Piper PA-28R-201T Turbo Cherokee Arrow, G-DNCS

AAIB Bulletin No: 10/2004	Ref: EW/G2004/06/17	Category: 1.3
Aircraft Type and Registration:	Piper PA-28R-201T Turbo Cherokee Arrow, G-DNCS	
No & Type of Engines:	1 Continental TSIO-360-F piston engines	
Year of Manufacture:	1978	
Date & Time (UTC):	22 June 2004 at 0145 hrs	
Location:	Liverpool Airport, Merseyside	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Damage to underside of fuselage, engine and propeller	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	27 years	
Commander's Flying Experience:	276 hours (of which 38 were on type)	
	Last 90 days - 40 hours	
	Last 28 days - 15 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and further AAIB enquiries	

Synopsis

The aircraft was carrying out solo stop-and-go circuits to Runway 27 as part of a night qualification exercise at Liverpool Airport. As it touched down at the conclusion of its second circuit, ATC observed sparks from the aircraft and initiated aircraft accident procedures. The aircraft came to rest on the runway with the landing gear collapsed, damage to its propeller, engine and underside. The pilot was able to vacate the aircraft without assistance.

History of the flight

During an earlier flight with an instructor on the night of the accident, the pilot carried out three circuits, a one hour dual navigation exercise and a full stop landing on the dry runway. The weather was fine with a surface wind of 080°/03 kt, visibility 12 km with few clouds at 3,000 feet, a temperature of +11°C, dew point +7° and a QNH of 1011 mbs. The instructor commented that throughout this instructional flight the pilot had carried out the checks consistently and in a very competent manner and that, after refuelling and a short briefing on next detail, he was happy to send him solo.

The pilot reported that on the second solo circuit he completed the normal downwind checks, selecting the landing gear down and checking that it was fully extended and locked by the illumination of three green lights below the selector lever. After obtaining clearance to carry out a 'stop-and-go' he completed his finals checks and confirmed that the green lights were still illuminated. The aircraft crossed the threshold at approximately 75 knots and flared normally but, on touchdown, the landing gear collapsed. The pilot stated that before vacating the aircraft he confirmed that the gear selector was still down and the gear indication still showed 'three greens'.

Landing gear system

The aircraft is equipped with a retractable tricycle landing gear activated by an electrically powered hydraulic pump. The pump is controlled by a selector switch on the instrument panel, or by a backup gear extender which lowers the gear regardless of gear selector position, depending on the combination of airspeed and engine power sensed in the propeller slipstream. Gear extension is designed to occur at airspeeds below approximately 90 kt with power off, even if the selector is in the UP position. The device also prevents the gear from retracting at airspeeds below approximately 78 kt when full power is set. Actual activation speed decreases with increased power and/or lower altitude.

The backup device is controlled by differential air pressure across a flexible diaphragm that is mechanically linked to a hydraulic valve and an electrical switch which actuates the pump motor. A pitot and static air source for actuating the diaphragm is provided from a mast mounted on the left side of the fuselage above the wing. The device can be manually overridden by an emergency landing gear selector lever located between the front seats to the left of the flap handle. A yellow light immediately below the gear selector switch flashes whenever the override selector is in the OVERRIDE ENGAGED position.

Two micro switches in the throttle quadrant activate a warning horn and a red 'warning gear up' light under the following conditions:

1. *Gear up and power reduced below approximately 14" manifold pressure.*
2. *Gear extended by backup gear extender system, with gear selector in the UP position, except at full throttle.*
3. *Gear selector in the UP position while the aircraft is on the ground.*

During a normal approach and landing it is possible that neither of the first two conditions would be met until just prior to touchdown, when the throttle is fully retarded in the flare. Gear extension, by either means, takes approximately six to eight seconds. Consequently, if the landing gear has not already been selected down it is unlikely that the system will lower it automatically, or warn the pilot to lower it in sufficient time to extend fully and lock before touchdown.

Engineering inspection

Following the accident the aircraft was removed to a maintenance facility on the airfield. During the initial inspection the landing gear selector was found in the DOWN position and the backup extender override lever was found in the NORMAL position. The nose gear doors had been forced open against the underside of the engine cowling and the left main wheel hub was abraded on its outboard edge, consistent with landing gear extension having commenced very shortly before touchdown. When the aircraft was lifted clear of the surface and the battery master switch selected ON, the landing gear moved to the down and locked position without further intervention.

When checked on the ground, the backup extender actuating diaphragm was found to be leaking and the system failed to lower the landing gear at simulated airspeeds below 90 kt. Also, with the landing gear retracted and throttle closed, the landing gear warning horn did not sound unless the throttle lever was held hard against the left-hand side of the throttle quadrant in a manner that would not be encountered in normal operation. However, it was not possible to determine whether the landing gear

had been activated manually or automatically during the final approach. No pre-existing condition was found that would have prevented the landing gear from extending fully had it been selected down by the pilot earlier in the approach.