AIRCRAFT ACCIDENT REPORT 1/2019

AIR ACCIDENT INVESTIGATION AUTHORITY

The Government of the
Hong Kong Special Administrative Region

Report on the accident to Robinson R22 Beta II Helicopter
Registration B-HJU operated by the
Hong Kong Aviation Club Limited
at Shek Kong Airfield, Yuen Long
on 23 October 2016

Hong Kong

June 2019

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.

The completion of the investigation coincided with the transfer of the responsibility for air accident and incident investigation in Hong Kong from the Civil Aviation Department (CAD) to the Air Accident Investigation Authority (AAIA). The investigation is reported and published in accordance with the Hong Kong Civil Aviation (Investigation of Accidents) Regulations.

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GLOSSARY OF ABBREVIATIONS

ATC	Air Traffic Control
CAD	Civil Aviation Department, Hong Kong
CFI(H)	Chief Flying Instructor (Helicopters)
CPL(H)	Commercial Pilot's Licence (Helicopters)
C.G.	Centre of Gravity
CIA	Chief Inspector of Accidents
EAP	Emergency Action Plan
ELT	Emergency Locator Transmitter
FO	Flight Operations (the room used by the Hong Kong Aviation Club Limited for flight operations at Shek Kong Airfield)
HKAC	Hong Kong Aviation Club Limited
kg	kilogram
km	kilometre
MHz	Megahertz
ºC	Degree Celsius
SK	Shek Kong Airfield
TRT	Total Rotor Thrust
UTC	Coordinated Universal Time
VHF	Very High Frequency

Notes:

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

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

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AIR ACCIDENT INVESTIGATION AUTHORITY

Aircraft Accident Report 1/2019

Registered Owner:	Hong Kong Aviation Club Limited
Operator:	Hong Kong Aviation Club Limited
Aircraft Type:	Robinson R22 Beta II Helicopter
Nationality / Registration:	B-HJU
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:	23 October 2016 at 1508 hrs

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SYNOPSIS

On 23 October 2016, a Robinson R22 Beta II helicopter owned and operated by the Hong Kong Aviation Club Limited ("HKAC"), with registration B-HJU, was on an instructional flight within Shek Kong Airfield ("SK"). A flying instructor ("Instructor"), who was the pilot-in-command of the flight, and a student pilot ("Student") were on board. Having completed the training exercise, the Instructor took over the control and "hover taxied" (i.e. helicopter manoeuvre close to ground for taxiing purpose) the helicopter over a grass strip that runs parallel to the runway, with an intention to take the helicopter back to the HKAC apron located at the western end of the runway. Before reaching the HKAC apron, the Instructor landed the helicopter halfway down the grass strip for traffic consideration. When the traffic was clear, the Instructor attempted to lift off again to continue the hover taxi but the fronts of both skids were entangled with the grass. The helicopter subsequently rolled over forward and rested on its left side. The engine stopped on impact. The helicopter sustained substantial damage. The Instructor suffered some minor injuries. The Student was not injured. Both occupants exited through the right door without assistance.

Civil Aviation Department (CAD) was informed of the occurrence by the HKAC on the same day. A team of CAD Inspectors of Accidents immediately proceeded to SK to conduct a site survey, inspect the accident helicopter and collect other preliminary information. 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 preserving life and avoiding similar accident in future. It is not the purpose of this investigation to apportion blame or liability.

The investigation concluded that the probable cause of the accident was a dynamic rollover caused by an uncontrollable angular momentum that was created by the Instructor's attempt to lift off with the fronts of both the helicopter's skids entangled with long grass.

The investigation team has made two safety recommendations.

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1. FACTUAL INFORMATION

1.1 History of flight

1.1.1 On 23 October 2016, a HKAC Robinson R22 Beta II helicopter, registration B-HJU, with an Instructor and a Student on board, departed SK at about 1410 hrs for a low-level navigation exercise outside SK. Returning to SK with time available, the Instructor asked the Student to practise two "circuits" (i.e. standard visual patterns to self-position the aircraft from take-off to approach and landing). Runway 11 was in use. After completing the requested practice, the Student hovered the helicopter on a south-easterly heading over the hover training circle located at the eastern end of the runway. The Instructor then took over the control.

