SOUTH AFRICAN CIVIL AVIATION AUTHORITY

Section/division **Accident and Incident Investigations Division** Form Number: CA 12-57

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10195						
Classification	Accident	**Date**	19 July 2022		**Time**	0805Z	
Type of Operation	Private (NTCA Part 94)						
Location							
Place of Departure	Bapsfontein Aerodrome (FABA), Gauteng Province	Place of Intended Landing	Bapsfontein Aerodrome (FABA), Gauteng Province				
Place of Occurrence	On Runway 21 at FABA, Gauteng Province						
GPS Co-ordinates	Latitude	25° 59' 20.83" S	Longitude	28° 24' 58.22" E	Elevation	5 272 ft	
Aircraft Information							
Registration	ZU-FHP						
Make; Model; S/N	Rainbow Skyreach (Pty) Ltd; Cheetah XLS (Serial Number: CH109)						
Damage to Aircraft	Substantial	Total Aircraft Hours	525.4				
Pilot-in-command							
Licence Type	National Pilot Licence (NPL)	Gender	Male	Age	34		
Licence Valid	Yes	Total Hours on Type	121.3	Total Flying Hours	121.3		
People On-board	1 + 1	**Injuries**	0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On 19 July 2022, a pilot and a passenger on-board a Cheetah XLS aircraft with registration ZU-FHP took off on a private flight from Bapsfontein Aerodrome (FABA), also known as Microland Flight Park, in Gauteng province, to Petit Airfield (FARA) in the same province. The pilot's intentions were to perform touch-and-go landings at FARA before returning to FABA. No flight plan was filed for the flight, which was conducted under visual flight rules (VFR) by day and under the provisions of Part 94 of the Civil Aviation Regulations (CAR) 2011 as amended.

According to the pilot, the flight to FARA proceeded as expected and, after conducting four touch-and-go landings, the pilot returned to FABA for a full-stop landing. During the three-point landing, the aircraft's tailwheel impacted the runway surface hard, which caused the primary spring-loaded tail gear flat bar that connects to the tail wheel axle to snap. This resulted in the pilot losing directional control of the aircraft which veered off to the right-side of the runway before it came to a stop.

The aircraft's spring-loaded tail gear bar was damaged, the right main landing gear wheel axle broke off, and the rudder was also damaged. Both occupants were uninjured during the accident sequence.

Figure 1: The aircraft post-accident. (Source: Owner)

Figure 2: Location of the right axle fracture (in the yellow circle). (Source: Owner)

Findings

1. Pilot Information:

1.1. The pilot was reissued a National Pilot Licence (NPL) on 28 October 2021 with an expiry date of 11 September 2023. The Cheetah XLS aircraft type was endorsed on the pilot's licence. The pilot was issued a Class 2 aviation medical certificate on 3 July 2018 with an expiry date of 31 July 2023, with no restrictions.

1.2. The pilot was licensed and qualified for the flight in accordance with the existing regulations.

2. Aircraft Information:

2.1. According to the aircraft's latest Certificate of Release to Service (CRS), the aircraft's last annual inspection was certified on 8 April 2022 at 494.4 airframe hours. At the time of the accident flight, the aircraft had accumulated 525.4 hours. The aircraft was flown a further 31 hours since the last inspection.

2.2. The last annual inspection was carried out by an approved person (AP) with a valid certificate. The AP was certified to carry out maintenance on the aircraft type.

2.3. The aircraft's logbooks and maintenance history were scrutinised, and all documents were found to be in order. There were no applicable Service Instructions (SIs) / Service Bulletins (SBs) / Airworthiness Directives (ADs) that had to be complied with during the last inspection. There were no outstanding technical defects recorded in the aircraft's logbooks and flight folio.

2.4. The aircraft had a valid Authority to Fly (ATF) certificate and had been maintained in accordance with the regulations. The aircraft was airworthy when it dispatched for the flight.

