SOUTH AFRICAN CIVIL AVIATION AUTHORITY

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

LIMITED OCCURRENCE INVESTIGATION REPORT – FINAL

Reference Number	CA18/2/3/10421					
Classification	Accident	**Date**	16 February 2024		**Time**	0815Z
Type of Operation	Private (Part 91)					
Location						
Place of Departure	Hoedspruit Civil Airport (FAHT), Limpopo Province		Place of Intended Landing		Nelspruit Airport (FANS), Mpumalanga Province	
Place of Occurrence	Runway 22 at Nelspruit Airport (FANS)					
GPS Co-ordinates	Latitude	25°29'56.96"S	Longitude	030°54'52.18"E	Elevation	2901 ft
Aircraft Information						
Registration	ZS-MBT					
Make; Model; S/N	Textron Aviation; Beach Baron 58 (Serial Number: TH-129)					
Damage to Aircraft	Substantial		Total Aircraft Hours	6366.7		
Pilot-in-command						
Licence Type	Commercial Pilot Licence (CPL)		Gender	Male	Age	52
Licence Valid	Yes	Total Hours	6792.4	Total Hours on Type		4.1
Total Hours 30 Days	12.73		Total Flying on Type Past 90 Days			4.1
People On-board	1+0	**Injuries** 0	**Fatalities**	0	**Other (on ground)**	0

What Happened

On Friday, 16 February 2024, a pilot on-board a Beach Baron 58 aircraft with registration ZS-MBT took off on a private flight from Hoedspruit Civil Aerodrome (FAHT) in Limpopo province to Nelspruit Aerodrome (FANS) in Mpumalanga province. The flight was conducted under visual meteorological conditions (VMC) by day and under the provisions of Part 91 of the Civil Aviation Regulations (CAR) 2011 as amended.

The pilot reported that the take-off, flight and approach to FANS were uneventful. He stated that after the air traffic control (ATC) cleared him to land, he extended the landing gears and the three green lights illuminated on the instrument panel, which indicated that the undercarriage was in 'down and locked' position. The pilot also configured the flaps to Stage 2. He stated that after touchdown during the landing roll at approximately 150 metres (m) from the threshold and whilst the aircraft's speed decreased and the weight settled on the landing gears, the nose gear collapsed which caused the nose section to drop. Subsequently, the left main gear and the right main gear dropped, and thus, both propellers struck the ground. The aircraft veered off to the left and exited the runway; it skidded on its belly for approximately 5m before it stopped on the grass facing north-west.

A witness who was at the hangars had captured the event on a mobile phone as the aircraft was landing. The video footage showed the aircraft's approach and descent near the runway. As it neared a flaring height, the aircraft's landing gears began to extend. The aircraft maintained a slight float and immediately touched down with the main landing gears; it rolled along the runway until the nose landing gear dropped. As soon as the aircraft's weight settled, it collapsed and the nose section dropped, followed by the main landing gears. This caused the aircraft's belly to contact the runway; thereafter, it skidded and veered off to the left side of the runway.

The aircraft sustained damage to the nose section, both propellers and the belly. After the accident, the aircraft was relocated to the hangar. The aircraft was recovered before the occurrence was reported to the Accident and Incident Investigations Division (AIID).

SRP date: 14 May 2024 Publication date: 15 May 2024

The accident occurred during landing on the asphalt Runway 22 and at Global Positioning System (GPS) co-ordinates determined to be 25°29'56.96"S, 030°54'52.18"E, at a field elevation of 2901 ft.

Figure 1: Aerial view of the accident site at FANS. (Source: Google Earth)

Figure 2: The aircraft during approach at a low height with the landing gear retracted. (Source: Still video footage)

Figure 3: The aircraft undercarriage collapses. (Source: Still video footage)

Figure 4: The aircraft scrapes along the runway as it veers off to the left. (Source: Still video footage)

After the accident, the operator relocated the aircraft from the accident site without informing and attaining permission from the investigating authority. Although the post-accident inspection was conducted, no testing and conclusion could be established except for the finding that both the gearbox and the electrical motor stopped operating before the undercarriage was fully extended. There was no other evidence to prove that the landing gear system had failed during the landing phase.

Fine weather conditions prevailed on the day of the flight. The meteorological conditions provided by the pilot through the pilot questionnaire were as follows:
Wind direction: 080°; wind speed: light and variable; visibility: 9999m; air temperature: 21°C; cloud cover: 3/8; cloud base: 1500ft; dew Point: 13°C.

Aircraft

The Beechcraft Baron is a four to six-seat with all metal, low-wing, equipped with two engines and a retractable tricycle landing gear system.

Figure 5: The aircraft type. (Source: https://beechcraft.txtav.com/en/baron-g58#specs)

Maintenance

A review and study of the aircraft maintenance records was conducted. It was found that the aircraft's maintenance was conducted as per the manufacturer's prescribed procedures. All Service Bulletins (SB), Service Instructions (SI), Airworthiness Directives (AD) and so forth were complied with and they were recorded in the logbooks.