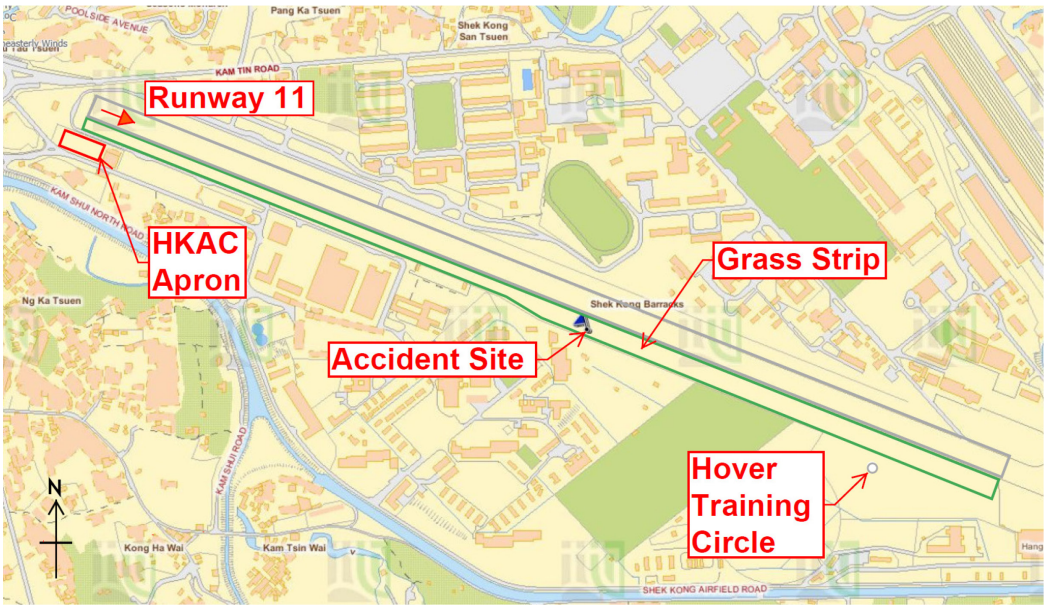

Figure 1 – The Accident Site in Shek Kong Airfield

1.1.2 Noting that there were three fixed-wing aircraft in the circuit and they were all practising "touch-and-go landing" (i.e. landing and take-off without coming to a full stop) on Runway 11, the Instructor started hover taxiing the helicopter towards the HKAC apron over the grass strip parallel to and south of the runway. At about halfway down the grass strip heading westerly, he noticed that one of the three fixed-wing aircraft in the circuit was on short final (i.e. on approach and close to the landing area). The Instructor stated in the post-accident interview

that he was concerned about the possible adverse effects of the helicopter's downwash from the main rotor on the landing fixed-wing aircraft. Therefore, he decided to put the helicopter on the ground first. However, during the landing he had difficulties in judging the height of the aircraft over the ground as the grass was quite long and he remarked the same to the Student. He landed the helicopter with the collective control fully down.

1.1.3 After the fixed-wing aircraft had touched down, the Instructor attempted to lift off the helicopter again with the intention of continuing the hover taxiing. He stated that he saw both fronts of the skids were entangled with the grass. He thought the grass would come loose by lifting up the helicopter. During the lifting manoeuvre, the Student felt that the helicopter was first lifting off very slowly, then it started rolling forward and to the left.

1.1.4 As the helicopter started rolling forward, the Instructor stated that he had lowered the collective control in response and tried using the cyclic control to level the helicopter. The forward rolling movement continued until the main rotor hit the ground. The Instructor stated that it all happened very quickly. While the helicopter was rolling forward, the fronts of the skids were in contact with the ground.

1.1.5 The pilot on the fixed-wing aircraft on short final, who was about to practise a touch-and-go landing, witnessed the sequence of the accident. He stated that he could not see the skids of the helicopter and that the grass appeared to be longer than normal. When he was at a position almost abeam of the helicopter, he saw the helicopter starting tilting forward. The tilting continued to an unusually steep nose-down position, followed by the main rotor hitting the ground and eventually the tail boom. The helicopter flipped over and some white smoke came out. He then made a radio call to the Flight Operations (FO) of the HKAC at SK to report the accident.

1.1.6 The helicopter rested on the ground with its left side down at about 1508 hrs. The Student stated that as he was hanging from his seat at the top, he chose to stay put in order to allow the Instructor to get out first. After both had evacuated from the

helicopter, the Instructor asked the Student to shut down the engine which was already not running. The Student then secured the engine by pulling the Mixture Control, turning off the Ignition Switch and the Master Battery Switch.

1.1.7 After shutting down the helicopter, the Student took the first aid kit from the helicopter, and contacted the FO by his mobile phone. The personnel of the HKAC arrived soon after the Student made the call.

1.2 Injuries to persons

The Student was not injured. The Instructor suffered some minor cuts. He was first treated at the FO, and then taken to a hospital for further treatment and subsequently released.

1.3 Damage to aircraft

The helicopter sustained substantial damage. The forward end of the right skid tube was found broken.

Photograph 1 – The Wreckage

1.4 Other damage

Nil.

1.5 Personnel information

The Instructor held a Commercial Pilot's Licence (Helicopters) and a Flying Instructor's Rating on Robinson R22, and a valid Class 2 Medical Certificate. In this flight, he was exercising the privileges of a Private Pilot's Licence included in the CPL(H).

His information is as follows.

Sex / Age	Male, aged 61 years
Licence	Commercial Pilot's Licence (Helicopters)
Type rating	Robinson R22, R44, EC120
Medical certificate	Class 2, renewed on 17 October 2016, valid until 31 October 2017.
Limitations	Corrective lenses to be worn and additional spectacles to be available
Flying Instructor's Rating Certificate of Test	Issued on 17 January 2015, valid for 25 months
Certificate of Experience	Issued on 11 October 2016, valid until 10 November 2017
Flying experience	Total all types 6,740 hours (fixed-wing and helicopter)
Total on Robinson R22	2,851 hours
Total on Robinson R22 as instructor	2,329 hours
Day of the accident	2.0 hours
Day prior to accident	2.1 hours

1.6 Aircraft information

1.6.1 Robinson R22 Beta II helicopter

R22 Beta II is a single-engined helicopter manufactured in the United States of America. The primary structure of the fuselage is welded steel tubing and riveted aluminium. The tail boom is a monocoque structure in which the aluminium skins carry the primary loads. This helicopter is powered by a Lycoming O-360-J2A piston engine and is equipped with dual controls. Both the main and the tail rotors have two all-metal blades.

