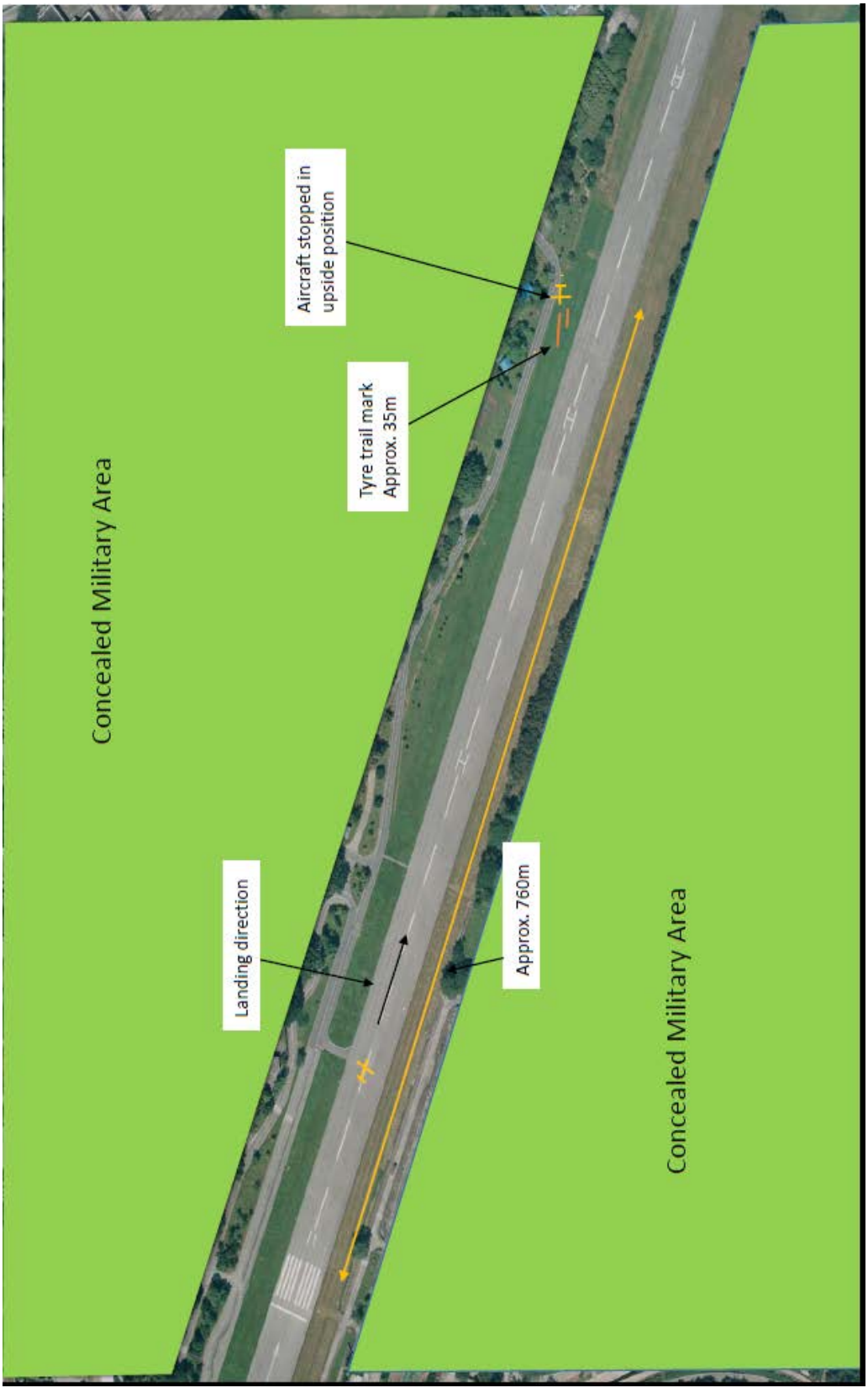
Appendix 1: Picture of the Fuel Dip Stick **(Page 1 of 1)**

Appendix 2: Local Shek Kong area map **(Page 1 of 1)**

Appendix 3: The Aircraft layout and wreckage position **(Page 1 of 1)**



Appendix 4: The wreckage photos **(Page 1 of 5)**

The aircraft B-HRH (front left view)

The aircraft B-HRH (rear right view)

Appendix 4: The wreckage photos **(Page 2 of 5)**

The markings on ground – front wheel and right main wheel

The right Wing

Appendix 4: The wreckage photos **(Page 3 of 5)**

The left wing

The nose landing gear

Appendix 4: The wreckage photos **(Page 4 of 5)**

The nose wheel

The left wheel

Appendix 4: The wreckage photos **(Page 5 of 5)**

The right wheel

The engine and propeller

Appendix 5: The nose wheel damage **(Page 1 of 1)**

The nose landing gear damage

The nose wheel damage (view from behind – right hand side with mud)

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