

Piper PA-34-200T Seneca II, G-BEHU

AAIB Bulletin No: 4/2003	Ref: EW/C2002/9/2	Category: 1.3
Aircraft Type and Registration:	Piper PA-34-200T Seneca II, G-BEHU	
No & Type of Engines:	2 Continental Motors LTSIO-360-EB piston engine	
Year of Manufacture:	1976	
Date & Time (UTC):	20 September 2002 at 0926 hrs	
Location:	Prestwick Airport	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 4
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Scraping to the underside of the fuselage and wings, propellers damaged.	
Commander's Licence:	Private Pilots Licence	
Commander's Age:	60 years	
Commander's Flying Experience:	443 hours (of which 252 were on type)	
	Last 90 days - 28 hours	
	Last 28 days - 8 hours	
Information Source:	AAIB Field in the UK	

Synopsis

The aircraft was on final approach for Runway 13 at Prestwick and full downwind checks had been carried out. The pilot confirmed three greens, indicating the landing gear was down and locked. Following what the pilot described as a very smooth landing, the brakes were applied and the flaps were selected up; the left side of the aircraft vibrated followed by the left propeller striking the runway. Shortly afterwards the right propeller struck the ground and the aircraft ended up sliding on its underside. After a short distance the aircraft rotated through 90° on the runway before coming to a stop. The passengers and pilot escaped unhurt. After extensive post accident tests no faults could be found with the landing gear or its control system.

History of Flight

G-BEHU was being flown from Stapleford to Prestwick and on board were the pilot and four friends as passengers. One friend was seated in the front right hand seat and the remaining three were in the aft passenger compartment, with two facing forwards and one facing aft. The flight from Stapleford to Prestwick had been without incident and, at the end of the flight, the aircraft was positioned downwind for an approach to Runway 13. The pilot stated that he carried out his downwind checks, which included checking that the landing gear was extended by confirmation that the three green landing gear down and locked lights on the pilots instrument panel, were illuminated. As the pilot had experienced a problem with the landing gear on this aircraft on a previous occasion, he visually confirmed that at least the nose landing gear (NLG) had extended by using the mirror on the left engine cowl. (This mirror is in a position to clearly show the extended NLG, but not the main landing gears (MLGs).)

The aircraft was turned onto final approach and the pre-landing checks carried out by the pilot indicated that nothing appeared to be abnormal with the aircraft. The passengers and pilot felt the aircraft land and later commented that it was very smooth. Following the landing, the pilot applied the brakes and made a request to the tower for instructions as to which runway exit was to be used. As he did this, he selected the flap lever to UP to raise the flaps. At this point the left side of the aircraft began to vibrate, described by the occupants as though there was a flat tyre. The left propeller was then seen to strike the runway and, instinctively, the pilot pulled back on the control column and applied right aileron. The right propeller then struck the runway and a grinding noise was apparent from the underside of the aircraft. The aircraft then continued to travel along the runway on its underside to the left of the runway centre line. After a short distance, it rotated through 90° before coming to rest facing south-west between blocks 10 and 9 of Runway 13.

The three passengers in the aft passenger compartment made their exit through the aft door on the left of the aircraft; the front passenger alighted by the front door, with the pilot following after he had shut the aircraft down. All the passengers had been wearing lap strap and diagonal harnesses and were unhurt in the accident. Neither the passengers nor the pilot recall any unusual warning lights or sounds prior to the landing. There were no eyewitnesses to the accident and the airport CCTV security cameras did not pick up G-BEHU during its approach and landing. Tower personnel were unable to recall if they saw the aircrafts approach and landing, but quickly became aware that it had crashed.

Damage sustained to the fuel drains on the underside of the left wing during the ground slide resulted in a significant amount of leakage of fuel. There was no fire but when the fire service arrived they quickly applied foam to the aircraft and the surrounding area.

A local maintenance organisation, which offered assistance, made the aircraft safe by gaining access to the battery and disconnecting it, and helped remove the aircraft from the runway. It was lifted, using a crane, and placed on a trolley. During the lift it was observed that the NLG was retracted, with the nose gear doors closed, and that the right and left main gears were sagging under their own weight.

Landing Gear System

G-BEHU was fitted with a tricycle retractable landing gear system. The system is hydraulically operated, electrically powered and controlled, and features a manual extension facility as an emergency back up. The NLG retracts forward and the MLGs inboard. The system uses its own

hydraulic power pack, located in the aircraft's nose, and is controlled by two solenoids operated from the cockpit selection switch. These control a reversible electric motor, which provides pressure in either the up or down sense to each of the three gear hydraulic actuators.

Several switches are installed in the system for control and warning purposes. Each landing gear has an UP limit switch, which is activated whenever the gear is physically in the up position, and a DOWN limit switch which actuates once the gear is down and fully locked in position. Additionally, the left gear is fitted with a safety (weight on wheels) switch, such that when the gear is compressed on the ground, it actuates and isolates electrical power from the UP solenoid in the hydraulic power pack and so prevents the landing gears from being inadvertently retracted.

