

Piper PA-31 Navajo Chieftain, PH-MBL

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Aircraft Type and Registration:	Piper PA-31 Navajo Chieftain, PH-MBL	
No & Type of Engines:	2 Lycoming TI0-540-J2BD piston engines	
Year of Manufacture:	1974	
Date & Time (UTC):	22 December 2002 at 1450 hrs	
Location:	Stand 5 at Norwich Airport, Norfolk	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Nose gear doors damaged, left propeller damaged and engine shock loaded	
Commander's Licence:	Commercial Pilot's Licence with Instrument and Instructor Ratings	
Commander's Age:	57 years	
Commander's Flying Experience:	9,575 hours (of which 2,611 were on type) Last 90 days - 19 hours Last 28 days - 5 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and subsequent telephone enquires by AAIB.	

Synopsis

Following arrival at Norwich, the commander carried out the standard procedure to check the hydraulic system using the left engine driven pump. After the gear selector had been placed in the GEAR-DOWN position, during the check, the nose landing gear (NLG) retracted and the main landing gear (MLG) doors opened. The probable cause of the accident was attributed to a defective landing gear anti-retraction (squat) switch and a loose spring in the landing gear selector lever, the combination of which allowed the selector lever to move past the GEAR-NEUTRAL position during the check.

History of Flight

After an uneventful flight from Rotterdam, PH-MBL arrived at Norwich and was taxied to Stand Number 5. After the brakes were applied and before the engines were shutdown, the commander

commenced the standard operating procedure to check the hydraulic system. This involved shutting down the right engine first, but leaving the left engine running at idle. With only the left engine now supplying pressure to the hydraulic system from the engine driven pump, the commander continued with the test by selecting the landing gear selector lever to GEAR-DOWN, from the GEAR-NEUTRAL position to which the lever returns after a normal gear down selection in flight. The expectation was for the gear lever to return to the GEAR-NEUTRAL position. However, within a couple of seconds of the pilot selecting the lever, the NLG collapsed. As the nose of the aircraft dropped, the left engine propeller contacted the ground, causing the engine to stop suddenly. The commander immediately shut down the aircraft and exited through the rear stair-door, along with the passenger. As the aircraft was now on its nose, the rear of the aircraft was raised up, and so the passenger and commander had to jump to the ground; both did so without injury.

A little later the commander re-entered the aircraft and found the gear selector was at GEAR-NEUTRAL. Subsequent inspection of the aircraft on the stand revealed that both MLG doors were open with the NLG collapsed.

Hydraulic and Landing Gear System

The Piper Navajo hydraulic system is powered by two engine driven pumps, one on each engine, and these supply hydraulic pressure to the landing gear and braking systems.

For the landing gear system, hydraulic pressure is supplied to a power pack, which is connected to the landing gear selector lever. The power pack contains several valves which control the landing gear sequence for operation of the landing gear doors, the NLG and the MLG. To simplify the description only the selection of the landing gear to DOWN will be described.

To start the process, the gear selector is pulled aft against an internal spring and moved to GEAR-DOWN; it is held in position by the landing gear selector lever release valve. A door solenoid valve is then electrically actuated which allows pressurised hydraulic fluid to pass to the landing gear door actuators in order for them to open. Once the doors have opened, hydraulic pressure builds to a level which opens a priority valve. This then ports hydraulic fluid to the landing gear selector valve, which directs the fluid to the down side of the three landing gear actuators. As the landing gears lock down, electrical limit switches actuate, which then command the door solenoid valve to operate and close the landing gear doors. With the doors now closed, hydraulic pressure builds again and this time opens a time delay valve. Fluid is then ported to the landing gear selector lever release valve, which moves the lever back to the GEAR-NEUTRAL position.

To prevent the gear from being retracted on the ground, a squat switch on the left main landing gear upper torque link is actuated whenever the gear is compressed, i.e., when the aircraft is on the ground. This squat switch signals an anti-retraction solenoid to operate, which provides a balk at the landing gear selector lever, and prevents it from being inadvertently moved by the crew beyond the GEAR-NEUTRAL position. A fixed metal guard, that protrudes from the instrument panel at the neutral position for the gear selector lever, prevents it from travelling beyond neutral when returned to this position after gear down selection. To move past this guard to the UP position, the handle first must be pulled aft against a spring in the handle.

Engineering Investigation

Subsequent engineering investigation revealed that the squat switch on the left main landing gear failed to actuate when the gear was in the compressed state. The switch had been damaged but the cause of this damage could not be ascertained. In addition, the spring in the gear selector lever was found to be weak, which reduced the ability of the handle to return to its stowed position. Enquiries made of a Piper servicing agency in the UK revealed that this is not an uncommon defect.

Thus, with a defective squat switch, the anti-retraction solenoid that should prevent the gear selector from being moved UP, would have remained disengaged.

Therefore, it is probable that when the landing gear selector lever was moved to DOWN, during the post flight checks, it began its travel to GEAR-NEUTRAL, as expected. However, with the defective spring in the handle and with the anti-retraction solenoid not being engaged, the force applied to the handle may have caused it to move past the metal guard and solenoid balk, toward the UP position and begin the retraction sequence. This would start by unlocking the aft retracting NLG down lock, and opening the landing gear doors. With the weight of the aircraft on the sideways retracting MLG, it is probable that the main gears were unable to move. It was not established how the selector lever came to be found after the accident in the neutral position.