The aircraft's mandatory periodic inspection (MPI) was conducted and certified, and the Certificate of Release to Service (CRS) was issued on 22 November 2023 at 6364.2 airframe hours with an expiry date of 21 November 2024 or at 6464.2 airframe hours, whichever comes first. The aircraft had 6366.7 airframe hours at the time of the accident. It accumulated 2.5 hours since the last MPI.

The latest maintenance included rigging of the landing gears which required adjustment of the extension, and retraction cables and control tubes mechanism.

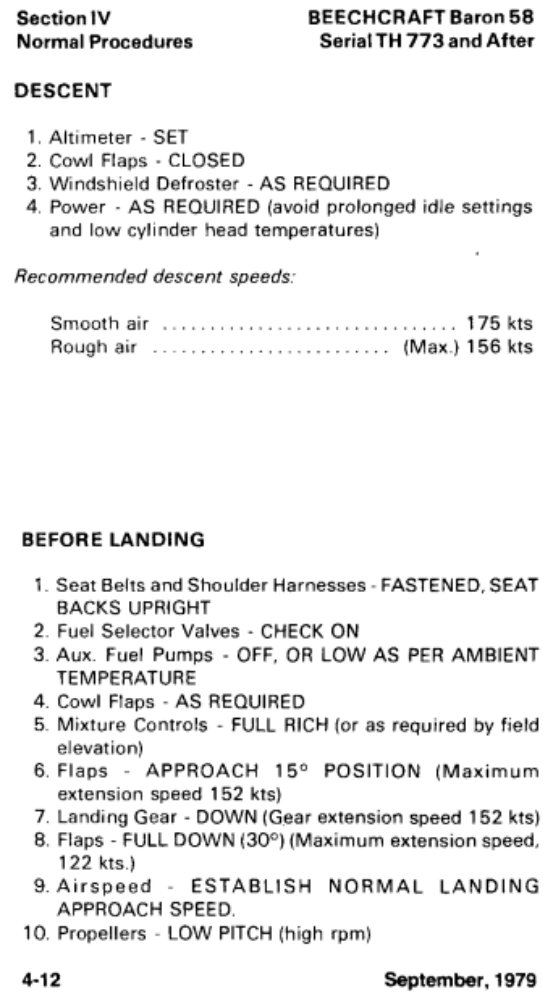
Maintenance Manual (Source: Beechcraft Manual 55-590000-13 HO Rev HO Dated 15/12/2022)

Landing Gear Operation
The very nature of the Baron undercarriage system precludes the possibility of the main gear collapsing because the nose gear collapsed. All three undercarriage struts are operated by a central actuator/gearbox which cycles through 180 degrees between 'gear up' and 'gear down' and is driven by an electric motor.

The main gear and nose gear are retracted and extended via push rods onto drag braces and they are locked into the 'down' position by sufficient travel of the 'gearbox' which compresses a spring on the push rods which holds the drag brace in over centre by the tension of the spring.

*If the nose gear collapses for any reason it does not affect the tension of the push rod spring on the main gear, which will still be locked down – '**if**' - the actuator/gearbox has cycled its full travel. The fact that all three gears collapsed indicates that the gearbox did not do its full cycle and that there was insufficient travel to compress the push rod springs.*

Note that on the touchdown, the squat switch is activated on the main gear and power to the electric motor is immediately lost (this also prevents retraction of the gear while on the ground). This also precludes the theory that the pilot selected gear up instead of flaps up.



Section IV
Normal Procedures

BEECHCRAFT Baron 58
Serial TH 773 and After

DESCENT

1. Altimeter - SET
2. Cowl Flaps - CLOSED
3. Windshield Defroster - AS REQUIRED
4. Power - AS REQUIRED (avoid prolonged idle settings and low cylinder head temperatures)

Recommended descent speeds:

Smooth air ..... 175 kts
Rough air ..... (Max.) 156 kts

BEFORE LANDING

1. Seat Belts and Shoulder Harnesses - FASTENED, SEAT BACKS UPRIGHT
2. Fuel Selector Valves - CHECK ON
3. Aux. Fuel Pumps - OFF, OR LOW AS PER AMBIENT TEMPERATURE
4. Cowl Flaps - AS REQUIRED
5. Mixture Controls - FULL RICH (or as required by field elevation)
6. Flaps - APPROACH 15° POSITION (Maximum extension speed 152 kts)
7. Landing Gear - DOWN (Gear extension speed 152 kts)
8. Flaps - FULL DOWN (30°) (Maximum extension speed, 122 kts.)
9. Airspeed - ESTABLISH NORMAL LANDING APPROACH SPEED.
10. Propellers - LOW PITCH (high rpm)

4-12 September, 1979

Figure 6: The Beech Baron 58 before landing checks.

Post-accident Inspection Findings

According to the aircraft maintenance organisation (AMO) which conducted the post-accident inspection, during relocation, the aircraft's uplock striker was disconnected to free the gear (to fall freely). The landing gears were then locked with the use of a jury strut. The owner checked with the AMO to confirm if the cockpit controls were not tampered with following the accident, and if the gearbox and the emergency crank handle had not been disturbed.