1.6.2 The accident helicopter

Manufacturer:	Robinson Helicopter Company
Type:	R22 Beta II
Aircraft serial number:	3845
Year of manufacture:	2005
Certificate of Registration:	Issued on 29 April 2016 in the ownership of Hong Kong Aviation Club Limited
Certificate of Airworthiness:	Issued on 29 April 2016 in the Transport Category (Passenger) and valid until 28 April 2017
Engine:	One Lycoming O-360-J2A piston engine
Maximum Approved Gross Weight:	622.7 kg
Total airframe hours:	1386.6 hours

1.6.3 Emergency locator transmitter

1.6.3.1 The helicopter was fitted with a KANNAD 406 AF Emergency Locator Transmitter (ELT), part number S1821502-02 Variant D, and was a standard version for the helicopter. It can be activated by a built-in accelerometer (i.e. a "G-switch") which senses abrupt movement in the forward direction only, or manually with a switch on the transmitter itself or on a Remote Control Panel in the cockpit.

1.6.3.2 The ELT is designed to transmit on three frequencies (121.5, 243 and 406 MHz). The two basic emergency frequencies (121.5 and 243 MHz) are mainly used for homing in the final stages of the rescue operations. The 406 MHz frequency is used by the "Cosmicheskaya Sistyema Poiska Avariynich Sudov - Search and Rescue Satellite-Aided Tracking" (COSPAS-SARSAT) satellites for precise pinpointing and identification of the aircraft in distress.

1.6.4 Airworthiness and maintenance of aircraft

1.6.4.1 The aircraft's technical records indicated that the helicopter had been maintained in accordance with the CAD approved maintenance schedule. The operation check of the ELT was carried out satisfactorily on 5 August 2016. The most recent scheduled check was the 50-hour Inspection carried out on 20 September 2016. On completion of the inspection, the airframe and engine had each accumulated 1345.1 flight hours since new.

1.6.4.2 A review of the Flight Authorisation Log revealed that the helicopter had no outstanding defects prior to the accident flight. The helicopter was fully serviceable in all respects.

1.6.4.3 The helicopter had been operating within its weight and centre of gravity limitations throughout the accident flight.

1.7 Meteorological information

The weather conditions over SK were generally fine with wind from the east of around three knots. The temperature was around 30ºC. The visibility was more than 10 km.

1.8 Aids to navigation

Nil.

1.9 Communications

The helicopter was equipped with Very High Frequency (VHF) radio. The radio communication with the FO was good.

1.10 Aerodrome information

SK is an airfield located in Shek Kong, Yuen Long, New Territories, Hong Kong.

There is no air traffic control or flight information service provided by CAD within the Shek Kong Aerodrome Reporting Area (SKARA[1]).

1.11 Flight recorders

Not applicable.

1.12 Wreckage and impact information

Severe damage to the Perspex canopy, tail boom, main rotor blades, engine mount, and deformation of the engine firewall were evident.

A site inspection in the vicinity of the wreckage, about 10-metre in radius, was conducted. No foreign objects were found.

[1] HKAC pilots flying within the SKARA report their positions and listen out on a specific VHF frequency.

1.13 Medical and pathological information

There was no evidence to suggest that the performance of the Pilot had been affected by fatigue, alcohol, drugs and/or medication at the time of the accident.

1.14 Fire

Fire did not occur.

1.15 Survival aspects

1.15.1 The Instructor and the Student were both secured by the three-point seat harness assemblies until they released them for the evacuation.

1.15.2 During the wreckage inspection, both the left and the right doors could be opened without obstruction.

1.16 Tests and research

1.16.1 Fuel sample test

1.16.1.1 Fuel samples of grade **Avgas 100LL** (the "LL" indicating low-lead) were collected from both the helicopter fuel tank and the fuel bowser used for the last refuelling.

1.16.1.2 Laboratory test reports showed that both fuel samples contained Tetraethyl Lead Content 14% higher than the specification value of grade Avgas 100LL. The results were still within the specification value of grade Avgas 100 which can also be used on Robinson R22 Beta II, as specified in its Pilot's Operating Handbook.

1.16.2 Flight control / throttle control mechanical check

A series of checks and inspections were performed on the wreckage including, collective pitch control mechanism, throttle control mechanism, pitch control mechanism, yaw control mechanism (anti-torque pedals) and tail rotor driving mechanism. The results indicated that no anomaly existed prior to the accident.

1.16.3 Emergency locator transmitter functional test

1.16.3.1 In view of no emergency frequency signal being received by the Air Traffic Controller (ATC) of CAD after the ground impact in the accident, the ELT assembly and the associated wiring of the helicopter were tested in accordance with the Kannad Aviation Component Maintenance Manual (CMM), reference: 25-63-05 Rev. OCT 02/2015.

1.16.3.2 An ELT Frequency & Power Check, an Operating Test on the G-switch of the ELT, and a Continuity Test on the ELT panel wiring were conducted. The results did not indicate any anomaly.

1.17 Organisational and management information

All HKAC flying activities were conducted at SK.

1.18 Additional information

Nil.

1.19 Useful or effective investigation techniques

Nil.

