No: 12/87 **Ref: 1c**

Aircraft type and registration:	PA31 Navajo G-AZHL	
No & Type of engines:	2 Lycoming TIO-540-A piston engines	
Year of Manufacture:	1972	
Date and time (UTC):	15 July 1987 at 0616 hrs	
Location:	Tees-side Airport	
Type of flight:	Public transport	
Persons on board:	Crew — 2	Passengers — 2
Injuries:	Crew — 1 (serious)	Passengers — None
Nature of damage:	Aircraft damaged beyond economical repair	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	55 years	
Commander's Total Flying Experience:	2769 hours (of which approximately 900 were on type)	
Information Source:	AAIB Field Investigation	

History of the flight

The aircraft was due to take off at 0600 hrs for Nantes. The operating crew consisted of the commander, who was properly qualified for the flight, and a pilot's assistant, who held a Private Pilot's Licence, Group A. It was to carry 2 passengers and 250 kg of cargo, including a container of Type A radioactive material weighing 37 kg. This container was secured in the nose compartment, and the balance of the cargo, packed in 4 metal cases, was loaded in the cabin aft of the passengers, who were in rearward-facing seats immediately behind the pilots' seats. An operations officer and engineer/loader from the company were on hand to assist the departure. When the commander arrived at the aircraft the cabin cargo was loaded but not secured. He asked for suitable restraining equipment but the company were unable, at that time, to provide tie-down rings that would fit the seat rails of the aircraft. By this time the flight had been delayed by 10 minutes and the commander decided to delay no longer. He and the pilot's assistant reloaded the cabin cargo to wedge it into the cabin so that it was restrained from lateral and aft movement by the cabin sidewalls and the rear bulkhead.

The commander taxied to the holding point using the outboard fuel tanks then changed to the inboard tanks for power checks, which were normal. Take-off acceleration was also normal and he allowed the aircraft to accelerate to 100 mph, some 15 mph above the minimum controllable single-engine speed, before lifting off. Very soon after lift-off he felt a loss of power from the left engine but, believing this to be only a partial failure, decided to continue the take-off and raised the landing gear. He felt the aircraft was still climbing and heard the pilot's assistant say "I HAVE THE RUDDER". He then realised that the airspeed was reducing rapidly and that he was losing directional control. He lowered the nose and headed for a grass

area to the left of the runway, where the aircraft struck the ground in a steep left bank. During the impact sequence the tail section was bent to the left opening a break in the right fuselage side through which 3 of the 4 metal boxes in the cabin were ejected with considerable force. The radioactive container was not damaged. All occupants remained secured in their seats and were able to leave the aircraft unaided despite injury to the pilot's assistant's right foot. The aerodrome fire service arrived on site 1 minute 45 seconds after the crash and spread foam on leaking fuel. They were supported by the local authority fire and ambulance services some 13 minutes later.

After the accident the pilot's assistant stated that he too had felt the power loss and had attempted to apply right rudder but found that it was already fully forward. He also said that he heard the stall warning horn just before the aircraft hit the ground. The commander said that he thought the pilot's assistant's pressure on the right rudder had tended to disguise the seriousness of the power failure. He also thought that his actions were influenced by his experience during a base check in a different PA31 on 7 July when, soon after take-off, he experienced a partial failure of the left engine just before the examiner, seemingly unaware of the power loss, throttled that engine back as part of the routine of the check. The engine subsequently behaved normally when power was restored. The examiner confirmed that he had not been aware of the partial engine failure but said that observers on the ground had seen smoke from the engine during the take-off.

Engineering investigation

The aircraft had come to rest on the grass to the left of the departure end of the runway, just beyond the taxiway. The left wingtip had struck the ground first, followed by the left propeller and engine nacelle. The aircraft had then begun to cartwheel causing the nose, right propeller and engine nacelle and right wing to strike the ground in succession. After the aircraft had rotated through about 180°, the right tailplane sustained a heavy ground impact which breached the fuselage behind the wing. This allowed the cargo to be ejected and reversed the rotation of the aircraft, which finally came to rest approximately 260 feet beyond the first ground impact at about 90° to its original flight path. The ground marks made by the propellers showed that the right engine had been turning at approximately 2575 rpm, but the left engine had been turning at only about 600 rpm. Neither propeller was feathered. The aircraft was destroyed in the impact but there was no fire.

No pre-impact defects were found in the airframe or flying control systems, and the engineering investigation concentrated on the failure of the left engine. Since no major mechanical failure was apparent, tests were carried out on the fuel and ignition systems and their component parts. A damaged gasket was found in the Lear-Romeo engine driven fuel pump, capable of causing a large fuel leak and allowing air to enter the fuel system. Slight staining was found on the pump body near the gasket defect and corrosion deposits were found within the pump, indicating that the gasket had not been fully effective for some time before breaking up. Similar failures have occurred in the past to the gaskets on this particular model of pump, and these failures have been brought to the attention of operators in General Aviation Safety Information Leaflet (GASIL) No 2/87. This leaflet contains the advice that, when these pumps are refitted, the cover screws should be re-torque loaded after the first 20 minutes of operation. However, it was noted during the AAIB investigation that these screws were not readily accessible on the installation on the accident aircraft, and the advice in the GASIL would have been difficult to follow.

Regulatory aspects

Article 19 of the Air Navigation Order (ANO), dealing with flight crew qualifications, states that a person shall not act as a member of the flight crew of an aircraft unless he is the holder of an appropriate licence. The minimum licence for a person who handles the controls of an aircraft on a public transport flight is a Commercial Pilot's Licence with a type rating on the aircaft. This regulation is amplified in Notice to Air Operator's Certificate (AOC) Holders No 3/83, issued by the Flight Operations Inspectorate. Section 28 of the ANO place upon the operator of a public transport flight the responsibility of ensuring that the load may safely be carried on the flight.

Section 32 requires the commander to satisfy himself that the load is so secured that it may safely be carried.