ACCIDENT

Aircraft Type and Registration:	Piper PA-28-181 Cherokee Archer II, G-BTAM
No & Type of Engines:	1 Lycoming O-360-A4M piston engine
Year of Manufacture:	1988
Date & Time (UTC):	24 August 2010 at 0615 hrs
Location:	Isle of Man (Ronaldsway) Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Aileron control rod failure
Commander's Licence:	Private Pilot's Licence
Commander's Age:	50 years
Commander's Flying Experience:	3,538 hours (of which 2,500 were on type) Last 90 days - 101 hours Last 28 days - 34 hours
Information Source:	AAIB Field Investigation

Synopsis

Shortly after departure the pilot noticed a loss of aileron control and made an uneventful diversion and landing using the rudder to control bank and heading. The eye end on the right aileron control rod had failed at the aileron due to reverse bending fatigue. This was caused by the bearing in the eye end having seized, due to corrosion and an absence of lubrication.

History of the flight

Shortly after departing from a private strip near Douglas on the Isle of Man, the pilot noticed a loss of aileron control. He was heading towards Isle of Man (Ronaldsway) Airport at the time so he made contact via radio and requested an emergency diversion. The pilot controlled the aircraft's bank angle and heading using the rudder and made an uneventful landing on Runway 26.

Aileron control rod examination

Each aileron on the Piper PA-28-181 is operated by the control wheels through a series of cables and pulleys which connect to a bellcrank in the outer wing. A control rod connects this bellcrank to the aileron, with an eye end at the bellcrank and one at the aileron attachment (Figure 1). After G-BTAM landed it was discovered that the right aileron control rod had failed at the threaded shank of the eye end at the connection to the aileron (Figures 1 and 2). Metallurgical examination revealed that the threaded shank of the eye end had failed in bending due to fatigue and that the ball inside the

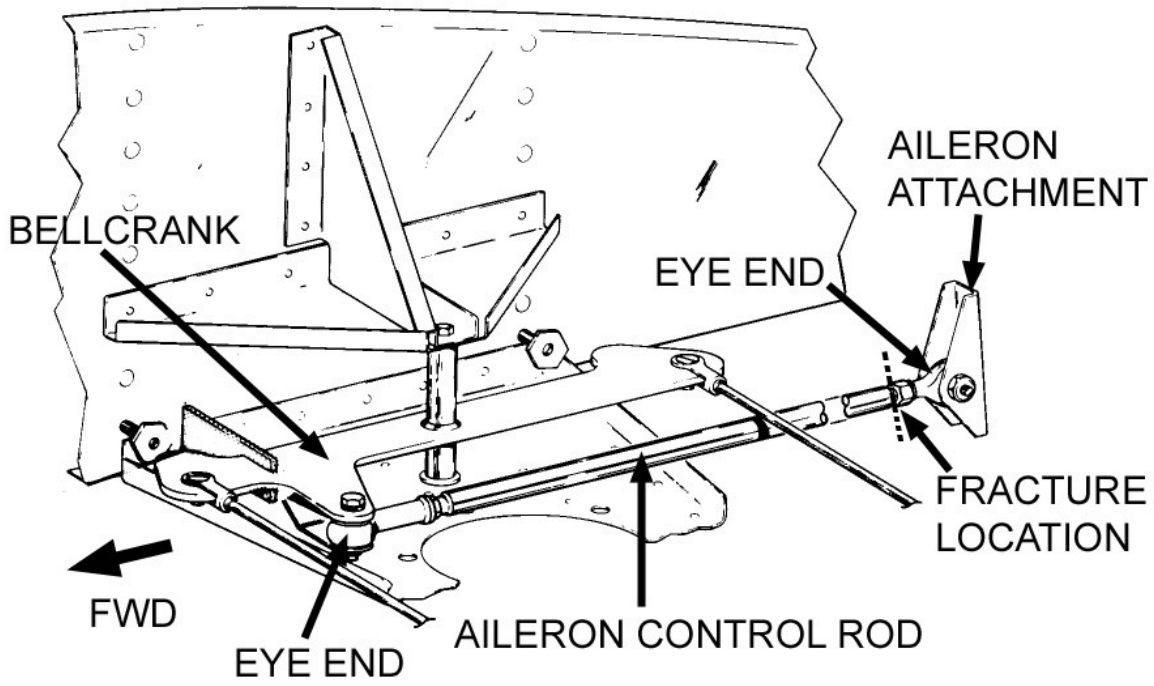

Figure 1

Location of aileron control rod and fractured eye end

Figure 2

G-BTAM right aileron control rod eye end with fractured threaded shank

plain bearing of the eye end was seized. There was no evidence of lubricating oil inside the bearing and there was evidence of corrosion build-up between the ball and the race of the bearing. There was also evidence of corrosion and corrosion pitting on the external surfaces of the eye end.

Maintenance history

The aircraft maintenance manual requires that the aileron control rod eye end bearing is lubricated every 100 hours with a MIL-L-7870 standard oil, which lubricates and provides protection against corrosion. The aircraft's last annual inspection was completed on 18 February 2010 at 3,488 airframe hours, when the rod end was reportedly lubricated. The pilot had subsequently carried out a 50-hour maintenance check on 11 June 2010, at 3,536 airframe hours, but had not lubricated the aileron control rod eye ends. The airframe hours at the time of the eye end failure were 3,586 hours – 2 hours short of when the next 50-hour check and the 100-hour lubricating check would have been required.

The aircraft was based at a private strip near Mount Rule Field, Douglas, on the Isle of Man, about 3 miles from the sea. The aircraft was not hangared, so it would have been regularly exposed to wind containing salt particles from the sea. The Federal Aviation Administration's (FAA's) Advisory Circular (AC 43 4A) entitled '*Corrosion Control for Aircraft*' includes maps of the world showing the degree of corrosion severity by area, ranging from '*mild'* and '*moderate'* to '*severe'*. These maps show that in the UK the corrosion severity is '*severe'* in all locations that are about 50 miles or less from the sea. The Advisory Circular recommends:

> *'thorough cleaning, inspection, lubrication, and preservation at prescribed intervals'*

and in this document the suggested interval for aircraft based in '*severe'* corrosion zones is 15 days.

Unrelated to this incident, the aircraft manufacturer is planning an amendment to Chapter 5-30-00 of the PA-28-181 aircraft maintenance manual, which will introduce specific maintenance requirements for aircraft operating in high salt or high humidity environments.

Research on previous aileron control rod failures

The AAIB's accident database was searched for previous occurrences of Piper PA28 aileron control rod failures and none was found. The aircraft manufacturer's safety department was contacted and they were not aware of any previous occurrences of aileron control rod failures on PA28s. The manufacturer's search of the FAA's 'Service Difficulty Reports' database revealed that since 1995 there have been 79 reports of problems relating to ailerons on PA28s but none of these involved seized or separated control rod end bearings.

Analysis

The aileron control rod end had failed as a result of reverse bending fatigue and this fatigue failure was probably a consequence of the bearing seizure in the eye end. Once the ball in the eye end had seized, any further movement of the aileron would only have been possible due to slippage of the bolt relative to the eye end. However, the eye end would not have rotated freely around the bolt so this would have introduced bending loads on the threaded shank. It was these repetitive bending loads which probably resulted in the rod end failing. Thus, the bearing had seized due to corrosion and an absence of lubricating oil and this corrosion was probably exacerbated by the aircraft being parked outside in an environment close to the sea with a '*severe'* corrosion risk. The pilot/owner candidly admitted that he should have inspected and lubricated the rod end bearing more frequently, given its operating environment.