2. ANALYSIS

There were neither video nor flight records of this accident. The pilot on the fixed-wing aircraft, who was about to practise a touch-and-go landing on short final of Runway 11, witnessed the accident ("the witness"). The Instructor, the Student, the witness and the HKAC Resident Flying Instructor at the FO were interviewed by the CAD Inspectors of Accidents. The analysis of the circumstances and causes leading to the accident was based on the information collected from the interviewees, examination of the wreckage and research.

2.1 Flight operations

2.1.1 According to HKAC's normal practice, when Runway 11 in SK is in use, all returning helicopters would need to backtrack to the west of the airfield over the runway, subject to the prevailing traffic. Prior to the accident, the Instructor took over the control of the helicopter over the hover training circle located at the eastern end of the runway, intending to backtrack. However, he also noticed that there were three fixed-wing aircraft in the circuit, all practising touch-and-go landings on Runway 11. Considering the situation, the Instructor assessed that there would not be a time slot sufficient for him to backtrack the helicopter over the runway, unless one of the fixed wing aircraft were to make a full stop landing or execute a go around.

2.1.2 With the tight traffic situation in the circuit area, the Instructor recalled that a visiting Robinson instructor had previously proposed an alternative — backtracking over the grass strip — which would provide sufficient separation between a hover taxiing Robinson helicopter and the landing fixed-wing aircraft on the runway. Although this alternative was not stipulated in the HKAC Helicopter General Flying Orders GEN-24 – Shek Kong Procedures dated 25 October 2013 as a standard procedure (see Appendix 2), the Instructor decided to try it out for the first time and therefore he started hover taxiing the helicopter from the hover training circle over the grass strip on a westerly heading.

2.1.3 There was neither guidance nor procedure in the HKAC Helicopter General Flying Orders regarding operations on grass areas in SK.

2.1.4 The Instructor, the Student and the witness all described the grass in the airfield was long on the day of the accident. During the investigation, the measurement on the length of the grass at the accident site was found to be about 1.3 m (see Photograph 2). The surface of the accident site was made up of deep grass with large 'clumps of grass' embedded. No foreign objects were found.

Photograph 2 – Length of Grass

2.1.5 When the helicopter had reached halfway down the grass strip, the Instructor stated that he saw one of the fixed-wing aircraft was already on short final. He was concerned about the possible effects of the helicopter's downwash on the landing fixed-wing aircraft and decided to land the helicopter first despite the long grass.

2.1.6 During the landing, the length and the overlaying of the grass under the downwash of the helicopter would have been dense and deep enough to prevent the Instructor from seeing the ground texture, thus judging the height of the skids above the ground would have been difficult (see Photograph 3). Although he was unsure about the exact height of the helicopter from the ground and the depth of the grass, he decided to land the helicopter with the collective control fully down, putting both skids into the grass.

Photograph 3 – Overlaying of the Long Grass

2.1.7 After the fixed-wing aircraft had touched down, the Instructor stated that he attempted to lift the helicopter up again. He recalled that he saw the fronts of both skids were entangled with the grass. He stated that he thought the grass would come loose by lifting up the helicopter. During the attempt to lift up, the Student sensed that the helicopter was first lifting up very slowly, as it lifted further up, it started rolling forward and flipped to the left. As the helicopter started rolling forward, the Instructor stated that he had lowered the collective control in response and tried using the cyclic control to level the helicopter. The

Instructor described that the accident happened very quickly. He said in his statement that he thought it was a dynamic rollover[2].

2.1.8 Consistent with the descriptions by the Instructor and the Student, the witness also stated that he saw the helicopter lifting off at a very steep nose-down attitude before rolling over forward.

2.1.9 To lift off a helicopter under normal circumstances, the pilot would raise the collective control, thus increasing the Total Rotor Thrust (TRT). The higher the collective control is raised, the more TRT is created. When the TRT equals the weight of the helicopter, the helicopter would start lifting off from the ground (see Figure 2).

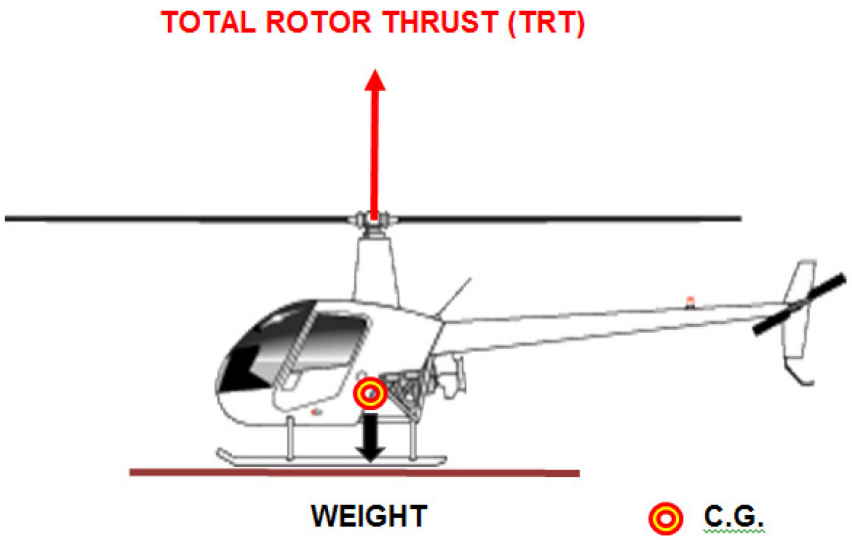

Figure 2

[2] **Dynamic Rollover** begins when a helicopter starts to pivot around its landing gear, be it skid or wheel, in contact with the ground. When the critical roll rate or angle is exceeded, recovery is impossible.

