

Piper PA-23-250, G-BAED, 20 March 1996

AAIB Bulletin No: 8/96 Ref: EW/C96/3/3 Category: 1.2

Aircraft Type and Registration: Piper PA-23-250, G-BAED

No & Type of Engines: 2 Lycoming IO-540-C4B5-pistonengines

Year of Manufacture: 1968

Date & Time (UTC): 20 March 1996 at 1655 hrs

Location: Runway 08 at Eglington (Londonderry) Airport

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - 5

Injuries: Crew - Nil Passengers - Nil

Nature of Damage: Both propellers damaged beyond repair, engines shock loaded and the lower nose fuselage and nose landing gear doors damaged

Commander's Licence: Airline Transport Pilot's Licence

Commander's Age: 29

Commander's Flying Experience: 2,720 hours (of which 110 were on type)

Last 90 days - 105 hours

Last 28 days - 20 hours

Information Source: AAIB Field Investigation

After turning onto final approach with all final approach checks completed, which included a check that the three green landing gear 'down-and-locked' lights were illuminated, a normal approach and smooth initial landing were made. After a gentle lowering of the nose, the pilot commenced brake application whereupon the nose landing gear collapsed. During the ground slide, the pilot noticed smoke entering the cockpit which prompted him to request immediate fire service assistance. When the aircraft came to a halt, the pilot ordered an evacuation and all the passengers disembarked safely and with no injuries. The pilot turned off the fuel and all the electrical systems before disembarking. There was no fire. Some time following the accident the pilot recalled that following the take off on the accident flight he had to select the landing gear UP three times before he could obtain a landing gear 'up-and-locked' indication.

Initial examination showed that the landing gear system functioned satisfactorily using the aircraft's hydraulic hand pump, except that the nose landing gear down-and-locked light would not illuminate, even though the down lock was engaged. This fault was found to have been caused by severe buckling of a two piece 'U' shaped floating link assembly between the landing gear end of the hydraulic actuator and the down lock (Piper part number 16667-00). Examination of the damage to this floating link assembly and the system operation indicated that the buckling had occurred during the nose landing gear collapse. A new link assembly was fitted and a full hydraulic system test was carried out in accordance with the manufacturer's Maintenance Manual, section VI, paragraph 6-11 to 6-23 using an external hydraulic pressure supply rig and two pressure gauges fitted in the aircraft's supply and return lines. From the hydraulic system test, it was found that the aircraft's hydraulic power pack was not functioning correctly. When the landing gear was selected down, the landing gear extended and locked down and the hydraulic pressure increased to 900 psi (the correct pressure should have been 1250 psi) before the landing gear selector lever returned to its neutral position. After the selector lever returned to its neutral position, the supply pressure to the landing gear actuators dropped to about 50 psi, over a 40 to 50 second interval. It was also observed that the return line gauge exhibited a steady indication of approximately 125 psi. The effect of this would have been that the 'retract' side of the landing gear actuators would have had a higher hydraulic pressure than the 'extend' side. It was also noted that during the retract cycle the first event to occur was that the nose landing gear down lock disengaged, followed by the 'breaking' of the over-centre mechanical lock. The nose landing gear down lock was withdrawn by the first 1/4 inch of movement of the actuator. The specification for the hydraulic system is that the supply pressure should not drop below 700 psi over a 10 minute period and that there should be no more than 18 psi pressure in the return line.

After further testing of the hydraulic system it was diagnosed that the hydraulic power pack and the priority valve were faulty. A reconditioned power pack was fitted, the tests repeated and the system was found to function satisfactorily, except that there was still a residual pressure of approximately 125 psi in the return line. A reconditioned priority valve was fitted which rectified this high return line pressure.

Both defective units were taken to an authorised overhaul organisation for testing and examination. The hydraulic power pack did not perform correctly when bench tested. On strip examination there was good evidence that the unit had, within the last few hundred hours of operation, been dismantled and cleaned. In addition the main relief valve, which sets the pressure at which the landing gear selector lever is returned to neutral, had been incorrectly adjusted. The reason for the unit not holding the pressure in the supply line was corrosion of the poppet valves in the areas where they interfaced with the valve seats. No fault could be found associated with the priority valve.

The operation and maintenance records for the aircraft were examined in detail. There were no entries in the aircraft log books (which only went back to 1983) to indicate that the hydraulic power pack had been removed for repair or adjustment, or had been replaced. The aircraft had been involved in two previous accidents, both of which featured collapse of the nose landing gear during landing (AAIB Bulletins 11/83 and 12/87). No link could be found between this accident and the two previous accidents. Following the accident in 1987, the aircraft was dismantled and transported by road to a repair organisation where it remained for 15 months until the repair had been completed. It is considered that the corrosion of the poppet valves within the hydraulic power pack may have initiated during the period of this repair. Following this repair, the aircraft was operated in the Private Category for about 4 years during which time a number of landing gear problems were reported, the majority of which were recorded as "Port/starboard landing gear down-and-locked light going out during the landing, when landing gear selector lever put in the DOWN position

the light illuminated immediately". There was also a report that the landing gear doors were opening in flight. There were no entries in the airframe log book of any rectification work having taken place to rectify these defects. The aircraft was not flown between May 1993 and March 1994, when it changed ownership to its present owners. On two occasions during 1995 it was reported that the landing gear up-and-locked light went out during flight (the landing gear is held in the up-and-locked position by hydraulic pressure). After both of these reports the aircraft was placed on jacks with the landing gear retracted for a period of time, but no faults were found. The accident flight was the first flight of the aircraft following a thorough annual maintenance check. During this check considerable time and effort had been expended on the landing gear and hydraulic system, which included an emergency landing gear extension using the aircraft's compressed air system, but no faults were found. During the emergency landing gear extension, the priority valve was disengaged by the compressed air pressure. When the compressed air pressure was removed from the priority valve it would have automatically reset to its normal operating position upon application of hydraulic system pressure. It is felt that following this emergency landing gear extension the priority valve did not fully reset which resulted in the abnormally high pressure observed in the return line during the landing gear extension tests. The hydraulic system check using an external hydraulic test rig and the insertion of two pressure gauges as detailed in the aircraft manufacturer's Maintenance Manual section XI, paragraph 6-11 to 6-23 was not carried out, or required during this maintenance check.

Summary: Following an uneventful approach and touch down the nose landing gear collapsed during the landing roll. The engineering investigation identified faults with the hydraulic power pack and priority valve which allowed a positive hydraulic pressure to be present in the landing gear retract system once the landing gear had achieved the 'down-and-locked' position. The effect of this positive pressure would have been to withdraw the nose landing gear down lock and possibly initiate the 'breaking' of the over-centre mechanical lock. The fault within the hydraulic power pack was found to have been caused by corrosion which was considered to have initiated during a long period when the aircraft underwent repair following a similar, but unrelated accident in 1987. No fault could be found within the priority valve, but it is considered that following the activation of the landing gear emergency lowering system during the maintenance check immediately prior to the accident flight, the priority valve did not completely reset. Since the repair following the earlier accident in 1987 a number of landing gear problems were reported that did not appear to have been investigated and rectified satisfactorily.