Gear indications in the cockpit take the form of a red GEAR UNSAFE light at the top of the left cockpit instrument panel, a warning horn and three green gear down and locked lights. These lights are connected to their respective DOWN limit switches on each gear and, when these operate, the lights illuminate. The red GEAR UNSAFE lights illuminate whenever there is a discrepancy between the gear selected position and the actual gear position determined from the various limit switches on each gear. Additionally, the gear warning horn sounds if the safety switch signals the left gear to be compressed with the selector lever not at DOWN. The horn will also sound if any of the three gear DOWN limit switches indicate any landing gear is not down and locked with the throttles set to low power. This is approximately defined as a manifold pressure of less than 14 inches and it is signalled by throttle lever position from a micro-switch in the throttle quadrant.

Once all three DOWN limit switches are activated as the gear locks down, power to the DOWN solenoid is removed and the hydraulic motor stops. The gear is retained in the down and locked position by over-centre springs in the sidestay lock links. However, should any one of the three DOWN limit switches indicate that a gear is no longer locked down, the hydraulic motor restarts, generating pressure in the gear down sense, and attempts to re-lock the gears down.

The gears are not physically or mechanically locked in the UP position; instead they rely on the retention of hydraulic pressure in the UP lines of the system. If the pressure drops, as is likely due to internal leakage, a pressure switch commands the UP solenoid to energise the electric motor in the hydraulic power pack and re-apply pressure to the UP lines. This ensures the gear remains retracted. To extend the gear manually, an emergency lever is provided which, when pulled, dissipates the hydraulic pressure in the UP lines of the system and allows the gears to free-fall under the influence of gravity. The over-centre springs on the lock links then lock the sidestays, and hence the gears, into the DOWN position.

The electrical control system and hydraulic power pack are protected by two circuit breakers (CBs). The Landing Gear Control CB protects the control system and if this is tripped, then the GEAR UNSAFE, the green down and locked lights and the warning horn do not operate. In addition there would be no control of the UP and DOWN solenoids in the hydraulic power pack. The Landing Gear Pump CB protects the hydraulic power pack motor and if this is tripped then the hydraulic motor does not operate in either direction.

The nose landing gear doors are operated mechanically and close once the nose landing gear has retracted into its bay. As it does so, it applies upward pressure to a roller assembly in the roof of the nose landing gear bay. This assembly is connected by push rods to the doors and causes them to close.

Examination of Aircraft

The AAIB undertook an inspection of the aircraft at Prestwick where G-BEHU was parked beside a maintenance hangar on a trolley normally used to transport cargo containers. Both left and right propellers were damaged, the general nature of this damage indicating that both engines were producing low power at the time of the accident.

There was little damage to the right wing and underside of the right engine cowling but the access step on the right side had been chamfered along its bottom edge and had bent upwards into the aircraft structure. The left wing was extensively damaged on its underside; the fuel drains and pitot probe were missing and scrape marks were present on the lower sections of the hinges for the left flap and left aileron. The underside of the left engine cowling also exhibited extensive scrape marks, some of which had worn through the lower cowl. All this damage was consistent with the aircraft having been left wing low during the first stages of the accident. The underside of the fuselage also showed extensive scraping damage.

Although an inspection of the cockpit revealed that the gear lever was selected DOWN, some time had passed since the accident and neither the pilot nor the passengers could recall the gear selector position immediately after the accident. The throttle levers were both found at idle, the mixture levers at RICH, the left cowl flap lever closed with the right lever open. Several circuit breakers were found to have tripped, including those for the Landing Gear Pump and Landing Gear Control but no one involved with the aircraft recovery could remember if the circuit breakers had been pulled deliberately or if they had tripped prior to the accident. The emergency gear extend switch was stowed and its securing clip was engaged.

The aircraft was lifted from the trolley for further examination of the landing gear and this revealed that all three gear lock links were unlocked with no evidence of mechanical damage to the gear operating mechanisms. Prior to lifting, it was observed that both main landing gears were out of their bays and were partially supporting the aircraft. The left gear door had slight damage to its forward corner and the right gear door was undamaged and the outer faces of both MLG tyres showed slight rubbing, consistent with ground contact. The nose gear was fully retracted such that the nose gear doors were fully closed. The nose gear doors, which remained connected to their operating mechanism, had some ground contact damage along their bottom edges. No mechanical damage to the door operating mechanism was evident.

As it was possible for all three gears to be manually locked down, the aircraft was lowered to the ground such that its weight was supported by the landing gear. The aircraft was then towed, without incident to a local maintenance facility where testing of the landing gear operating system was carried out.

System Tests

Due to relative lack of damage to the landing gear system it was extensively tested, with the aircraft supported on jacks. The tests were carried out along similar lines to that specified in the Piper PA-34-200T maintenance manual. The tests involved:

- Retractions and extensions with the hydraulic system pressurised.
- Tests of the red GEAR UNSAFE warning light and warning horn, with weight on the left landing gear and the gear selector switch selected to UP, and with the gear not locked down and the throttles at idle.

- Manual extensions using the emergency extend lever.
- Tests with the Landing Gear Control and Landing Gear Pump CBs tripped.
- Attempts to retract the gear using external force on the gear.
- Deliberate breaking of the lock links with the gear extended to check the warnings and the hydraulic pump operation.

All of these tests were satisfactory and the system was demonstrated to operate as described in the Piper Maintenance Manual. This included the correct operation of the warning lights and horn, and at no point was it possible to retract the gears with the gear selector switch in the DOWN position.

Following the tests of this system the aircraft was repaired and, during this process, the associated wiring, hydraulic and electrical systems were inspected for any signs of dormant failures. None were found. As a precaution, the landing gear wiring loom and microswitches have been replaced as part of the repair process.