2.5. The aircraft was substantially damaged; and the occupants were uninjured during the accident.

3. BushCat – Cheetah XLS Owner's Manual Information:

3.1. According to the *Training Supplements section – Approach and Landing:*

The normal approach speeds for the aircraft, depending on the type of landing and weight, are between 56 and 60 MPH. ***However, the aircraft has been shown to bleed off speed very quickly during the flare and high sink rates can occur. To reduce the risk of hard and bounced landings, it is recommended that an approach speed of 1.3 x V_{so} is used, particularly when new to the aircraft. The aircraft should then be gently flared at 3-6ft above the landing surface and this altitude held until the speed bleeds off and the aircraft sinks to the ground.***

The lower approach and landing speeds afforded by the vortex generators can lead to a lack of elevator authority to flare the aircraft prior to touchdown if speeds lower than the published V_{Ref} are used, particularly if steeper approaches are flown to clear obstacles. It is imperative that this situation is caught before the flare is initiated, by diligently flying the recommended approach speeds and going around if the approach becomes destabilised. If it is found that full aft stick is inadequate to achieve the required pitch rate/attitude in the flare, a controlled increase in power can assist the situation.

3.2. Based on the Training Supplements issued to owners by the manufacturer in section 3.1, it is possible that the aircraft experienced a rapid sink rate during the flare, which led to a hard landing with the tailwheel first. As a result, the main spring-loaded tail gear flat bar broke off and the pilot lost directional control of the aircraft, which veered off to the right-side of the active runway where it came to rest. The aircraft was substantially damaged during the accident sequence.

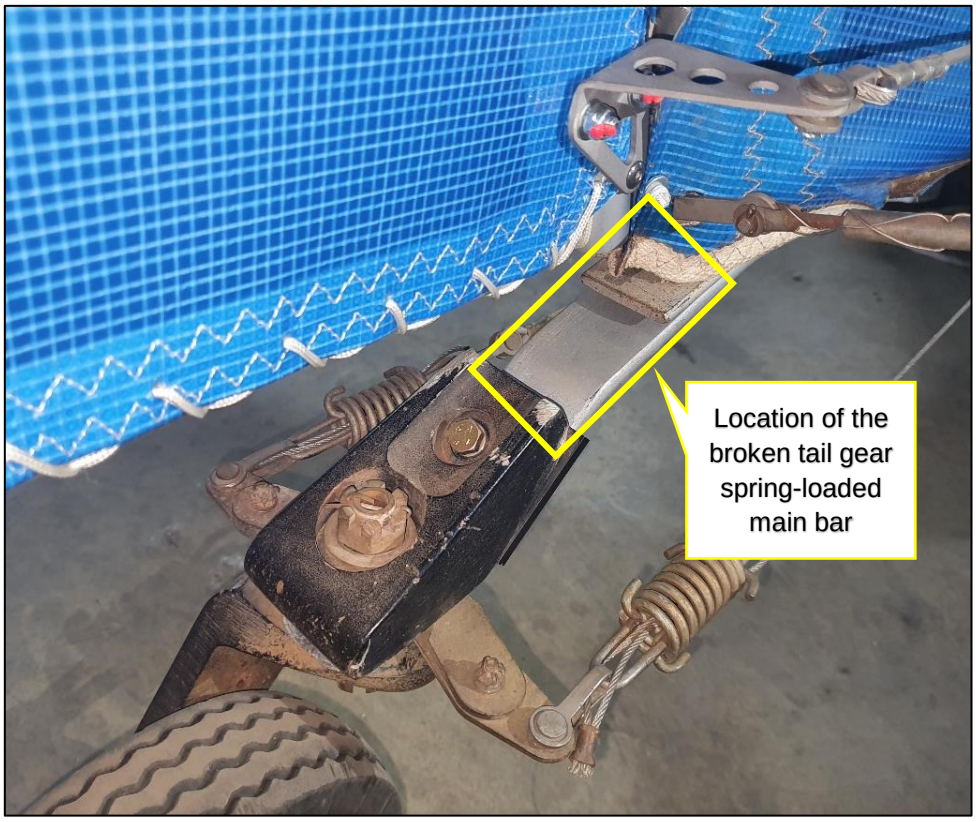

Figure 3: Location of the tailwheel primary spring-loaded tail gear flat bar that failed.

- Three-point landing
  (Source: http://krepelka.com/fsweb/learningcenter/advancedflyingskills/flyingtaildraggers.htm)

  Landing

  Taildraggers require skill and judgment to land safely. A slow landing speed and proper pitch attitude control are the keys. Once the tailwheel is on the ground, hold the joystick back to bring down the tail—and keep it there. This helps to prevent the tail from rising if you hit a bump. If you land with too much airspeed, however, the plane may want to bounce into the air and fly again, as the wing is still producing enough lift to carry the airplane back into the air.

