

<b>Aircraft Type and Registration:</b>	Piper PA-23-250 Aztec, N54211	
<b>No &amp; Type of Engines:</b>	2 Lycoming TIO-540 piston engines	
<b>Year of Manufacture:</b>	1974	
<b>Date &amp; Time (UTC):</b>	5 February 2005 at 1310 hrs	
<b>Location:</b>	Elstree Aerodrome, Hertfordshire	
<b>Type of Flight:</b>	Private	
<b>Persons on Board:</b>	Crew - 1	Passengers - 1
<b>Injuries:</b>	Crew - None	Passengers - None
<b>Nature of Damage:</b>	Damage to nose cone, nose underside and nose gear doors	
<b>Commander's Licence:</b>	Private Pilot's Licence	
<b>Commander's Age:</b>	41 years	
<b>Commander's Flying Experience:</b>	999 hours (of which 13 were on type) Last 90 days - 10 hours Last 28 days - 3 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and further enquiries by the AAIB	

### Synopsis

The nose landing gear would not lock down in flight due to an unidentified technical defect involving a loss of hydraulic fluid from the nose landing gear system. Upon landing the nose gear collapsed resulting in damage to the aircraft's nose. During the recovery operation the main landing gear collapsed resulting in further damage to the aircraft. At the time of compiling this report (May 2005) the aircraft had not been raised on jacks to identify the source of the hydraulic leak or to carry out repairs.



## **History of the flight**

The purpose of the flight was to test the engines following the aircraft's annual maintenance check. The pilot, who was also the maintenance engineer, carried out his normal pre-flight checks. The aircraft's hydraulic system was function checked on the ground by cycling the flaps and checking that the landing gear selector returned to neutral following a gear DOWN selection. The pilot carried out a normal takeoff and then selected the gear and flaps UP. The flaps retracted normally and the amber light illuminated indicating that all three landing gear legs were up and locked. The pilot then carried out a large visual circuit, verified the engine operation, and then lined up for a long final approach to Elstree. On final he selected one stage of flap and selected the gear DOWN. Both main gear legs locked down as evidenced by two green indicator lights, but the nose gear's green light did not illuminate. There was also slower traffic ahead so, from a two mile final, the pilot initiated a go-around, retracted the flap and selected gear UP. The flap retracted and he felt the main gear retract but not the nose gear. A visual check via the mirror on the left engine nacelle revealed that the nose gear was in a semi-retracted state.

The pilot left the circuit and flew to a nearby area to troubleshoot the problem. He selected the gear DOWN and obtained two 'greens' on the main gear but the nose gear did not lock down. He then used the emergency hand pump to try and extend the gear but he felt no resistance while pumping and noticed a strong smell of hydraulic fluid in the cabin. Next, he slowed the aircraft and activated the emergency gas blow-down bottle. He heard the bottle discharge but still the nose gear did not lock down. As a final resort he manoeuvred the aircraft around to try and lock the nose gear down but to no effect. He then informed Elstree Information by radio of his predicament. The emergency services were activated and then the pilot circled for approximately 30 minutes to permit some local aircraft to recover to the airfield. The pilot carried out a flapless approach and then once over the runway threshold, he shut down both engines and feathered both propellers. After a normal touchdown on the main gear the aircraft rolled for a short distance before the nose sank to the runway. The nose gear retracted and the nose of the aircraft scraped along the runway surface until the aircraft came to a rest. Both the pilot and his passenger were able to vacate the aircraft via the normal exit door.

## **Recovery of the aircraft**

The recovery plan for the aircraft was to lower the tail so that the nose gear could be manually pulled forwards until it locked into position. A truck was connected to the tie-down ring on the tail of the aircraft using a rope. Then, whilst the pilot was holding the foot brakes, four people sat on the horizontal tail of the aircraft and the truck pulled on the rope to lower the tail. With the tail lowered the pilot got out of the aircraft and then started to pull the nose gear into the locked position. As he did this, the main gear retracted, the aircraft hit the ground, and the truck pulled the tie-down ring and surrounding skin off the aircraft.

## **Description of the landing gear system**

The aircraft has a hydraulically actuated retractable tricycle landing gear system. The nose gear leg retracts aft while both main gear legs retract forwards. Each landing gear leg is individually actuated by a hydraulic actuator. When the landing gear is selected DOWN, hydraulic pressure causes each actuator to extend a drag link on the respective gear leg until the link reaches an over-centre position. The final movement of the actuator causes a mechanical lock to lock the drag link in the over-centre position. Once the landing gear has locked down, microswitches for each gear leg trigger a respective green light in the cockpit and the gear selector returns to the neutral position. When the gear is selected UP, the actuators retract causing the downlocks to unlock and the drag links to collapse. Once the gear is locked up, microswitches cause an amber light in the cockpit to illuminate and the gear selector returns to the neutral position. When no lights are illuminated the landing gear is in an intermediate position. If the engine driven hydraulic pump fails, an emergency hand pump can be used in its place. In the event of a hydraulic system failure caused by a line rupturing, an emergency CO<sub>2</sub> bottle can be activated to blow the landing gear down.

The hydraulic lines of all three landing gear actuators are connected such that when the system is depressurised, manually moving one actuator will cause hydraulic fluid displacement that will result in the other two actuators moving in the opposite direction.

## **Maintenance history**

The most recent maintenance on the aircraft was an annual inspection completed on 1 February 2005. The accident flight was the first flight since this maintenance. During this maintenance input the aircraft was jacked up and the landing gear was cycled several times and operated satisfactorily. A check of the hydraulic lines and actuating cylinders for 'leaking and security' was also documented in the maintenance worksheets.

Between August 2002 and the accident flight, the aircraft had only flown on one other occasion - a 45 minute flight on 10 May 2004. The accident flight was the aircraft's first flight in nine months. The aircraft's total airframe hours at the time of the accident were 2,341 hours.

## **Landing gear examination**

An inspector from the AAIB examined the aircraft and did not find any evidence of a mechanical fault with the main landing gear or the nose gear. Hydraulic fluid was found congealed around the nose gear door and on the belly of the aircraft aft of the nose gear bay. The nose landing gear actuator and hydraulic lines were not accessible for inspection with the aircraft on the ground. The

aircraft needed to be jacked up to determine the source of the hydraulic fluid but this was not possible at the time of inspection.

### **Analysis and conclusions**

The nose landing gear retracted on landing because it was not locked down. No mechanical fault of the nose gear was found that would have prevented it from locking down and therefore it was a loss of actuating power that prevented the nose gear from locking down in flight. The nose gear extends forwards in flight, against the slipstream, and therefore more actuating force is required to extend the nose gear than to extend the main gear which extend aft. The evidence of congealed hydraulic fluid on the belly of the aircraft aft of the nose gear bay indicated that it was a loss of hydraulic fluid in flight that resulted in the loss of actuating force. The source of the hydraulic fluid leak could not be determined at the time of inspection. It is possible that the aircraft's low usage over the past two years may have contributed to the deterioration of a component within the hydraulic system.

The main gear collapsed during recovery of the aircraft because, as the nose gear actuator was being manually extended, the displaced hydraulic fluid caused the main gear actuators to move in the retract direction which caused the downlocks on the main gear drag links to unlock. Fortunately no one was injured but more damage resulted to the aircraft from the recovery operation than from the landing itself. This incident demonstrated how important it is to fully understand an aircraft's landing gear system before attempting a recovery.