2.1.10 In this accident, the fronts of both skids of the helicopter were entangled with the fluttering deep grass. The Instructor thought the grass would come loose by lifting up the helicopter. As the fronts of both skids still remained entangled while raising the collective control, he thus attempted to get the skids untangled by raising the collective control more than that would have been required for a normal liftoff. It did not work and yet this additional collective input would inevitably create more TRT. As the TRT was increasing, more downwash was being generated. It was probable that the increasing downwash would be pressing down on the overlaying grass, thus holding the skids even firmer. Simultaneously, with the skids still being entangled thus serving as a pivot point on the ground, the helicopter would start tilting forward (see Figure 3).

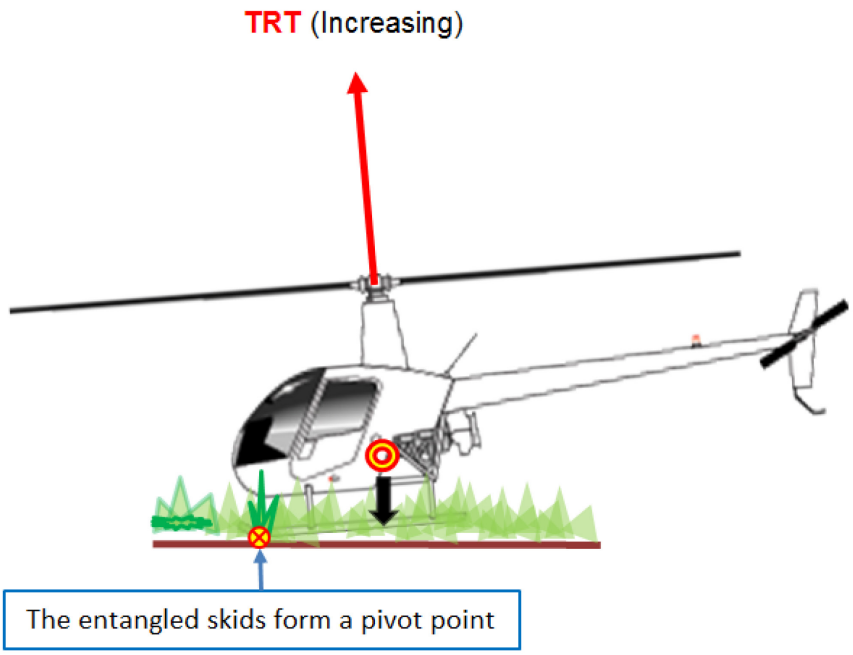

Figure 3

2.1.11 As the helicopter had already tilted forward and the TRT was increasing, a forward component of the TRT (Forward TRT) would be formed, thus generating an angular momentum that rolled the helicopter further forward (see Figure 4).

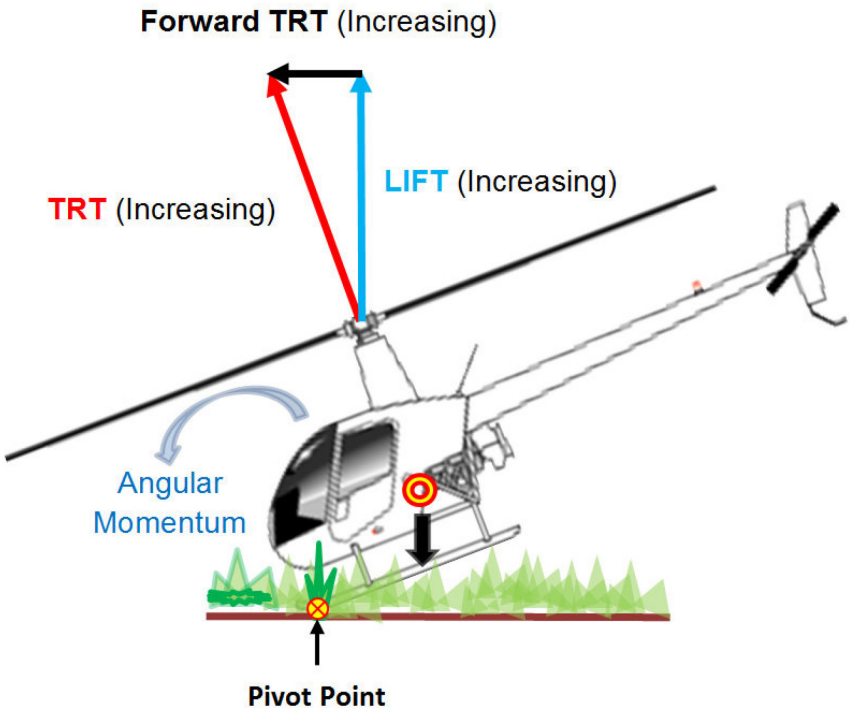

Figure 4

2.1.12 As the roll angle increased, the Forward TRT increased, thus increasing the roll rate. The Instructor stated that he was aware of this happening and he had lowered the collective control in response. However, at this particular moment, the roll rate had reached a magnitude that the control authority available from the cyclic control would not have been sufficient to arrest the rollover. This is confirmed by the Instructor's statement that he had tried using the cyclic control to level the helicopter but to no avail. As a result, the helicopter rolled over eventually (see Figure 5).

