

No: 1/89

Ref: EW/C1092

Category: 1c

**Aircraft Type
and Registration:**

Beechcraft B 76 Duchess, G-BNTT

No & Type of Engines: 2 Lycoming O-360-A1G6D piston engines

Year of Manufacture: 1976

Date and Time (UTC): 20 September 1988 at 1115 hrs

Location: Glenrothes airport, Fife

Type of Flight: Training

Persons on Board: Crew - 2 Passengers - None

Injuries: Crew - None Passengers - None

Nature of Damage: Damage to the underside of nose, nosewheel doors and propellers.

Commander's Licence: Private Pilots Licence with Instructors Rating

Commander's Age: 69 years

**Commander's Total
Flying Experience:** 15,134 hours, (of which 84 were on type)

Information Source: Aircraft Accident Report Form submitted by the pilot and additional investigations by AAIB

The pilot under instruction had just completed his multi-engined rating on this aircraft, but wanted further instruction to familiarise himself with the landing attitude of the aircraft. He was consequently briefed to perform a 'circuits and landings' exercise, with all landings to be 'touch-and-go' with full undercarriage operation. The pre-flight check of the aircraft was satisfactory. The first three circuits were performed uneventfully, but on the fourth, the instructor felt that the landing gear had taken a longer time than usual to indicate 'down and locked'. On the next circuit, however, after selecting 'gear down', only a red 'in-transit' indication was obtained.

The selector was returned to the 'up' position, (at which point the red indication extinguished), and then to 'down' again, when only a 'red' indication was again obtained. The aircraft's speed was then reduced to bring it well below the landing gear limiting speed, but to no effect. Air Traffic Control was notified of a problem on the aircraft, and having plenty of fuel, it was then flown around the circuit area whilst the crew consulted the manual. Since this only suggested high airspeed as a possible explanation, it was decided to use the emergency lowering procedure which is a 'free fall' system.

After using the emergency lowering procedure, indications of 'down and locked' were obtained on the two main landing gear legs but not the nose landing gear (NLG). A low flypast of the control tower was performed and the controller informed the crew of the aircraft that the nose gear appeared to be completely retracted.

A landing on the mainwheels was then executed and as speed was lost, the nose of the aircraft sank, allowing the propellers to contact the runway.

Subsequent investigations revealed two faults in the landing gear operating system, one of which was latent.

The hydraulic system was found to have a fluid leak from the union to the 'down' pressure line at the base of the electro hydraulic pack. This had allowed all the system fluid to escape, disabling the powered extension of the landing gear.

The latent fault was a malfunction of the NLG door operating mechanism.

Although the Beechcraft Class 1 Service Instruction No. 1209 had been complied with and the rigging of the NLG door operating mechanism was correct, it was possible for a situation to arise where the nose gear was retracted but its doors and their operating mechanism were in the open position. Witness marks on the inboard face of the door operating forked bellcrank lever (see photograph) showed that the drive pin on the drag brace knee had slipped past the fork on several occasions and had subsequently been forced back past the fork during gear extension. If the gear door drive pin slips past the mechanism drive fork during the retraction cycle, it becomes lodged above it. Under these circumstances, the NLG doors are spring driven to the open position and the door operating mechanism then rests on the open limit stop. Thus when the pilot next attempts to lower the landing gear , the NLG door drive pin on the drag brace knee is forced against the top of the fork, which cannot move away in a normal pivoting movement. (see Fig 3 of door operating mechanism)

It was discovered that the tendency for the pin to pass the fork arose from higher than expected loads between the drive pin and the fork. These were caused by fouling between the lower scissor link and the arm on the door operating shaft at an intermediate position during the door operating sequence, (see Fig 2 of door operating mechanism) which prevented normal movement of the scissor link pair. These loads exploited lateral flexibility of the forked bellcrank support structure which, when combined with poor lateral engagement of the drive pin in the fork, allowed the fork to move sufficiently outboard to permit the pin to pass the fork.

Hydraulically powered operation of the system was still possible with this fault as the forked bellcrank support structure could be distorted to release the jam by the force applied by the actuator. However, when it was attempted to extend the landing gear by free fall, the weight of the nose leg was insufficient to cause enough distortion to clear the jam.