  A three-point landing is where all three wheels (the two main gears and the tailwheel) touch the runway surface at the same time. But it takes some practice to achieve. This requires that the aircraft be in a nose-high attitude at touchdown, which takes getting used to if you've only flown tricycle-gear airplanes.

  The nose-high attitude for landing a taildragger three-point landing is the same as the attitude when the taildragger is sitting on the taxiway or runway at rest. Memorize this view, or "sight picture." This sight picture is what you will establish in the landing flare to perform perfect three-point landings.

  The key to successful taildragger landings—and perhaps one of the most challenging aspects of landing a taildragger—is to keep the aircraft's speed as slow as possible. If you attempt a three-point landing with too much airspeed or touch down too hard, the increased angle of attack of the nose-high attitude (and thus increased lifting force generated by the wings) can

cause the airplane to bounce back into the air. Close to stall speed, this can be dangerous. If a bounce occurs, apply full throttle, and then gently drop the plane back onto the runway.

Note: *Because this technique requires an even greater angle of attack than a full-stall, three-point landing, the landing speed is even slower, and is often the choice for short runways. However, tail-first landings can damage the tailwheel gear if the touchdown is too hard. Touching down too hard can also result in the aircraft hopping from tailwheel to main gear, back to tailwheel and so forth, which makes the aircraft difficult to control on the ground.*

4. Meteorological Information:

4.1. The weather information below was obtained from the Meteorological Aerodrome Report (METAR) that was issued by the South African Weather Service (SAWS), recorded on 19 July 2022 at 0800Z at O.R. Tambo International Airport (FAOR) Automatic Weather Station (AWS), which is located approximately 13 nautical miles (NM) from the accident site.

Wind Direction	350°	Wind Speed	13kt	Visibility	9999m
Temperature	12°C	Cloud Cover	CAVOK	Cloud Base	CAVOK
Dew Point	05°C	QNH	1027hPa		

4.2. Based on the wind conditions prevalent at the time of the accident, the aircraft was landed in a tailwind component of 9.96 knots (kt) and a crosswind component of 8.36 kt from the right. According to *Normal Procedures: Airspeeds for safe operation of the aircraft Owner's Manual*, the maximum crosswind component for this aircraft is 32 miles per hour (mph) (27 kt), however, the maximum tailwind component is not provided.

Based on the METAR information, the crosswind component prevalent at the time of the flight was within the limitations of the aircraft and would not have adversely affected its landing.

5. Conclusion:

5.1. According to the pilot, the indicated landing airspeed was 55 mph (48 kt) with the flaps set at 30 degrees. However, according to the aircraft Owner's Manual, *to reduce the risk of hard and bounced landings, it is recommended that an approach speed of 1.3 x V_{s0} is used*.

	Speed	
	CAS [MPH]	IAS [MPH]
V_s	47	42
V_{s1}	44	37
V_{s0}	43	35
V_R	53	56
V_{Ref}	56	56
$V_{bg\ (clean)}$	64	67
$V_{x\ (take\text{-}off\ flap)}$	56	60
$V_{Y\ (clean)}$	68	76

Figure 4: Performance flight speeds. (Source: Cheetah XLS Owner's Manual)

The required indicated airspeed (IAS) for approach was calculated as follows:

$$1.3\ x\ V_{s0} = 1.3\ x\ 35\ mph = \ 45.5\ mph$$

5.2. Based on the calculation above, the aircraft's recommended approach speed was exceeded by 9.5 mph (8 kt), therefore, the aircraft's sink rate was too rapid during the flare because of the high landing speed, which led to a hard landing and, most likely, a bounce. This resulted in the primary spring-loaded tail gear flat bar breaking off as well as the damage on the rudder during impact. The pilot lost directional control of the aircraft on touchdown, resulting in damage to the right main landing gear.

Probable Cause

During a three-point landing, the aircraft's landing speed was higher than normal, which led to an inadvertent tail-first hard landing; as a result, the primary spring-loaded tail gear flat bar broke off, followed by loss of directional control.

Contributing Factor

Poorly executed three-point landing technique.

Safety Action/s

None.

Safety Message

Pilots should execute a go-around immediately if they recognise that their approach is unstable. This is a proven risk mitigation when it comes to avoiding a hard touchdown which may result in damaging the aircraft and/or injuring persons.

About this Report

The decision 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, a limited scope, fact gathering investigation was conducted to compile this limited report and allow for greater industry awareness of potential safety issues as well as possible safety action/s that the industry might want to consider in preventing a reoccurrence.

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****.*

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