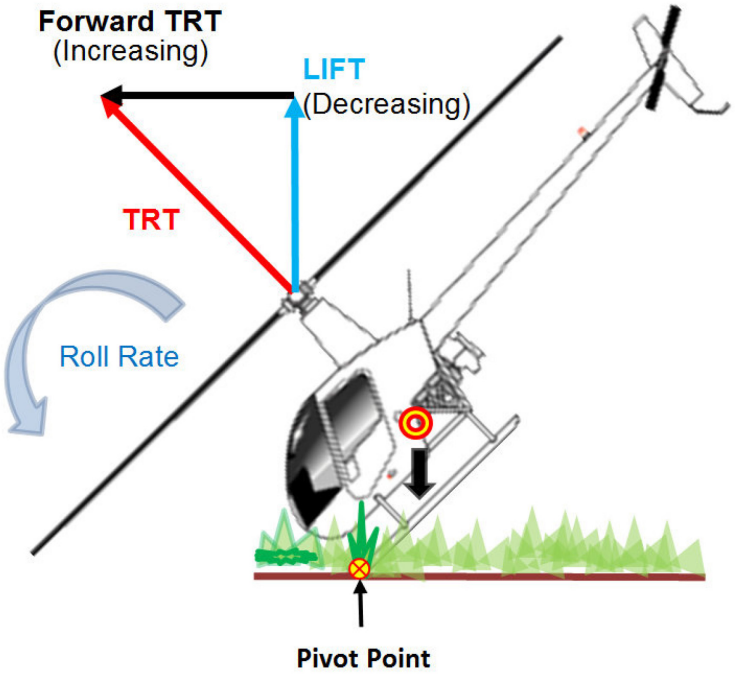

Figure 5

2.1.13 Safety Notice SN-9 (Issued: Jul 82 Rev.: Jun 94) in the Robinson R22 Pilot's Operating Handbook has provided guidance to avoid a dynamic rollover:

- *Always use a two-step liftoff.*
- *Pull in just enough collective to be light on the skids and feel for equilibrium, then gently lift the helicopter into the air.*

2.2 Technical

2.2.1 Examination of the wreckage

2.2.1.1 From the results of the wreckage examination, fuel sample test, and flight controls / throttle control mechanism checking, no evidence showed any technical problem contributing to the accident.

2.2.1.2 As the helicopter was rolling forward, the Forward TRT would increase whereas the Lift would decrease even the Instructor did not lower the collective control to decrease the TRT. With the fronts of the skids in contact with the ground, the weight of the helicopter being exerted on the contact points would increase as the roll angle increased. It was probable that the front end of the right skid could no longer support the weight of the helicopter and broke because of the decrease of Lift at an acute roll angle (see Figure 5).

2.2.1.3 The damage of the helicopter was consistent with the direction and the impact marks made on to the ground during a dynamic rollover. The damage was consequential to the dynamic rollover.

2.2.2 ELT functional test

The results of an ELT Frequency and Power Check, an Operating Test on the G-switch of the ELT, and a Continuity Test on the ELT panel wiring, proved that the ELT system could function properly. It may imply that the rolling motion of the helicopter during the dynamic rollover with the skids pivoting on the ground was not significant enough to trigger the G-switch sensor which senses abrupt movement in the forward direction only.

2.3 Emergency response

The accident was first reported to the SK FO by the witness on VHF radio. HKAC then activated its Emergency Action Plan (EAP), notifying the concerned parties and emergency services accordingly.

3. CONCLUSIONS

3.1 Findings

3.1.1 The Instructor held a Commercial Pilot's Licence (Helicopters) and a Flying Instructor's Rating on Robinson R22, and a valid Class 2 Medical Certificate. In this flight, he was exercising the privileges of a Private Pilot's Licence included in the CPL(H).

3.1.2 The helicopter had no defect prior to the accident flight and was fully serviceable in all respects.

3.1.3 The flight was conducted in day light under Visual Flight Rules.

3.1.4 The helicopter was operated within its weight and centre of gravity limitations.

3.1.5 The Instructor attempted to lift off the helicopter with the fronts of both skids entangled with long grass. It was probable that the TRT acting against the fronts of both skids as the pivot points translated into a forward angular momentum that eventually led to a dynamic rollover.

3.1.6 There was neither guidance nor procedure in the HKAC Helicopter General Flying Orders regarding operations on grass areas.

3.1.7 The damage that the helicopter sustained was consequential to the dynamic rollover.

3.1.8 The ELT was serviceable but not activated.

3.1.9 The EAP of the HKAC was activated.

3.2 Cause

It was probable that this accident was a result of a dynamic rollover caused by an uncontrollable angular momentum that was created by the Instructor's attempt to lift off with the fronts of both the helicopter's skids entangled with long grass. (Refer 2.1.7 and 3.1.5)

3.3 Contributing factors

3.3.1 Being concerned about the possible effects of the helicopter's downwash on the landing fixed-wing aircraft, the Instructor decided to land the helicopter first despite the long grass. (Refer 2.1.5)

3.3.2 Knowing that the fronts of both skids were entangled with the grass, the Instructor underestimated the force required to get the skids untangled and decided to lift off. (Refer 2.1.10)

3.3.3 With the fronts of both skids still remained entangled while lifting off, the Instructor raised the collective control more than that would have been required for a normal liftoff. It was probable that the extra collective control input exacerbated the forward angular momentum. (Refer 2.1.10 and 2.1.11)

4. SAFETY ACTIONS AND RECOMMENDATIONS

4.1 Safety action taken by HKAC

After the accident, HKAC suspended its helicopter operations and conducted an internal investigation and review. On 25 October 2016, an amendment to the Helicopter General Flying Orders GEN-24 on the Shek Kong Procedures was issued by the Chief Flying Instructor (Helicopters) CFI(H) (see Appendix 3), which consisted of the following procedures for operations on grass areas:

(a) The grass areas in Shek Kong are inspected and identified before the first flight of the day.

