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Category: 1c

Aircraft Type and Registration: Piper PA-34-200 Seneca, G-BARB

No & Type of Engines: 2 Lycoming IO-360-C1E6 piston engines

Year of Manufacture: 1973

Date & Time (UTC): 24 September 1991 at 1515 hrs

Location: Birmingham International Airport

Type of Flight: Private

Persons on Board: Crew - 1 Passengers - None

Injuries: Crew - None Passengers - N/A

Nature of Damage: Left main landing gear and local wing structure damaged

Commander's Licence: Commercial Pilot's Licence with Instrument rating

Commander's Age: 37 years

Commander's Flying Experience: 853 hours (of which 127 were on type)

Information Source: Aircraft Accident Report Form submitted by the pilot and AAIB inquiries and examination of the aircraft

The aircraft made an uneventful flight from Leavesden to Birmingham International Airport. On arrival the weather was good, with the wind estimated at 13 kt from 250°M, and an ILS approach was made to Runway 33, an asphalt runway with a landing distance available of 2,134 metres. Landing gear indications were normal. Touchdown was described by the pilot as exceptionally smooth, with no bounce, but a few seconds later the landing gear warning horn sounded, the landing gear unsafe caption illuminated, and the green down-and-locked caption for the left main landing gear extinguished. The pilot found that the steering was unusually vague and that considerably greater right pedal force than usual was necessary, and also noted that the left wing seemed to be slightly lower than usual. Suspecting a flat tyre, he cleared the aircraft from the runway and taxied towards the apron until a passing aircraft informed the Ground ATC Controller that the left landing gear of the Seneca appeared to be about to collapse. G-BARB's pilot shutdown both engines, exited the aircraft and found that the left main landing gear leg had pivoted outwards to around 30° from the vertical until stopped by contact of the landing gear door with the outboard edge of the landing gear bay.

Aircraft damage was limited to the left main landing gear area and comprised fracture of the the landing gear truss assembly, crushing of the landing gear door, abrasion of part of the brake assembly, and local deformation of the wing rib forming the outboard wall of the landing gear bay.

The landing gear retracts and extends by pivoting of the leg on two trunnions about a fore and aft axis. Lateral bracing of the extended leg is by a truss assembly (Fig 1), comprising an upper link attached to a pivot on the wing forward spar and connected by a pivot bolt to a lower link attached to a pivot on the leg. The truss assembly overcentres when the leg is locked down and is retained overcentred by a hook that is carried on the upper link and engages with spigots on the lower link, and in the locked-down condition a large spring acts to maintain the truss assembly overcentred and to keep the hook engaged. The truss assembly and the hook are driven by a landing gear operating actuator that acts on a rocker fitting, pivoted on the upper link.

Examination of G-BARB showed that both outboard lugs of the truss assembly upper link had fractured in two places, allowing the link to separate from the pivot bolt connecting the upper and lower links and the leg to pivot outwards. Deformation of the link adjacent to the failures was clearly indicative of an overload condition in the truss assembly, in the mainwheel outboard sense, and inspection by a materials specialist revealed no signs of pre-existing cracking or material defect and concluded that the failure had resulted from overload.

