

**Aircraft type and registration:** Piper PA 31-350 Navajo G-BASU

**No & Type of engines:** 2 Avco Lycoming TIO-540-J piston engines

**Year of Manufacture:** 1973

**Date and time (UTC):** 12 May 1987 at 1546 hrs

**Location:** Dounreay Airfield

**Type of flight:** Public transport (charter)

**Persons on board:** Crew — 2                      Passengers — 7

**Injuries:** Crew — None                      Passengers — None

**Nature of damage:** Landing gears collapsed sideways. Both propellers, nose and airframe damaged. Airfield perimeter fence damaged.

**Commander's Licence:** Airline Transport Pilot's Licence

**Commander's Age:** 33 years

**Commander's Total Flying Experience:** 5,950 hours (of which 150 were on type)

**Information Source:** AIB Field Investigation

#### History of the Flight

The aircraft was engaged on a Public Transport Charter carrying passengers from East Midlands Airport to the licenced airfield at Dounreay. On arrival at Dounreay, at 0900 hrs, the outboard fuel tanks were indicating empty and the inboards contained enough fuel to fly the next trip from Dounreay to RAF Lossiemouth. At about 1400 hrs the commander and the Pilot's Assistant completed a particularly thorough and detailed pre-flight inspection as a training exercise for the Pilot's Assistant in preparation for his forthcoming type rating. The aircraft's engines were started at about 1500 hrs and run for approximately 5 minutes to warm them prior to the arrival of the passengers. During the time between the engine run and the arrival of the passengers the Pilot's Assistant was familiarising himself with the flight deck. During this familiarisation he moved the fuel selectors from the inboard positions to the outboard positions and back to the inboard positions. It was normal practise to leave the fuel selectors in the ON positions when on the ground. He also operated the cross-feed cock and left it in the OFF position.

The passengers arrived at approximately 1530 hrs. Having briefed the passengers the commander started the aircraft's engines and taxied to the threshold of runway 04. The weather at the time was partially cloudy with a surface wind of 350/25. Because of recent showers the runway was wet. After lining up on the runway the pre-take-off checks were carried out including a full power check, which was satisfactory. During these checks the Pilot's Assistant checked the positions of all the fuel selectors in accordance with the check list, and confirmed that both inboard tanks were selected. The commander released the brakes and

applied full power but because of the crosswind he initially concentrated on keeping the aircraft straight on the runway centre line and cannot recall checking if the engines had achieved full power. At this stage the acceleration appeared to be normal. At about 65 knots the commander noticed the aircraft yaw to the right which he corrected. This was followed shortly by another yaw to the right. At about this time the commander noticed that the right Fuel Boost Inoperative light had illuminated. As he was certain that the Emergency Fuel Pumps were selected ON and knew that each engine had its own engine driven fuel pump he considered that the illumination of the right-hand Fuel Boost Inoperative light would not affect the take-off performance and decided to continue. The Flight Manual states "The fuel boost pumps are provided to maintain fuel under pressure to the other fuel pumps improving the altitude performance of the fuel system". At a speed just below minimum rotate speed (101 mph) the commander noticed a loss of acceleration and a further yaw to the right. He looked down and saw that the right engine rpm was fluctuating and at about the same time heard banging from the right-hand engine, which was also heard by his passengers and people on the airfield. At this point the commander decided to abandon the take-off. He applied maximum braking, closed the throttles, placed the mixture levers in the idle cut-off position and feathered both propellers. As the aircraft crested a hump in the runway the end of the paved surface became visible. The commander realised that he would not be able to stop in the remaining distance available and turned the aircraft to the right to minimise the severity of the impact. The aircraft left the runway travelling sideways, left wing first, passed through the airfield perimeter fence which was constructed with frangible wooden posts, and came to rest 20 metres from the end of the runway with the landing gear collapsed and facing back the way it had come. The Pilot's Assistant supervised the evacuation of the passengers while the commander called for the emergency services and turned off the fuel and master switch before evacuating the aircraft himself. There was no fire and none of the occupants were injured. The emergency services responded quickly but were not required.

#### Examination of the Wreckage

Examination of the aircraft on-site showed that when they contacted the ground both propellers were feathered and that the right-hand propeller was almost stationary and the left-hand propeller had a small amount of rotation. All of the cockpit controls and switch selections were in their aircraft shut down positions which included the fuel selectors to their OFF positions. The fuel gauges, which were the type that freeze at the indications showing when the master switch was selected OFF, were reading:

Left — 1/4 full  
Right — empty

Examination of the runway and the aircraft's main wheels revealed that the aircraft had aquaplaned for some 400 metres before leaving the end of the runway.

The aircraft was removed to a hangar where an examination of the airframe, fuel system and right engine was carried out. There was no evidence of a fault or fuel leak. The fuel filters, electric pumps, pressure switches, selectors, pipework and electrical circuits were physically checked and activated and no fault was found. The fuel tanks were drained and the following quantities were found present:

Left outer — 2.5 Imperial gallons  
Left inner — 33 Imperial gallons  
Right outer — 6.5 Imperial pints  
Right inner — 33 Imperial gallons

The Flight Manual quotes the unusable fuel as

Outer tanks — 2.45 Imperial gallons each  
Inner tanks — 1.65 Imperial gallons each

The fuel was of the correct colouring and smell for the type specified and there was no evidence of contamination.

The right-hand engine and propeller were removed and at a major overhaul organisation fitted to another Piper PA 31. An engine test run was conducted which showed the engine and its

systems to be serviceable. During the full power check the fuel was selected off. The engine speed fluctuated, the Fuel Boost Inoperative light illuminated intermittently and a number of loud "bangs" were heard just prior to loss of power.

Examination and testing of the Fuel Boost system showed the following causes for the Fuel Boost Inoperative light illuminating:

- a. Failure of the fuel boost pump.
- b. Failure of the fuel boost pressure warning switch.
- c. Failure of the fuel boost inoperative warning light electrical circuit.
- d. Lack of fuel at the input to the fuel boost pump.