ACCIDENT

Aircraft Type and Registration:	Piper PA-34-200T Seneca II, G-BEVG
No & Type of Engines:	2 Continental Motors Corp TSIO-360-E piston engines
Year of Manufacture:	1975
Date & Time (UTC):	12 December 2007 at 1210 hrs
Location:	Sibson Airfield, Peterborough
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - None
Nature of Damage:	Damage to propellers and nose
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	55 years
Commander's Flying Experience:	6,500 hours (of which 500 were on type) Last 90 days - 30 hours Last 28 days - 10 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot, with additional AAIB enquiries

Synopsis

Following a normal touchdown with 'three greens' indicating that the landing gear was locked down, the nose landing gear (NLG) collapsed, causing both propellers and the aircraft's nose structure to contact the ground. No technical cause was determined for the collapse, although the NLG mechanism reportedly exhibited evidence of wear and a lack of recent lubrication. The aircraft had made approximately 45 flights since an Annual Inspection where a pivot bolt, which reportedly exhibited signs of wear, was recorded as having been changed in accordance with a FAA Airworthiness Directive AD No 2005-13-16.

History of the flight

Following an uneventful flight from Kemble, the aircraft landed on Runway 24 at Sibson in light winds with no significant crosswind component. The normal 'three greens' indication had been obtained on lowering the landing gear, and the touchdown was described as smooth. However, almost immediately, a muffled bang was heard, the nose lowered and the propellers contacted the ground. The aircraft continued along the runway in this attitude with the pilot applying left rudder in an attempt to clear the side of the runway, but, a lack of momentum resulted in the aircraft coming to rest to the left of the centre line. The magnetos, switches and fuel were turned off and the aircraft was evacuated.

On raising the nose of the aircraft during the subsequent recovery operation, the NLG leg swung down under gravity and locked into position. The battery master switch was turned on and the 'three greens' indication was confirmed. The aircraft was towed clear of the runway without further event.

Nose landing gear operation

The nose landing gear (NLG) of the Piper Seneca is of the forward retracting type and is hydraulically operated. When retracted, the leg is held up by hydraulic pressure in the actuator and, when extended, it is held in the down position by a geometric downlock mechanism. There are no locking hooks for either position. When the NLG is fully extended, it is prevented from collapsing by the drag link assembly, Figure 1. The offset drag link centre pivot is below the line between the drag link outer pivot bolt centres and prevents the drag link assembly folding when the landing gear is under load. The geometry of the NLG is such that the aircraft's weight on the nosewheel applies a compressive load to the drag link assembly which tends to drive it more firmly into the safe overcentre condition when the gear is properly extended. Conversely, it will tend to cause the drag link to fold, and the NLG to retract, if the load is applied when the drag link assembly is not fully overcentre.

Examination of the aircraft

When the aircraft nose was lifted clear of the ground by maintenance personnel following the accident, the NLG deployed under the influence of gravity and the drag strut adopted the normal overcentre position without any apparent problem. A series of retraction tests

