No: 10/92 **Ref: EW/G92/05/22** **Category: 1c**

Aircraft Type and Registration:	Piper PA-34-200-2 Seneca, G-BBZJ
No & Type of Engines:	2 Lycoming 1O-360-C1E6 piston engines
Year of Manufacture:	1974
Date & Time (UTC):	25 May 1992 at 1143 hrs
Location:	Dunsfold Airfield, Surrey
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 3
Injuries:	Crew - None Passengers - None
Nature of Damage:	Extensive fire damage behind the right-hand instrument panel
Commander's Licence:	Private Pilot's Licence with IMC and Night ratings
Commander's Age:	51 years
Commander's Flying Experience:	330 hours (of which 60 were on type) Last 90 days - 20 hours Last 28 days - 13 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and investigation by an AAIB Inspector (Engineering)

Whilst in the cruise, smoke appeared from under the right-hand instrument panel combing, but with no other warning indication. The pilot turned the aircraft back towards an airfield over which he had just flown. The smoke appeared in 'surges' before sparks and a small amount of flame were seen, for a few seconds, in the area of the right-hand rudder/brake pedals. The right generator 'over-voltage' circuit breaker activated two to three minutes after the smoke first appeared, and the left generator over-voltage circuit breaker tripped prior to landing. The pilot carried out a rapid descent and landed on runway 03 at Dunsfold Airfield, where he brought the aircraft to a stop some 50 to 60 yards beyond the end of the runway. The airfield fire service attended the scene and, after cutting into the side of the aircraft fuselage, extinguished the fire.

Examination of the aircraft revealed extensive fire damage behind the right-hand instrument panel. The fire had destroyed the instrument air filter, all the rubber instrument air pipes located in that area, in addition to the main aircraft right-hand electrical and avionics wiring loom. The source of the fire was

traced to the "Alternator Inoperative Switch" Unit, Piper Part No. 587863, manufactured by Lamar, Part No. A-00258-1. The function of this unit was to sense the output voltage of the alternator and to illuminate the "Alternator Inoperative Warning Light" in the cockpit when the voltage dropped below a preset value. The unit was a solid state device, encapsulated in a form of epoxy resin and approximately the size of a matchbox. A report, by the Analytical and General Chemistry Section of the Royal Aircraft Establishment of Farnborough, indicated that several volatile chemical compounds would have been released from the heated epoxy resin which, if inhaled sufficiently, can induce 'loss of the righting reflex', *ie* intoxication. Examination of the aircraft's electrical generation system revealed no faults and the 5 ampere circuit breaker between the main electrical bus bar and the alternator inoperative switch had not tripped.

In December 1986 an accident occurred to a Piper PA 38 at Walthamstow, London, which resulted in one fatal and one serious injury, and to which AAIB Bulletin 5/87 referred. A causal factor of this accident was smoke in the cockpit caused by the failure of the alternator inoperative switch manufactured by Lamar, part No. A-00258-1.

Examination of a printout from the data base of the Safety Regulation Group, Civil Aviation Authority (CAA), revealed that in June 1987 an incident occurred to a Piper PA 34 in which the left-hand Alternator Inoperative Switch manufactured by Lamar, part No. A-00258-1, had overheated and generated a burning smell within the cockpit. However in that instance the pilot had managed to land the aircraft successfully.

Since this accident to G-BBZJ the CAA has conducted an investigation into the Lamar unit installation in the PA 34 type and found that there was no electrical protection between the aircraft's alternator and the unit. Modification action has been instigated by the CAA to install an in-line 1 ampere fuse, since in normal operation the Lamar unit current requirement is approximately 20mA, between the alternator and the Lamar unit, on PA 34 aircraft. All Lamar Alternator Inoperative Switch, Part No. A-00258-1, installations are under review to ensure that they have electrical protection consistent with their function.

The modification that installed the Lamar unit on this aircraft was a locally produced modification approved by the CAA. Section K6-13 of BCAR's requires that:

Paragraph 6.6.3 "All electrical equipment including cables and their accessories shall, as far as is practicable, be constructed of materials which do not support combustion and which meet the relevant requirements of CAA Airworthiness Division Specification No 8 "Flame Resistance Testing for

Aircraft Interior Materials". Other materials shall be so applied and/or protected that the risk of fire is not increased by their use. (See also K4-3, 6).

Paragraph 6.6.4 "Electrical equipment shall be so constructed and/or installed that in the event of failure, no hazardous quantities of toxic or noxious products (*eg* smoke) will be distributed in the crew or passenger compartments".

Paragraph 6.6.5 "Precautions shall be taken to prevent any flammable material from coming into contact with any portion of electrical equipment which may attain a temperature exceeding 200 degrees centigrade under either normal or faulty condition".

Safety Recommendations

As a result of these occurrences, related Safety Recommendations are being pursued with the CAA and will be published in the next issue of AAIB Bulletins.