AAIB Bulletin No: 4/94 **Ref: EW/G93/10/25** **Category: 1.3**

Aircraft Type and Registration:	Sequoia Falco F8L, G-MRCI	
No & Type of Engines:	1 Lycoming IO 320 B1A piston engine	
Year of Manufacture:	1991	
Date & Time (UTC):	24 October 1993 at 1538 hrs	
Location:	12 miles north of Newcastle International Airport	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Loss of right-hand wing flap	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	54 years	
Commander's Flying Experience:	422 hours (of which 3 were on type) Last 90 days - 5 hours Last 28 days - 1 hour	
Information Source:	Aircraft Accident Report Form submitted by the pilot and inspection of the failed flap	

The aircraft was on its third flight after having a new flap fitted to the left-hand wing: G-MRCI had lost the flap from the left-hand wing in flight on 1 April 1993 and this accident was reported in AAIB Bulletin 8/93.

The pilot reports that the aircraft was cruising at an altitude of 2,000 feet and at an indicated airspeed of approximately 150 mph. Approaching the Newcastle TMA, a 'moderate-to-heavy' vibration was felt for one or two seconds; the pilot compared it to a burst of machine-gun fire. On checking the aircraft, it was apparent that the outboard portion of the right-hand flap was missing and the remaining inboard portion was hanging down at about 30°.

The pilot carried out a series of handling tests, including operation of the landing gear, and declared an emergency as he was concerned that the remaining half of the flap might detach. In the event, however, he was able to carry out a flapless landing at Newcastle with no further problems.

Examination of the remains of the right-hand flap from this accident showed that it had failed at two-thirds of its span, with the outboard one-third leaving the aircraft and the inboard two-thirds still attached at its inboard end. The failure of the structure appeared to be principally in a spanwise bending sense.

The previous accident, on 1 April 1993, had occurred when G-MRCI was being flown from Newcastle Airport on a PFA flight test schedule. The V_{NE} checks were being performed when, at approximately 195 kt in a 30° dive, there was a loud buzzing sound and airframe vibration for about two seconds; the pilot reduced power, eased out of the dive and then noticed that the entire left-hand flap had departed the aircraft. The pilot checked the controls for correct and safe flying qualities and, after some difficulties in lowering the landing gear (which, in this design, require flap selection before the landing gear may be lowered), the pilot made a safe landing, without flap, at Newcastle.

Following the accident on 1 April 1993, the Popular Flying Association were in communication with the aircraft kit and plans manufacturer in the United States. The manufacturer produced a mandatory Service Bulletin, 93-1, on the subject of 'Flap Flutter' which also introduced three modifications to decrease the likelihood of it occurring. Two of these modifications were to introduce close tolerance bolts throughout the flap control system, to reduce the system free play, and to add reinforcing straps at the supports for the torque tube and flap actuator.

The third modification involved the balancing of the flaps by adding mass at the leading edge. This was accomplished by removing the flap pushrod and measuring the resulting download at a specified point at the trailing edge; the flap was then to be balanced by the addition of sufficient concentrated mass at the leading edge to reduce this out-of-balance to 23 oz or less. A sample of flaps similar to those on G-MRCI (that is, wood structure with plywood covering) had shown an average out-of-balance of 24.5 oz. with a standard deviation of 4.0 oz: the right-hand flap from G-MRCI, by contrast, had an out-of balance of 37.4 oz. Using the manufacturer's figure of leverage, 3-to-1, this required an addition of approximately 1.4 kg of lead at the leading edge, over 25% of the mass of the flap.

The reason for this large out-of-balance on the right-hand flap on G-MRCI appeared to be that a smooth and glossy finish on the flap had been accomplished with substantial amounts of filler material. In addition, there were some construction discrepancies within the flap, notably that the covering at the leading edge 'D' section was 2 layers of 1mm plywood rather than 1 layer of 2mm, as specified, with some areas of void between the layers and that the wood grain in the upper spar cap, in the area of flap failure, was approximately 15° to 20° from the axis of the spar.