(b) Grass areas where helicopters are allowed to land should be trimmed to enable an inspection on the surface of the ground and that the ground is suitable for a landing. Helicopters are not allowed to land in areas of the ground where the grass has grown to a length that will obscure the surface of the ground or the ground is not firm enough to prevent the skids from sinking into the ground.

(c) Helicopter pilots are notified by the Flight Operations for those grass areas not suitable to land with the assistance of the marked areas indicated on a location map of the airfield on the Notice Board.

(d) Notwithstanding the above Notice it is the responsibility of the Pilot in Command to ensure that all the grass areas where they intend to land and take off are trimmed to a length that will enable inspection of the surface and that the grass has not grown to a length that will cause entanglement of the skids and the ground is firm enough to prevent the sinking of the skids on landing and takeoff.

Upon the implementation of the above procedures, the helicopter operations in SK resumed normal.

4.2 Recommendations

4.2.1 Recommendation 2019-1

It is recommended that the HKAC should strengthen its flying members' awareness on dynamic rollover, in particular the risks associated with entangled landing gear prior to liftoff.

4.2.2 Recommendation 2019-2

It is recommended that the HKAC should regularly inspect the grass area in the Shek Kong Airfield, which is used for takeoff and landing by its helicopters, so as to ensure that the length and density of the grass will not affect the safety of helicopter operations.

APPENDICES

Appendix 1 Robinson Helicopter Company R22 Safety Notice SN-9

ROBINSON
HELICOPTER COMPANY

Safety Notice SN-9

Issued: Jul 82 Rev: Jun 94

MANY ACCIDENTS INVOLVE DYNAMIC ROLLOVER

A dynamic rollover can occur whenever the landing gear contacts a fixed object, forcing the aircraft to pivot about the object instead of about its own center of gravity. The fixed object can be any obstacle or surface which prevents the skid from moving sideways. Once started, dynamic rollover cannot be stopped by application of opposite cyclic alone. For example, assume the right skid contacts an object and becomes the pivot point while the helicopter starts rolling to the right. Even with full left cyclic applied, the main rotor thrust vector will still pass on the left side of the pivot point and produce a rolling moment to the right instead of to the left. The thrust vector and its moment will follow the aircraft as it continues rolling to the right. Quickly applying down collective is the most effective way to stop a dynamic rollover.

To avoid a dynamic rollover:

1) Always practice hovering autorotations into the wind and never when the wind is gusty or over 10 knots.

2) Never hover close to fences, sprinklers, bushes, runway lights or other obstacles a skid could catch on.

3) Always use a two-step liftoff. Pull in just enough collective to be light on the skids and feel for equilibrium, then gently lift the helicopter into the air.

4) Do not practice hovering maneuvers close to the ground. Keep the skids at least five feet above the ground when practicing sideward or rearward flight.

Appendix 2 HKAC Helicopter General Flying Orders GEN-24 – Shek Kong Procedures (dated 25 October 2013)

HONG KONG AVIATION CLUB LIMITED

HELICOPTER GENERAL FLYING ORDERS

GEN-24 – Shek Kong Procedures

Circuit

- Circuit height is 800 ft. amsl.
- Helicopter circuit is to the South of the runway and fixed wing circuit is to the North, i.e. right circuit for Rwy 11 and left circuit for Rwy 29.
- Helicopter pilots are to consider establishing final behind any fixed wing traffic when deciding the appropriate point for turning from downwind to base leg.
- Final 11 for the Grass should be flown directly over the line of trees paralleling the runway to the right so that, in the event of an engine failure, safe autorotation onto the runway may be carried out.
- Commence takeoff transition from a point on the runway which will result in sufficient height when reaching the boundary of the airfield. As a general rule, select a point to commence transition no further east than the 2nd "H" from the east for Rwy 11 and no further west than the 2nd "H" from the west for Rwy 29.
- When waiting to line up on the runway, hold off the runway and keep a distance of no less than 2 rotor diameters from the edge of the runway.

Departure

- Helicopters shall depart Shek Kong via Kadoorie Gap ("KDG") or Kam Tin Gap ("KAM") only.
- Exit via KDG should be made at 1,500 ft. amsl. For departure on Rwy 11, a climbing right turn should be made to allow sufficient time and distant to gain altitude and for traffic avoidance. For Rwy 29 departure, continue climb on downwind to 1,500 ft. amsl.
- Exit via KAM should be made at 1,000 ft. amsl.
- When exiting via KDG, change frequency to call HK Information early before Tai Mo Shan blocks radio signals. Otherwise, continue and make radio contact later but pay particular attention to any other traffic in New Town.