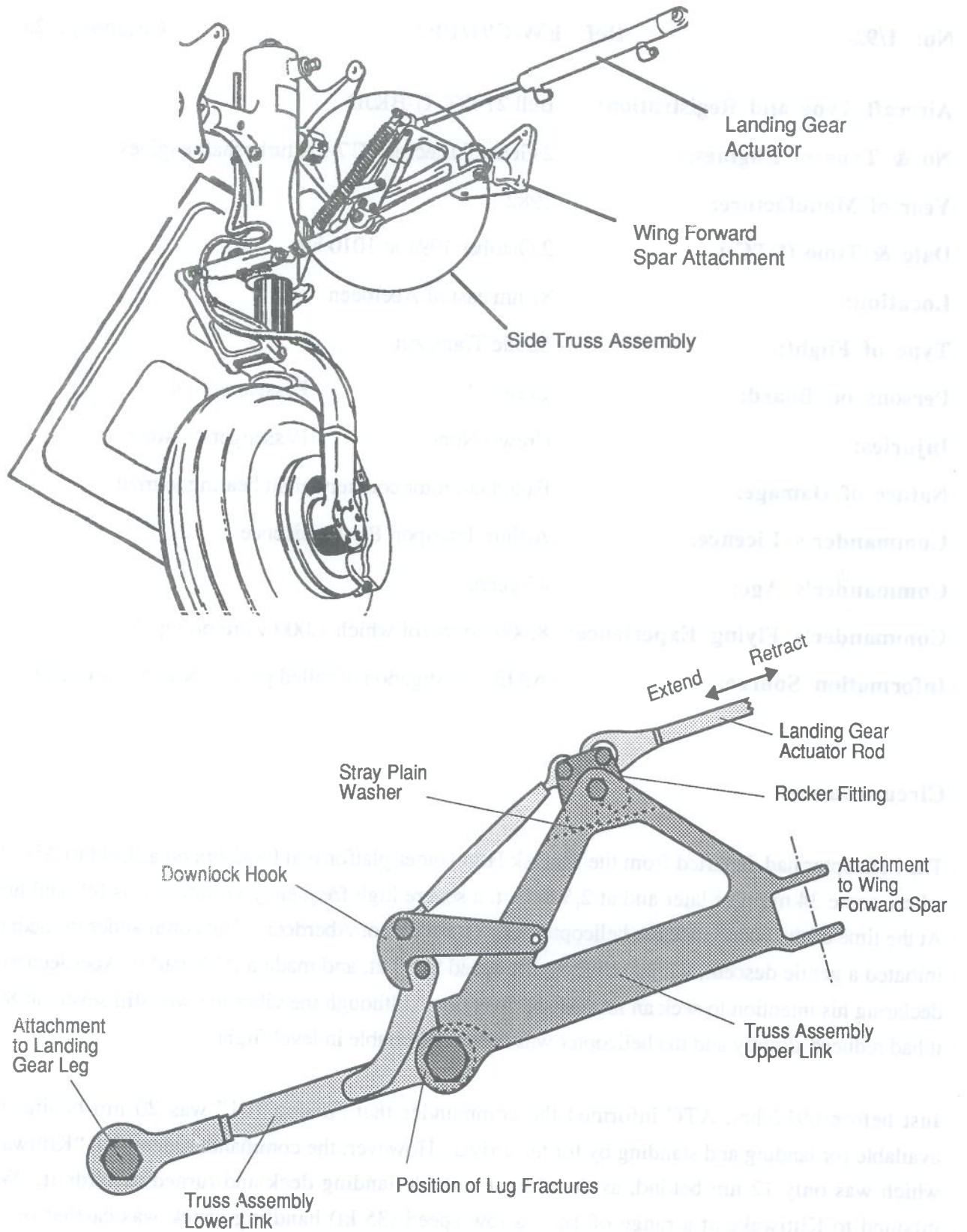
During stripping of the truss assembly a stray plain washer was found lying on the upper surface of the upper link, embedded in grease. The washer was 0.035 inch thick and 0.435 inch diameter and of a type used in a number of applications on the aircraft. Markings showed that it had been located for some time in a position beneath the forward edge of the rocker fitting where it had prevented the rocker from contacting its normal stop on the link when the actuator drove the gear in the extend direction. While this somewhat reduced the travel of the rocker and hence also the truss assembly hook in the downlock direction, checks indicated that it had not prevented the hook from contacting its downlock stop on the lower link and had probably not interfered significantly with the operation or integrity of the gear. It was also noted that considerable play was present at many of the landing gear mechanism pivots, but the evidence indicated that this had not significantly affected the operation of the gear, and reportedly was not abnormal, particularly after a period of operation from grass runways.

During the course of the investigation a truss assembly upper link from the right landing gear of G-BARB that had been replaced when found damaged around six months before the accident was obtained from the aircraft's maintainer. The link had a single fracture of the forward outboard lug, but this had not resulted in appreciable opening up of the lug or in failure of the other lug and no further damage had resulted. Corrosion adjacent to the failure was apparent and examination by a materials

specialist revealed evidence on the fracture faces of considerable intergranular corrosion. No signs of overload were present.

Records indicated that G-BARB had accumulated 2,200 hours since new at the time of the accident and that both failed truss assembly upper links had been original equipment. The maintenance schedule in effect (CAA LAMS Fixed Wing) requires an inspection of landing gear structural members at 150 operating hour intervals. On 22 January 1989 the aircraft experienced a heavy landing at Ronaldsway Airport that drove the nose landing gear up, resulting in structural damage in the windscreen area and ground contact of propeller tips (AAIB Bulletin 3/89). Inspection after this accident revealed no evidence of main landing gear distress. On 12 August 1989 G-BARB suffered a nose landing gear collapse at Newtownards Airport (AAIB Bulletin 10/89) but the circumstances suggested that this would not have caused main landing gear overload. More recently, the aircraft reportedly had been operated regularly from a particularly bumpy grass runway.

CAA database records for aircraft types with the same design of main landing gear side truss assembly, the PA-34, PA-32R and PA-28R, showed a considerable number of cases of landing gear failures in the last ten years. They included one previous case of a cracked upper link lug and one case of a cracked lower link, both found on PA-34 aircraft at 150 hour inspections, respectively at 2,758 hours and 3,472 hours time since new.



MAIN LANDING GEAR SIDE TRUSS ASSEMBLY

FIG 1