The CAA are in contact with the manufacturer on this subject and are considering the issue of an Additional Airworthiness Directive.

Beech Duchess 76 Nose Landing Gear Door Mechanism

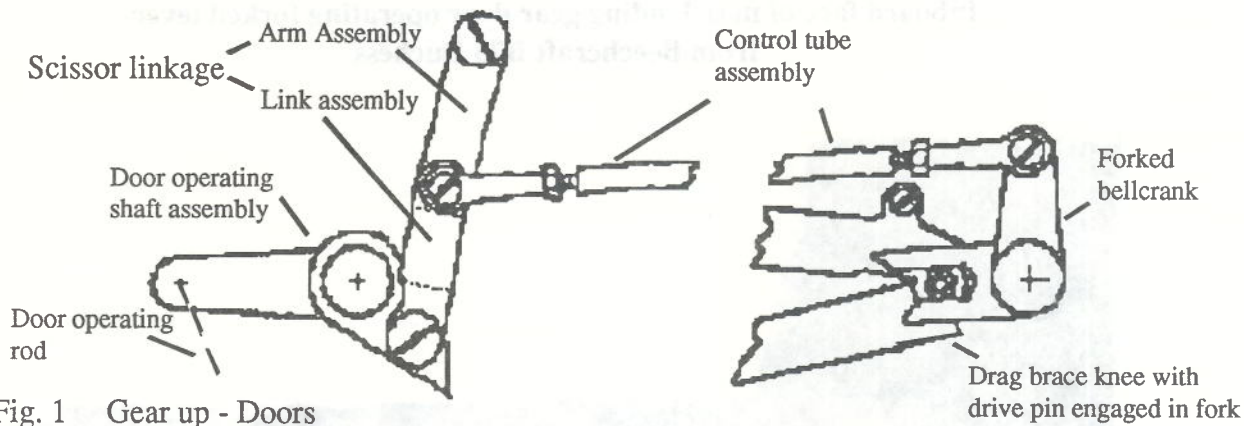


Fig. 1 Gear up - Doors

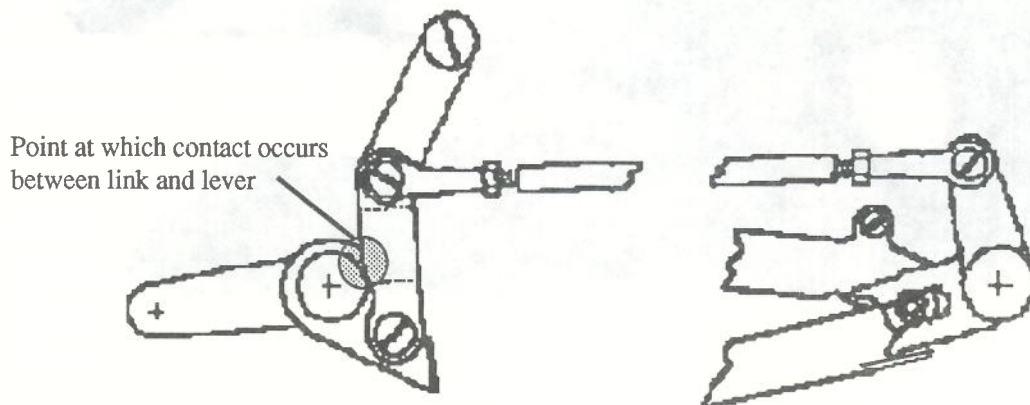


Fig. 2 Gear nearly up - doors nearly closed Point at which door mechanism becomes stiff