Arrival

- Helicopters shall join Shek Kong via KDG or KAM only.
- For KDG join, maintain 2,000 ft. amsl if cloud base permits. Otherwise, join at an appropriate altitude below cloud base. Proceed with caution to avoid any traffic exiting at 1,500 ft. amsl and announce your joining altitude.
- Maintain 2,000 ft. amsl over the circuit pattern and hold. When cleared of other traffic, descend to not below 1,500 ft. amsl over the runway. When turning to join crosswind, continue descent to pattern altitude.
- For KAM join, maintain 1,000 ft. amsl. For Rwy 11, join right base direct, if clear; otherwise, climb to 1,500 ft. amsl and proceed to join overhead the runway. For Rwy 29, join downwind direct, if clear; otherwise, climb to 1,500 ft. amsl and proceed to join overhead the runway.

Holding

Join overhead the runway at no lower than 1,500 ft. amsl and maintain altitude over the circuit pattern until cleared of traffic. Then descend to circuit height of 800 ft. amsl when established crosswind.

Parking

When parking on the grass adjacent the Rwy 11 Undershoot, ensure there is sufficient distance (two rotor diameters) from the fixed wing taxiways into and out of Area "X".

Area Whiskey

Only instructors may land direct into Area Whiskey. PPL(H)s are to land on Rwy 11, hover taxi to the Rwy 11 Undershoot, shut down, then push the helicopter on wheels to Area Whiskey.

Chief Flying Instructor

25 October 2013.

Appendix 3 HKAC Helicopter General Flying Orders GEN-24 – Shek Kong Procedures (dated 25 October 2016)

HONG KONG AVIATION CLUB LIMITED

HELICOPTER GENERAL FLYING ORDERS

GEN-24 – Shek Kong Procedures

Circuit

- Circuit height is 800 ft. amsl.
- Helicopter circuit is to the South of the runway and fixed wing circuit is to the North, i.e. right circuit for Rwy 11 and left circuit for Rwy 29.
- Helicopter pilots are to consider establishing final behind any fixed wing traffic when deciding the appropriate point for turning from downwind to base leg.
- Final 11 for the Grass should be flown directly over the line of trees paralleling the runway to the right so that, in the event of an engine failure, safe autorotation onto the runway may be carried out.
- Commence takeoff transition from a point on the runway which will result in sufficient height when reaching the boundary of the airfield. As a general rule, select a point to commence transition no further east than the 2nd "H" from the east for Rwy 11 and no further west than the 2nd "H" from the west for Rwy 29.
- When waiting to line up on the runway, hold off the runway and keep a distance of no less than 2 rotor diameters from the edge of the runway.

Departure

- Helicopters shall depart Shek Kong via Kadoorie Gap ("KDG") or Kam Tin Gap ("KAM") only.
- Exit via KDG should be made at 1,500 ft. amsl. For departure on Rwy 11, a climbing right turn should be made to allow sufficient time and distant to gain altitude and for traffic avoidance. For Rwy 29 departure, continue climb on downwind to 1,500 ft. amsl.
- Exit via KAM should be made at 1,000 ft. amsl.
- When exiting via KDG, change frequency to call HK Information early before Tai Mo Shan blocks radio signals. Otherwise, continue and make radio contact later but pay particular attention to any other traffic in New Town.

Arrival

- Helicopters shall join Shek Kong via KDG or KAM only.
- For KDG join, maintain 2,000 ft. amsl if cloud base permits. Otherwise, join at an appropriate altitude below cloud base. Proceed with caution to avoid any traffic exiting at 1,500 ft. amsl and announce your joining altitude.
- Maintain 2,000 ft. amsl over the circuit pattern and hold. When cleared of other traffic, descend to not below 1,500 ft. amsl over the runway. When turning to join crosswind, continue descent to pattern altitude.
- For KAM join, maintain 1,000 ft. amsl. For Rwy 11, join right base direct, if clear; otherwise, climb to 1,500 ft. amsl and proceed to join overhead the runway. For Rwy 29, join downwind direct, if clear; otherwise, climb to 1,500 ft. amsl and proceed to join overhead the runway.

Holding

Join overhead the runway at no lower than 1,500 ft. amsl and maintain altitude over the circuit pattern until cleared of traffic. Then descend to circuit height of 800 ft. amsl when established crosswind.

Parking

When parking on the grass adjacent the Rwy 11 Undershoot, ensure there is sufficient distance (two rotor diameters) from the fixed wing taxiways into and out of Area "X".

Area Whiskey

Only instructors may land direct into Area Whiskey. PPL(H)s are to land on Rwy 11, hover taxi to the Rwy 11 Undershoot, shut down, then push the helicopter on wheels to Area Whiskey.

Operations on Grass Areas

- The grass areas in Shek Kong are inspected and identified before the first flight of the day.
- Grass areas where helicopters are allowed to land should be trimmed to enable an inspection on the surface of the ground and that the ground is suitable for a landing. Helicopters are not allowed to land in areas of the ground where the grass has grown to a length that will obscure the surface of the ground or the ground is not firm enough to prevent the skids from sinking into the ground.
- Helicopter pilots are notified by the Flight Ops for those grass areas not suitable to land with the assistance of the marked areas indicated on a location map of the airfield on the Notice Board.
- Notwithstanding the above Notice it is the responsibility of the Pilot In Command to ensure that all the grass areas where they intend to land and take off are trimmed to a length that will enable inspection of the surface and that the grass has not grown to a length that will cause entanglement of the skids and the ground is firm enough to prevent the sinking of the skids on landing and take off.

Chief Flying Instructor

25 October 2016.