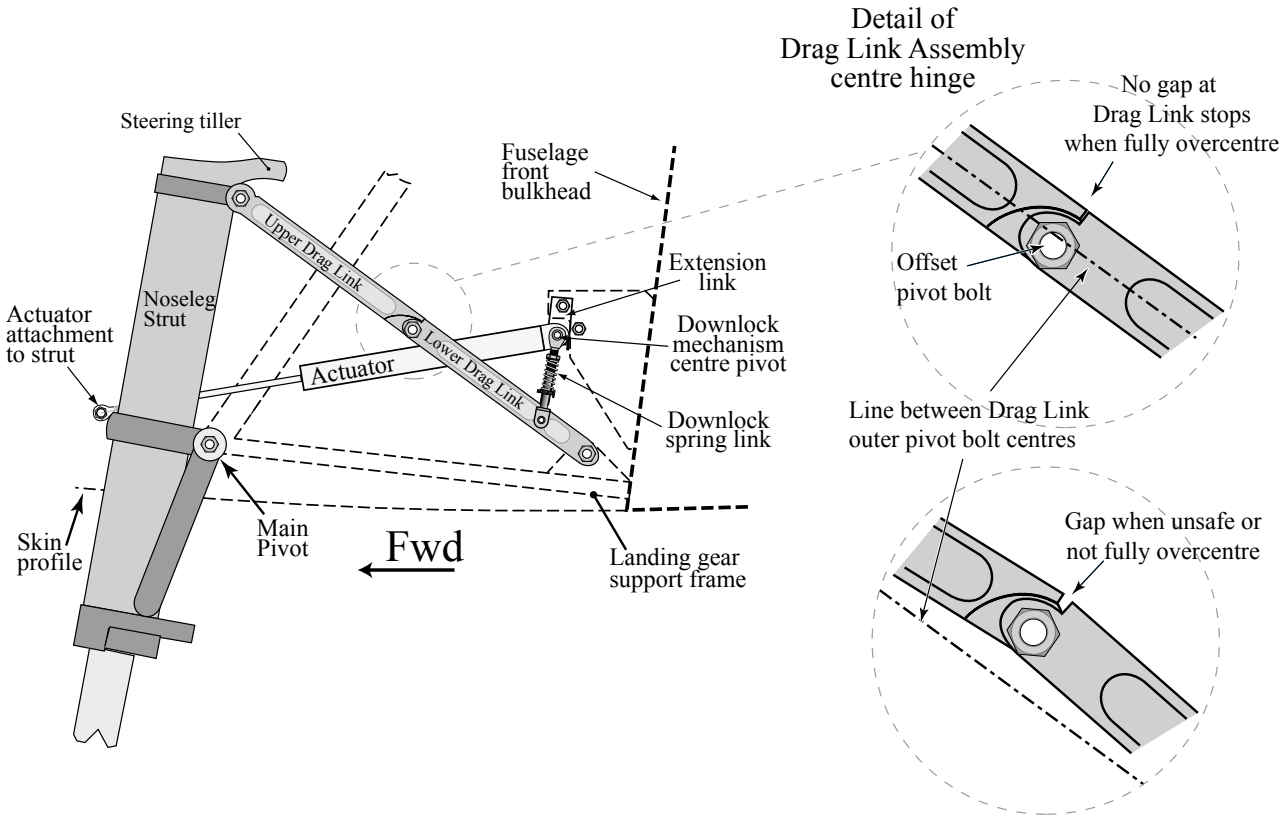

Figure 1

PA-34 nose landing gear side view showing main components in extended position
(Steering mechanism and download spring omitted for clarity)

showed that all three landing gear assemblies operated satisfactorily. A subsequent, detailed examination of the landing gear by a local maintenance organisation revealed no broken or damaged components, although a degree of wear was observed in the bushings and bolts in the drag link and in the aft attachment of the actuator to the structure. Additionally, it was observed that the grease on the gear components appeared old, which may have caused a degree of stiffness in the linkage.

Maintenance history

The aircraft's documentation recorded that an Annual Inspection had been completed on the aircraft on 22 May 2007. It underwent another Annual Inspection in September 2007, by the same maintenance organisation eight flying hours later, as a condition of sale by the owner who had recently acquired the aircraft. Following this inspection, an application for the issue of a non-expiring EASA Certificate of Airworthiness and an Airworthiness Review Certificate was made on 3 October 2007. A 50-hour Inspection was also recorded as having been completed on 29 October. At the second Annual inspection, it was recorded that minimal additional work was required following the recent previous inspection. The aircraft's log books indicate that the aircraft had made approximately 45 flights since the inspection in May.

The maintenance documentation also indicated that the bolt attaching the nose gear upper drag link to the trunnion block had been replaced in accordance with Airworthiness Directive (AD) No 2005-13-16 at the May 2007 inspection; this was one of the bolts showing evidence of wear. Lubrication of the landing gear components is required to be carried out during an Annual Inspection.

Previous occurrences

A number of Piper Seneca series of aircraft nose landing gear collapses have been investigated by the AAIB. Eight of the most recent are listed below, together with the AAIB Bulletin Reference Nos:

Registration	Date	AAIB Bulletin
G-BOSD	19 June 1999	12/2000
G-BOSD	28 February 2000	12/2000
G-EXEC	28 October 1999	3/2002
G-BNEN	22 February 2003	11/2005
G-ROLA	8 May 2003	5/2004
G-BEJV	30 March 2004	11/2005
G-BNEN	21 April 2005	4/2006
N43GG	27 September 2005	5/2006

The G-EXEC report contains the results of an examination of CAA occurrence data on nose landing gear collapses affecting the UK light twin aircraft fleet over the preceding 15 years. This revealed that there had been 35 occurrences to Piper PA-34 series aircraft during the period, compared with 13 for the PA-23 (Aztec) series, which had a similar average annual fleet size. In general, the PA-34 events were twice as frequent as the average for the rest of the light twin fleet.

Following the accident to G-BEVG, a similar examination of the CAA occurrence data was conducted, which covered the period January 2000 to January 2008. This revealed a total of eight occurrences, including the subject accident, with six of these appearing in the above table. Incidents in which the NLG collapsed as a result of other events, such as the aircraft overrunning the runway, are not included in this total. Only one occurrence for PA-23 series aircraft was recorded but this was the result of a failure of the landing gear to extend following a loss of hydraulic fluid and so was not directly comparable. The number of PA-34 series aircraft on the register had not changed significantly during the period of the second

survey, although the annual PA-23 fleet had reduced to around half its 1995 size.

The AAIB has made five Safety Recommendations during this series of occurrences; 2000-045, 2000-046, 2004-007, 2005-106 and 2005-107. The manufacturer has made a number of amendments to the Maintenance Manual and, in May 2003, issued Service Bulletin 1123, which introduced a number of maintenance actions and inspections. This was raised to Revision 'A' in November 2004 and Revision 'B' in April 2006. On 8 August 2005, the Federal Aviation Administration (FAA) issued Airworthiness Directive No 2005-13-16, which mandated SB 1123A. Additionally, it required the replacement, at 500 hour intervals, of the bolt that attaches the upper part of the drag link to the nose leg trunnion.

Discussion

Although the wear on the individual bushes and bolts in the nose landing gear of G-BEVG was not deemed excessive by the maintenance organisation tasked with repairing the aircraft, the cumulative effect of such wear, plus the stiffness in the linkage resulting from what appeared to be inadequate and/or old grease, may have combined to restrict the drag link's movement to the overcentre position, resulting in the NLG collapse. Additionally, it is possible that an exacerbating effect was provided by the undulating nature of the grass runway during the landing roll.

AD No 2005-13-16, in mandating SB 1123A, listed a number of factors identified in NLG collapses, including failure or out-of-tolerances of the retraction links and bolts, lack of cleanliness/lubricant in the components and an out-of-rig condition so nothing new appeared to feature in the subject incident.

The history of PA-34 series aircraft NLG collapses, in comparison with other light twins, might suggest that the landing gear could benefit from some additional development work. Although it would appear that a relatively minor degree of mis-rigging or component wear within the PA-34 NLG mechanism could provoke a collapse, SB 1123A and its associated AD, have identified and addressed several areas of concern. Since the AD was issued relatively recently, and it is possible that its benefits have yet to be reflected in a reduced incidence of NLG collapses, no safety recommendations are made.