LIMITED SERIOUS INCIDENT INVESTIGATION REPORT

Reference Number	CA18/3/2/1387								
Classification	Serious Incident	**Date**	22 January 2022	**Time**	1020Z				
Type of Operation	Arial Work Operations, Fire-fighting (Part 137)								
Location									
Place of Departure	Newlands Heliport, Western Cape Province	Place of Intended Landing	Newlands Heliport, Western Cape Province						
Place of Accident	Silver Mine Dam								
GPS Co-ordinates	Latitude	34˚04'31.22" S	Longitude	018˚24'02.10" E	Elevation	581 feet			
Aircraft Information									
Registration	ZS-HHJ								
Make/Model	Tamarack Helicopters Inc / UH-1H (Serial Number: 65-09637)								
Damage to Aircraft	Minor	Total Aircraft Hours	11 152.5						
Pilot-in-command									
Licence Type	Commercial Pilot Licence (CPL)	Gender	Male	Age 69					
Licence Valid	Yes								
Total Hours on Type	2 668.5	Total Flying Hours	5 456.3						
People On-board	1 + 0	Injuries	0	Fatalities	0	Other (on ground)	0		
What Happened									

On Saturday, 22 January 2022, a pilot on-board a UH-1H helicopter with registration ZS-HHJ took off from Newlands Heliport in the Western Cape Province to undertake a fire-fighting operation at Silver Mine Nature Reserve. The flight was conducted under the provisions of Part 137 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot stated that he filled the Bambi bucket with water from the dam and then tested the release mechanism of the Bambi bucket, which functioned satisfactorily. He then proceeded to fill the Bambi bucket with water again. Due to the shallow water level in the dam, the pilot could not submerge the Bambi bucket completely underwater, as a result, suspension cables got entangled on the tail rotor guard. During lift-off, the bucket swung horizontally (side to side) and remained tilted to one side. To remedy the situation, the pilot elected to fly to the nearby sports field with the

intention to untangle the empty Bambi bucket. However, whilst flying over a ridge and descending, the helicopter encountered a strong updraft along the cliff edge which caused the Bambi bucket, attached to a 5 metre (m) synthetic lifting line, to swing out and disappear from the pilot's helicopter mirror view. Shortly thereafter, the pilot felt (heard) a thump on the fuselage, which indicated that either the control head mechanism had detached or the Bambi bucket had made contact with the helicopter. There was no orbital observance conducted to check if the Bambi bucket had actually detached, according to the pilot.

As the Bambi bucket was not visible in the pilot's mirror field of vision (these mirrors are used by the pilot to monitor the sling load below the helicopter), the pilot assumed that it had either detached and fell off or had gotten entangled on an external part of the helicopter (the skid gear). The flight controls were tested by the pilot for any damage whilst still on the descent phase to the landing zone, flying at 30 knots with minimum control inputs (pilot induced). There was no vibration felt by the pilot, or loss of tail rotor authority experienced during the approach for landing. The helicopter landed on the sports field. After shutdown and during the walk-around inspection, the pilot noticed that the Bambi bucket was still suspended by two of the suspension cables from the helicopter's tail rotor guard. Further inspection revealed that the Bambi bucket was damaged, which appeared to have been caused during contact with the tail rotor blades. The helicopter sustained damage to both tail rotor blades. No person was injured during the incident.

Figure 1: The damaged Bambi bucket. (Source: Operator)

Figure 2: The damaged tail rotor blade with a nick on the leading edge.
(Source: Operator)

Figure 3: A similar helicopter fitted with a 5m synthetic sling line. (Source: Operator)

What was found:

- The pilot was issued a Commercial Pilot Licence on 29 May 2021 with an expiry date of 30 June 2022. The pilot was issued a Class 1 aviation medical certificate on 17 November 2021 with an expiry date of 30 May 2022, with a medical waiver.
- The helicopter was initially issued a Certificate of Airworthiness on 16 August 2018 with an expiry date of 31 August 2022.
- The last mandatory periodic inspection (Phase 1-6) that was carried out on the helicopter prior to the incident flight was certified on 19 November 2020 at 11 093.4 airframe hours.
- The helicopter was registered to the current owner on 5 April 2017.
- The operator was issued an Air Operating Certificate (AOC) under Part 137 on 24 December 2021 with an expiry date of 31 December 2022. The helicopter was duly authorised to conduct an aerial operation in accordance with the company's Operation Manual under G08 fire potting.
- According to the Operation Manual: Chapter 15.7 (Water Filling Procedure and Limitation), water filling/uplift from a shallow water source (dam) as well as mitigation procedure that must be followed when the bucket lifts horizontally are not addressed or clearly defined. The Operation Manual also does not have the tail rotor clearance calculation as laid out in the Bambi Bucket Operations Manual under Chapter 15.6: General Rules and Limitations.
- The type of the Bambi bucket used was BB2732B3. The pilot can vary the bucket's capacity

by the speed at which it is pulled from the water. As the submerged Bambi bucket is lifted, water pressure expands the fabric bucket shell and its internal fiberglass battens flex outward, increasing the Bambi bucket's volume. The greater the pressure, the more volume the Bambi bucket holds. The Bambi bucket has the capacity of carrying 1 230 litres of water. According to the tail rotor clearance calculation chart, the strap used was in accordance with the specification on the chart. The maximum speed to be flown with the Bambi bucket in tow is 80 knots of indicated airspeed (KIAS); this is according to the SEI Industries Bambi Bucket Operations Manual 2020A (see Appendix A).