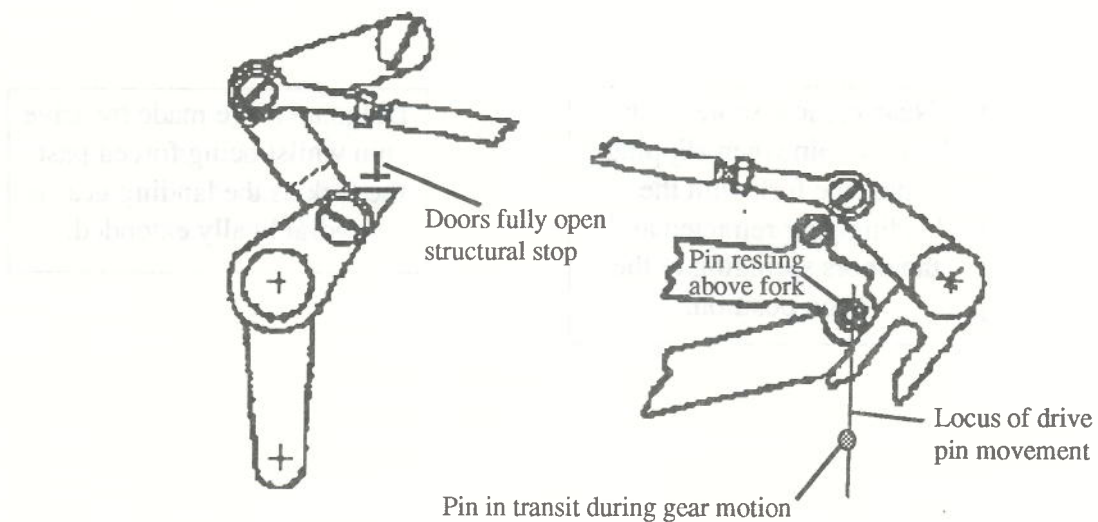
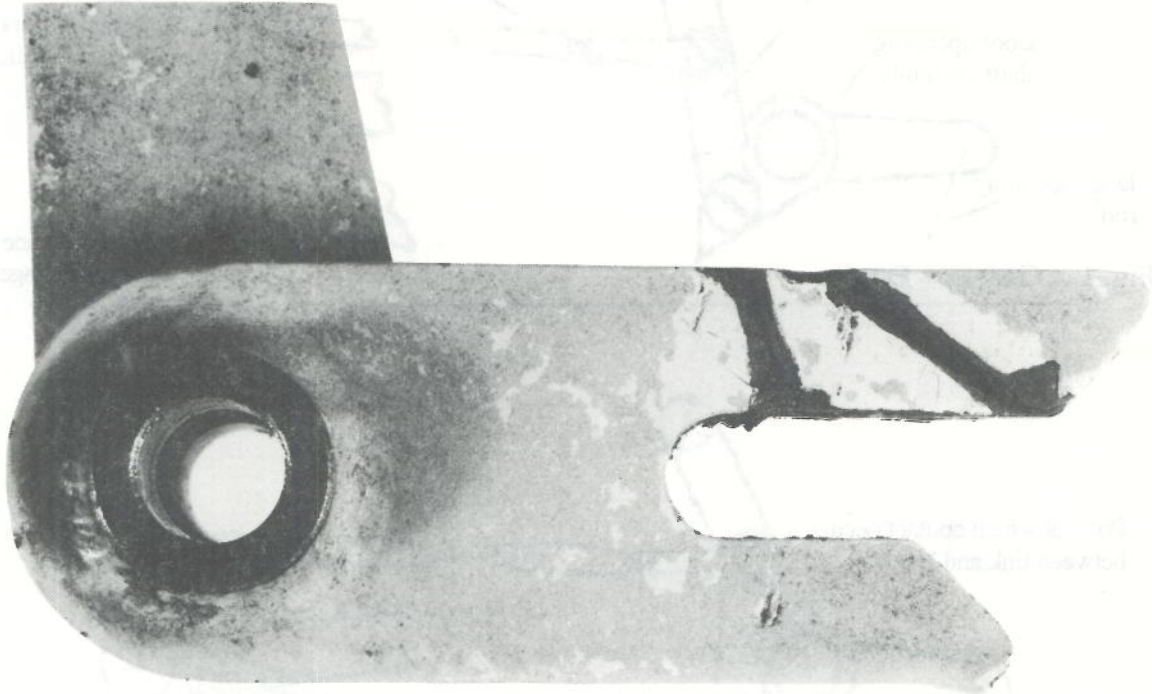


Fig. 3 Doors open In this position, the door linkage operating shaft cannot rotate anti-clockwise, any further

**Inboard face of nose landing gear door operating forked lever
from Beechcraft B76 Duchess**



Near vertical score made by drive pin when slipping past the fork with the landing gear retracted and the doors springing to the open position.

Diagonal score made by drive pin whilst being forced past the fork as the landing gear is hydraulically extended.