Piper PA-30, G-BAWN, 31 March 1998 at 1402 hrs

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Aircraft Type and Registration:	Piper PA-30, G-BAWN
No & Type of Engines:	2 Lycoming IO-320-B1A piston engines
Year of Manufacture:	1969
Date & Time (UTC):	31 March 1998 at 1402 hrs
Location:	Near Kexby, Lincolnshire
Type of Flight:	Test Flight
Persons on Board:	Crew - 1 - Passengers - 1
Injuries:	Crew - Minor - Passengers - Minor
Nature of Damage:	Damaged beyond economic repair
Commander's Licence:	Private Pilot's Licence with IMC and Night Rating
Commander's Age:	65 years
Commander's Flying Experience:	1,679 hours (of which 555 were on type) Last 90 days - 23 hours Last 28 days - 1 hour
Information Source:	AAIB Field Investigation

The aircraft had just received a 'Star Annual' Inspection, during which time a persistent defect on the fuel quantity gauging system had been rectified. The aircraft was air-tested by the Chief Engineer of the maintenance organisation, for the purpose of renewal of the Certificate of Airworthiness but also to check operation of the gauging system and it is reported that there were no abnormalities noted. A further two test flights were carried out, primarily to check for proper function of the fuel gauging system. Again, no handling problems were noted.

The aircraft was collected by its owner four days later and he took off to return to his base at Granston. During the flight, he noticed a slight tremor on the control yoke when light pressure was exerted on it. Although he was not by any means alarmed, he decided to return to Sturgate to have it checked. A conversation with the Chief Engineer suggested that the vibration might have been

engine-related and due to a magneto drop. The engine was run and it was decided that they would take off for a test flight to see if the problem had been cleared. This was done and, at 1,500 feet in the cruise, they were able to reproduce the tremor, which appeared to be speed-related. The Chief Engineer was unhappy with the situation and decided that they should immediately to return to Sturgate.

However, whilst still some 2 miles to the North of Runway 27/09, the tremor abruptly changed to a violent vibration - so severe that the pilots felt that control was almost impossible and two pairs of hands were required on the yoke to prevent the oscillations in pitch becoming intolerable. To have landed on the runway would have necessitated a right turn through about 120°, which the pilots did not feel they had enough control to achieve even though reducing airspeed appeared to slightly improve the situation. Instead they continued on a heading of 150°, descending for a forced landing in fields 2-2.5 miles South-east of the runway. A wheels-up, engines-off landing was made in a field of winter wheat. Although the landing was carried out without severe difficulty and the pilots evacuated the aircraft normally, the aircraft sustained sufficient damage to render it beyond economic repair, principally due to fracture of both wing spars.

Examination of the aircraft

It was immediately apparent that the stabilator of the aircraft had severe damage typical of that seen when control surface aeroelastic 'flutter' has occurred. There were clear signs of gross overtravel of the two-piece trim/anti-balance tab the elements of which were free to move independently of the stabilator because the AN3-11A bolt, MS20364-1032C nut, washers and inner plain bearing were missing from the rod which controlled them (see diagram). An aluminium alloy sheet bellcrank is rivetted to the inboard end of each tab half and a nut and bolt should be fitted, locking the bellcranks together with the control rod between them. Rotary movement of the rod relative to the bellcranks is accommodated by a plain oilite bearing running in two flanged oilite bushes in the rod end. The nut is specified as a self-locking type as opposed to using a split-pin or wire-locking method.

Signs of contact with the thread of the bolt could be discerned on both the bellcrank plates and also in one of the bronze bushes in the rod end. There was no evidence of distortion or oversizing of the holes in the bellcranks which could indicate that the bolt had been wrenched or had been a loose fit. All the indications were that the bolt had progressively migrated out of the assembly. Equally so, there were no signs of distress such as might indicate seizure of the bearings. Consideration was, of course, given to the possibility that the bolt or nut had fractured but there is apparently no previous history of this and there was no evidence of anomalies with the associated fittings which would be expected if the bolt or nut had been subjected to abnormal loading.

Discussion

It is beyond doubt that the severe oscillations in pitch control were caused by the disconnected tabs. The Chief Engineer, who was on-board at the time of the incident, expressed his surprise at the dramatic effect this had on the aircraft which leads to the possibility that some pilots and engineers may not be aware of the catastrophic potential of such an event. The Certificate of Airworthiness renewal flight had included a Vne dive and it is possible that, had the disconnection occurred during this phase of flight, then complete loss of control and/or structural failure may have occurred. The initial 'tremor' felt by the owner was probably the whole assembly becoming loose, changing to violent oscillation as the bolt departed.

Conversations with the maintenance organisation have failed to discover the reason why the nut apparently backed-off the bolt, allowing it to migrate out of the assembly. The Annual check required lubrication and inspection of the flying controls only which did not require disassembly. Indeed, from the records available to them, the last time work was done in that area was several years ago when the stabilator was replaced. It is unlikely that an engineer would not have spotted a loose or missing nut during an annual inspection - particularly when the assembly was lubricated (a Piper Service Manual requirement every 100 hours).

Despite a thorough enquiry by the maintenance organisation, no explanation for this state of affairs can be offered. In the light of this experience, however, the organisation has issued a number of maintenance requirements applicable to aircraft maintained by them with all-moving tailplanes. These requirements call for inspections for security of the subject assembly and conformance with the manufacturer's specification. In addition, the bolts are to be renewed every 500 hours.

The CAA has also published a resume of the circumstances of this accident in its *General Aviation Safety Information Leaflet* (GASIL) with a warning to pilots and engineers involved with this and other aircraft of the Piper range to pay particular attention to this area.