- At the time of repositioning, the helicopter was flying at 30 KIAS, according to the pilot.
- The pilot did not release the Bambi bucket during the incident while flying.
- Weather was as follows:

  METAR FACT 221000Z 21006KT 170V250 CAVOK 35/18 Q1016=

  METAR FACT 221030Z 19010KT CAVOK 35/18 Q1016 NOSIG=

  The meteorological aerodrome report (METAR) for Cape Town International Airport (FACT) at the time of the serious incident indicated that the wind speed did not fall within the range of a strong wind which, according to the Beaufort Wind Scale, is between 22 to 27 knots (40 to 50 kilometres/per hour).

  The environmental conditions in the area where the helicopter was operated might have been substantially different from the METAR data.
- The Bambi bucket and associated cargo sling equipment were removed by the operator before any photographs were taken and made available to the investigating authority, which hampered the outcome of this investigation; and this was in contravention of Part 12.04.4 (Interference with objects and marks at the scene of an accident) of the Civil Aviation Regulations 2011 as amended (see Annexure A).

Probable cause

The Bambi bucket got entangled on the tail rotor guard as well as made contact with the tail rotor blades after it disappeared from the pilot's helicopter mirror view in-flight.

Contributory factors

None.

Safety Action/s

Following the incident – *the operator held a virtual meeting with all the helicopter firefighting pilots to discuss the occurrence. From this meeting, an operational decision was made that in the event a Bambi bucket should get tangled whilst being lifted from a pickup point, the pilot should slowly air taxi to the closest suitable landing area and jettison the load if unable to immediately land at the location to untangle the cables. According to the operator, this was initially "Red-Tagged" and*

acknowledged by all and is currently being added to the SOPs.

Safety Message and/or Safety Recommendation/s

- It is recommended to the operator to amend the Operation Manual and include water filling procedure and limitation as it currently does not address and/or clearly define water filling/upliftment from a shallow water source and mitigation procedure that must be taken when the bucket cables are snagged as a result of filling water from a shallow water source.
- It is recommended that the operator reviews and amends the Operation Manual Chapter 15.6 General Rules and Limitations for the tail rotor clearance calculation to be in line with the Bambi Bucket Operations Manual.
- It is recommended that pilots who operate sling loads land as soon as practical when the load or sling is out of sight or out of the inspection/monitoring mirror.

Purpose of the Investigation

In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011, this report was compiled in the interest of the promotion of aviation safety and the reduction of the risk of aviation accidents or incidents and ***not to apportion blame or liability****.*

About this Report

Decisions regarding whether to investigate, and the scope of an investigation are based on many factors, including the level of safety benefit likely to be obtained from an investigation. For this occurrence, no investigation has been conducted, and the Accident and Incident Investigations Division (AIID) has relied on the information submitted by the affected person/s and organisation/s to compile this brief report. The report has been compiled using information supplied in the initial notification, as well as follow-up information to bring awareness of potential safety issues to the industry in respect of this occurrence, as well as possible safety action/s that the industry might want to consider in preventing a recurrence of a similar accident.

This report provides an opportunity to share safety message/s in the absence of an investigation.

All times given in this report are Co-ordinated Universal Time (UTC) and will be denoted by (Z). South African Standard Time is UTC plus 2 hours.

Disclaimer

This report is issued by:

Accident and Incident Investigations Division

South African Civil Aviation Authority

Republic of South Africa

Appendix A: Bambi Bucket tail rotor clearance

Checking Tail Rotor Clearance

WARNING

Using a Bambi Bucket with insufficient tail rotor clearance could result in a tail rotor strike which could result in serious injury or death.

NOTICE

If using a longline, the minimum recommended length is 50 ft (15 m).

When a Bambi Bucket is attached directly to the helicopter cargo hook or attached using a longline less than 50 ft (15 m) in length, it is important to confirm that there is adequate tail rotor clearance. Before using the Bambi Bucket, check the tail rotor clearance.

