SERIOUS INCIDENT

Aircraft Type and Registration:	Piper PA-34-200T Seneca II, G-BOCG
No & Type of Engines:	2 Continental Motors Corp TSIO-360-EB piston engines
Year of Manufacture:	1978
Date & Time (UTC):	15 February 2012 at 1025 hrs
Location:	Birmingham Airport
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Electrical connector in cabin heater power supply overheated
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	44 years
Commander's Flying Experience:	3,894 hours (of which 1,045 were on type) Last 90 days - 58 hours Last 28 days - 18 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and AAIB enquiries

Synopsis

During the approach, wisps of smoke were seen to come from the area of the cabin heater selector switch. The system was isolated, the cabin fire extinguisher was discharged and the aircraft made an uneventful landing. The source of the smoke and acrid smell was an overheated and partially melted electrical connector.

History of the flight

An instructor was conducting an instrument training flight with one student flying the aircraft and a passenger, who was also a student, in a rear seat observing the flight. The student had been given clearance for a low approach and go-around. The aircraft was approximately six miles from Birmingham Airport, established on the ILS for Runway 33, when the passenger reported that there were wisps of smoke rising from the cabin heater switches located on the centre console, which is situated between the two front seats. The instructor did not see the smoke, but was aware of an acrid smell. He immediately took control of the aircraft and instructed the student to remove the instrument flying screens. The student in the rear then reported that he could see a flame beneath the console. The instructor passed the details of the incident to the Birmingham Tower controller and informed him that he wished to land from the approach. The instructor

visually checked the Circuit Breaker (CB) for the cabin heater, which had not tripped. He switched off the heater, opened the vents and instructed the passenger to use the cabin fire extinguisher, which was stored between the two front seats. The passenger retrieved and then operated the extinguisher, while holding it at an angle. He advised the instructor that the discharge rate was poor, but sufficient to extinguish the flame.

The aircraft was now within four miles of the threshold for Runway 33 and the instructor updated the Birmingham Tower controller of the emergency and that the fire had been extinguished. The controller cleared the aircraft to land and alerted the emergency services who met the aircraft on landing. The landing was uneventful.

The instructor later discharged the remainder of the contents of the fire extinguisher onto the dispersal and noticed that full discharge pressure was only achieved when the extinguisher was held in an upright position.

Examination of electrical connector

The source of the fumes and flames was a partially melted plastic electrical connector, located in the centre console, through which the electrical power passes to the cabin heater. (See Figure 1) From an examination of the connector it was established that a pin in the connector, through which the electrical power from the CB to the heater selector switch is routed, had overheated.

Due to the extent of the damage it was not possible to identify why the pin had overheated. However, the organisation that maintained G-BOCG, and 12 other PA-34 aircraft, advised the investigation that the connector is frequently disconnected in order to inspect the flying control cables that run under the console. During this maintenance activity they have, on a number of occasions on different aircraft, found loose and corroded pins, and evidence of overheating. The affective parts were replaced on all these occasions.

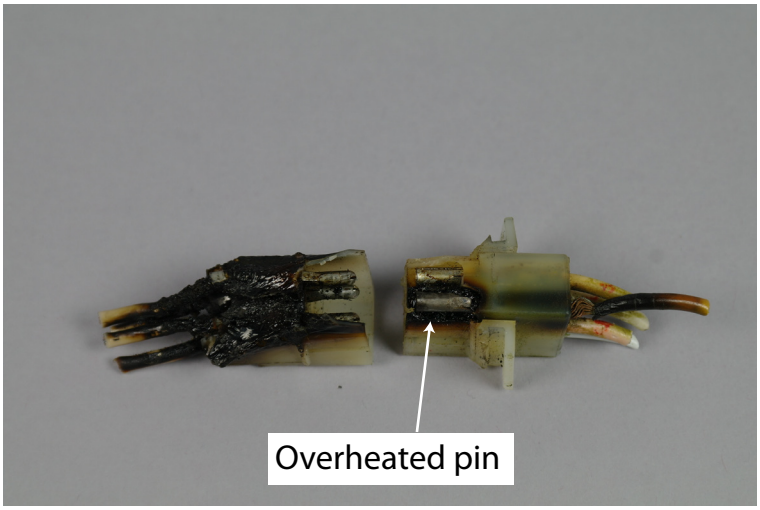

Figure 1

Electrical connector

Loose and corroded pins can result in an increase in electrical resistance, which might result in an increase in the voltage drop across the connector. This increase in voltage drop could cause the connector temperature to increase, which will further increase the electrical resistance and the temperature. This cycle of increased resistance and temperature increase is known as 'thermal runaway' and will continue until the power supply is disrupted.

The maintenance organisation confirmed that the 15 amp CB, that protected this circuit, did not operate during the incident and they subsequently found the CB to be serviceable.

Fire extinguisher

The cabin fire extinguisher utilised halon as the extinguishing agent, which is propelled out of the container by pressurised nitrogen. A label on the cabin fire extinguisher titled *'INSTRUCTIONS'* lists three steps in the operation of the extinguisher. The first steps states *'HOLD UPRIGHT. PULL OUT PIN'*. If the fire extinguisher is not held upright then the nitrogen will escape with the halon, thereby reducing the effectiveness of the fire extinguisher. The manufacture of the fire extinguisher advised the investigation that if the extinguisher is operated in the horizontal position, then only 50% of the halon will be discharged.

AAIB comment

The maintenance organisation had previously identified that the pins in the connector were susceptible to overheating as a result of corrosion or working loose. With the lack of any other obvious damage it is likely that these were the initiating factors which caused the thermal runaway that eventually resulted in the connector melting.

The fire extinguisher operated satisfactorily when held in the required vertical position, and the reported poor discharge rate was probably because it was operated when held at an angle. This demonstrates the importance of both crew and passengers being fully briefed on the use of any emergency equipment that they might need to use, or operate, in flight.