

**INCIDENT**

<b>Aircraft Type and Registration:</b>	Reims Cessna F406, G-SFPB	
<b>No &amp; Type of Engines:</b>	2 Pratt & Whitney Canada PT6A-112 piston engines	
<b>Category:</b>	1.2	
<b>Year of Manufacture:</b>	1991	
<b>Date &amp; Time (UTC):</b>	14 January 2005 at 0946 hrs	
<b>Location:</b>	40nm northwest Sumburgh VOR, Shetland Islands	
<b>Type of Flight:</b>	Aerial Work	
<b>Persons on Board:</b>	Crew - 3	Passengers - None
<b>Injuries:</b>	Crew - None	Passengers - N/A
<b>Nature of Damage:</b>	None	
<b>Commander's Licence:</b>	Airline Transport Pilot's Licence	
<b>Commander's Age:</b>	59 years	
<b>Commander's Flying Experience:</b>	11,505 hours (of which 6,750 were on type) Last 90 days - 150 hours Last 28 days - 35 hours	
<b>Information Source:</b>	Aircraft Accident Report Form submitted by the pilot and additional AAIB enquiries	

**Circumstances**

The aircraft was on a fisheries patrol flight and at the time of the incident had just completed a low level (200 ft) pass over a fishing vessel, for photographic purposes, which involved a 30° banked turn to the left. On completing the pass, a right turn was made in order to return the aircraft to straight and level flight. A further correction to the left was then attempted but the handling pilot, who was the First Officer (FO), encountered a strong resistance. He alerted the commander to the problem and together they found that an excessive force was required to maintain straight flight. Pitch control was found to be normal and the aircraft was climbed to 1,000 ft. A gentle right turn was initiated, which required normal control force. However, reverting to a wings level attitude required

excessive effort when the control yoke was some 3° to 5° left of the central position.

The commander assumed control and, having made a 'PAN' call, positioned the aircraft for a straight-in approach to Runway 15 at Sumburgh. The control difficulties continued during the approach, with corrections to the left requiring considerable effort. The aircraft landed without incident and whilst taxiing in the commander attempted a 'full and free' check of the flight controls; he found the resistance to a left aileron input exactly the same as in flight. He invited the FO to try, who, after experiencing the same resistance, felt a jolt and the control restriction disappeared, allowing normal

movement and associated forces throughout the range of operation. The commander later commented that the restriction had seemed to occur whenever an attempt was made to turn the control wheel to the left, regardless of its position. This led him to additionally comment that the restriction felt “electrical” in origin, despite the fact that the autopilot was disengaged.

At the time the crew initially became aware of the problem, the aircraft was clear of cloud, with an ambient temperature of +6°C and dew point of +3°C.

### **Subsequent investigation**

An engineer was flown from the operator’s base at Inverness to Sumburgh later on the day of the incident. The control restriction was no longer present and no evidence of one remained despite an extensive inspection of all cables, chains, linkages and attachment points. This involved the removal of various access panels and shrouds. The autopilot was also checked and its operation was found to be normal, with no restrictions on the flying controls. The aircraft was cleared for a test flight and two days later was flown to Inverness without further incident.

On return to Inverness, the cabin floor was removed and a repeat inspection made of the control system. No defects or loose articles were found. As a precaution, all four aileron attachment bearings, which were noted to be stiff in operation, were replaced. The aircraft was returned to service and the problem has not subsequently recurred.

### **Examination of aileron bearings**

The aileron bearings were sent to AAIB who commissioned a metallurgical examination of them. It was found, following disassembly that the grease in three of the bearings had dried out, leaving a powdery deposit. The fourth, the left hand inboard, was from a different bearing manufacturer and had a relatively large amount of grease applied. It was also of a different design in that it had a single row of convex rollers and no cage. The others were a dual race design, with concave rollers and a cage.

The dual race bearings all displayed extensive corrosion on the surfaces of the rollers and raceways. Corrosion was also apparent on the single race component, although it was less extensive. The effect of the corrosion was to cause the bearings to be stiff in operation, but there was no sign that they had seized. Had they done so, it would be reasonable to expect to find evidence, in the form of flats, worn on the roller surfaces.

### **Discussion**

The fact that aileron movement was restricted in one direction only, coupled with the outside air temperature of +6°C, meant that the possibility of ice in the bearings, or indeed any other part of the system, could be excluded as a potential cause. Similarly, the uni-directional nature of the restriction tended to discount an autopilot malfunction (notwithstanding the commander’s comments), this conclusion being given increased confidence by satisfactory operation since the aircraft was returned to service.

The crew report suggests that the problem may have been due to a small object causing a restriction in the movement of a bellcrank, lever or cable quadrant. Despite an exhaustive examination, no trace of such an object, which might include a nut or rivet, was found, although there would be ample scope for a small article to remain undetected in the bottom of the fuselage.

The only significant finding was the stiff operation of the aileron bearings, which were found to be in a corroded condition although they had remained intact. This particular aircraft spends a considerable amount of time at low level over the sea in a salt-laden atmosphere, and thus experiences an increased exposure to corrosion relative to conventional operations. However, the condition of the bearings was considered to have caused nothing worse than a slightly elevated level of aileron control forces throughout the range of movement.

The aircraft manufacturer similarly does not believe that the condition of the bearings were responsible for the reported restriction. Nevertheless, as a precautionary measure, they are proposing to issue a Service Bulletin (SB) that calls for a periodic inspection of the

aileron and rudder bearings (the elevator bearings are already subject to regular inspections). The Aircraft Maintenance Manual will eventually be amended to reflect the intent of the SB.