1. Determine the tail rotor length by measuring the distance from the cargo hook to the closest point on the helicopter tail rotor.
2. Determine the bucket overall length from the following chart:

Model	Overall Length	
BB6072	12'- 11"	3.94 m
BB8096	14'- 6"	4.42 m
BB8096S	12'- 11"	3.94 m
BB9011	14'- 6"	4.42 m
BB9011S	12'- 11"	3.94 m
BB1012	14'- 6"	4.42 m
BB1012S	12'- 11"	3.94 m
BB1214	14'- 10"	4.52 m
BB1214S	13'- 3"	4.04 m
BB1518	15'- 2"	4.62 m
BB1518S	13'- 7"	4.04 m
BB1821	15'- 11"	4.85 m
BB1821S	14'- 5"	4.39 m
BB1821L	18'- 1"	5.51 m
BB2024	20'- 1"	6.13 m
BB2024S	15'- 10"	4.82 m

Model	Overall Length	
BB2024L	22'- 4"	6.81 m
BB2226	15'- 10"	4.82 m
BB2732	23'- 0"	7.00 m
BB2732S	15'- 2"	4.63 m
BB2732B3	16'- 5"	5.00 m
BB3542	23'- 8"	7.22 m
BB420B	23'- 8"	7.22 m
BB4453	23'- 9"	7.25 m
BB5566	24'- 0"	7.32 m
BB680K	24'- 0"	7.32 m
BB6578	24'- 2"	7.37 m
BB7590	30'- 3"	9.21 m
BBHL4000	30'- 0"	9.14 m
BBHL5000	32'- 0"	9.75 m
BBHL7600	32'- 6"	9.91 m
BBHL9800	33'- 6"	10.21 m

Lengths are accurate to within 1%. Specifications subject to change.
If a firesock is used, add 8" (0.20m) to the above dimensions.

To confirm the bucket overall length, stretch out the bucket on the ground, pulling the suspension cables taut. Measure the distance from the shackle on the head to the bottom of the extended dump valve. If a firesock is attached, measure to the bottom of the firesock.

3. The tail rotor clearance is equal to the tail rotor length minus the bucket overall length.
4. **The tail rotor clearance must be a minimum of 6" (0.15 m).**

If the tail rotor clearance is insufficient, shorter suspension lines, triplines/riser, ring and restrainer, and deployment lines must be used and can be ordered from SEI. Please specify the model and serial number when ordering parts.

Appendix B: Bambi bucket flight operations

Section 4: Flight Operations

Flying the Bucket

The Bambi Bucket should be flown in accordance with the United States Forest Service recommendations limiting all helicopters, other than tandem rotor, to a maximum 80 KIAS while conducting external cargo hook operations.

The recommended never exceed speed (VNE) for the Bambi Bucket is 80 KIAS, however, this is not a flight manual limitation. Speeds above 80 KIAS should be approached with caution and any decision to exceed this speed should be based on flight characteristics, aircraft flight manual limitations, aircraft/bucket configuration and load stability, etc.

Any change that exceeds this recommendation should be formally authorized in your company's external load specifications. A suggested flight procedure is to build up speed slowly with the Bambi Bucket, under prevailing conditions, to determine a safe maximum flying speed.

In order to reduce drag on the bucket when empty, it can be flown in a valve open position by pressing the release mechanism once while in forward flight.

The dead weight of the load ensures different handling characteristics than when flying empty. As a result, the Bambi Bucket does not 'pulse' or 'throb' under load in flight.

Filling the Bucket

Once the Bambi Bucket touches the water surface, it immediately tips and sinks. This is a result of the ballast on one side of the bucket which makes it unstable on the water. A Bambi Bucket does not have to be towed to make it sink.

WARNING

When filling the Bambi Bucket, do not execute an abrupt pedal turn with the helicopter close to the water while towing the bucket. There is a danger that the Bambi Bucket suspension lines could get caught on a rear skid resulting in a dynamic rollover on lift out. This could cause personal injury and helicopter damage.

Check the load and suspension cables with your mirrors before lift out.

Annexure A

Interference with objects and marks at the scene of the accident

Part 12.04.4

(1) Subject to the provisions of this Part, no person shall interfere with an aircraft which has been involved in an accident, the wreck or wreckage, a part or component thereof or anything transported therein or any marks resulting from the accident which may be of assistance in an investigation—

(a) until authorised to do so by the investigator-in-charge; and

(*b*) until, in the case of an aircraft that must be cleared by a customs officer by virtue of the provisions of the Customs and Excise Act, 1964 (Act No. 91 of 1964), clearance has been issued or permission granted by such officer.

(2) The provisions of sub-regulation (1) shall not prevent any action necessary for—

(a) the rescue or extrication of persons or animals from the aircraft or the wreck;

(b) the reasonable protection of the aircraft, the wreck or wreckage from destruction by fire or other causes;

(c) the safeguarding by the owner, operator or police guard of precious metals, jewellery or valuables;

(d) the prevention of danger or removal of an obstruction to other aircraft, other means of transport or to the public; and

(e) the removal of the aircraft, any part or component thereof or anything transported therein to a safe place, when in water or otherwise endangered.