The aircraft maintenance organisation (AMO) which conducted the post-accident inspection on the aircraft's landing gear system provided the following information:

State of the aircraft

What was undertaken:
The actuator/ gearbox access panel was opened. It was observed that the actuator arm/quadrant on top of the gearbox had not rotated 180 degrees with a visible ±15 degrees remaining for further travel to full extension. This was proven by engaging the emergency crank and manually cranking the landing gear which further engaged the gearbox to a down position. According to the gearbox design specification, there is an internal built-in dynamic brake relay stop that allows the electrical motor to stop if contact is detected which gives a backlash of 1/8 -1/4 turn of the crank handle which is achieved during undercarriage system rigging. The crank was found to have allowed 3-4 turns towards the down position indicating the motor that the motor had stopped before the full cycle of the gearbox.

AMO's Conclusion:
Although the pilot reported that he had observed a green light, it is a known fact that the green light indication comes ON a second before the full cycle. In this case, for unknown reasons, the gearbox/ electrical motor stopped too soon, preventing the full lockdown. The AMO did not crank the handle to the stop as evidence was already showing that the landing gear gearbox or motor stopped before it reached the down and locked position. No further evidence of the motor or gearbox failure was noted.

The investigation revealed that the aircraft approached the runway with the landing gears retracted. If the landing gears were selected but not locked, the gear indication in the cockpit would have remained red and not indicate green. This is evidenced by the actuator quadrant arm which had not rotated to the full 180° thus, making it impossible for the landing gear indicator lights in the cockpit to have turned to green. There was no report of landing gear problems during approach, and there was no attempt to use the emergency landing gear extension system. Therefore, the investigation revealed that there were no landing gear system problems.

Findings

1. The pilot had a Commercial Pilot Licence (CPL) Airplane that was initially issued by the Regulator (SACAA) on 12 March 2012. The licence was reissued on 2 February 2023 with an expiry date of 29 February 2024. The pilot's aviation medical certificate was valid; it was issued on 9 October 2023 with an expiry date of 30 October 2024. The aircraft type was endorsed on the pilot's licence with additional night and instrument ratings.

2. The pilot had a total of 6792.4 hours which he acquired from both airplanes and helicopters. He accumulated 1873.1 hours on airplanes. Of the 1873.1 hours, 4.1 hours were on the accident aircraft type.

3. The aircraft had a Certificate of Airworthiness (C of A) that was issued by the Regulator on 11 December 2023 with an expiry date of 12 December 2024. The Regulator issued the aircraft's Certificate of Registration (C of R) to the owner on 30 September 2022.

4. The aircraft's mandatory periodic inspection was conducted and certified, and the Certificate of Release to Service (CRS) was issued on 22 November 2023 at 6364.2 airframe hours with an expiry date of 21 November 2024 or at 6464.2 airframe hours, whichever comes first. The aircraft had 6366.7 hours at the time of the accident. It accumulated 2.5 hours after the last MPI.

5. The aircraft maintenance organisation (AMO) that maintained the aircraft had an AMO Certificate that was issued by the Regulator on 21 August 2023 with an expiry date of 31 August 2024. The aircraft type was endorsed on the AMO's maintenance and operational specifications (Ops Specs) document that was issued on 21 August 2023 with an expiry date of 31 August 2024.

6. The aircraft was on final approach with the landing gears retracted. It is likely that when an audio warning sounded, it was only then that the pilot realised the landing gears were not selected to the 'down and locked' position. Instead of executing a go-around, the pilot extended the landing gears (selected them to the down position) which resulted in the aircraft touching down whilst the landing gears were transitioning to the down position and, thus, collapsed.

7. Evidence from the AMO stated that "*the actuator arm show that it had not rotated to the full 180° with a visible ±15° remaining for a further travel for it to be fully extended and that indicated that landing gears touched down whilst they were in transition and not fully extended and locked"*.

8. The weather was good at the time of landing; it did not contribute to this accident.

Probable Cause(s)

The landing gears were extended late during final approach and the aircraft touched down whilst the landing gears were transitioning and, thus, collapsed.

Contributing Factor(s)

Failure to conduct a go-around after the landing gear audio warning sounded.

Safety Action(s)

None.

Safety Message and/or Safety Recommendation/s
Pilots should conduct a go-around when the aircraft is not properly configured for the final approach and landing.
About this Report
The decision to conduct a limited investigation is based on factors, including whether the cause is known and the evidence supporting the cause is clear, the level of safety benefit likely to be obtained from an investigation, and that will determine the scope of an investigation. For this occurrence, a limited 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 limited report. The report has been compiled using information supplied in the initial notification, as well as from follow-up desktop inquiries 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 occurrence. *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.*
Purpose
In terms of Regulation 12.03.1 of the Civil Aviation Regulations (CAR) 2011 and ICAO Annex 13, 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 apportion blame or liability.
Disclaimer
This report is produced without prejudice to the rights of the AIID, which are reserved.

This report is issued by:
Accident and Incident Investigations Division
South African Civil Aviation Authority
Republic of South Africa