INCIDENT

Aircraft Type and Registration:	Piper PA-28-161, G-BGPJ
No & Type of Engines:	1 Lycoming O-320-D3G piston engine
Year of Manufacture:	1979
Date & Time (UTC):	17 August 2006 at 1200 hrs
Location:	Woodvale Airfield, Lancashire
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Fire damage within engine compartment. Some wiring and hoses damaged
Commander's Licence:	Commercial Pilot's Licence
Commander's Age:	52 years
Commander's Flying Experience:	4,500 hours (of which 2,000 were on type) Last 90 days - 240 hours Last 28 days - 70 hours
Information Source:	AAIB Field Investigation

Synopsis

The engine stopped twice following an uneventful local flight. The pilot tried to restart the engine but with no success and he was told that there were flames around the nose landing gear leg. The pilot and passenger evacuated the aircraft rapidly and the fire was quickly extinguished. Examination revealed that one of the two hollow arms of the horseshoe-shaped float in the carburettor contained a substantial amount of fuel, which prevented the needle valve from fully closing. This allowed excess fuel to flow through the carburettor's jets, giving a rich mixture and, at low power, caused the engine to suffer a rich fuel mixture cut. It also caused fuel to pour out of the carburettor into the air box. Safety Recommendation 2007-040 is made to the FAA.

History of the flight

During the landing roll following an uneventful local flight the engine stopped. The pilot restarted the engine and taxied the aircraft to the hangar and on closing the throttle, the engine stopped again. He tried to restart the engine but with no success and decided to shut down the aircraft. The pilot was discussing the possible causes of the engine failures with his passenger when his attention was caught by a passer-by. On opening the cockpit door he was informed that there were flames around the nose landing gear leg. The pilot and his passenger rapidly evacuated the aircraft and the fire was quickly extinguished using a foam fire extinguisher.

Engineering examination

Initial examination by a licensed aircraft engineer found that there had been moderate to severe fire damage in the lower engine bay area, which had burnt through the engine fuel primer hose and some electrical cable insulation. After the primer hose was replaced, the engine was started and run up to full power without any problems but, when the power was reduced to idle, the rpm was lower than normal, black puffs of smoke were seen to come from the exhaust and the engine stopped. Fuel was then seen running down the back of the carburettor air box. Further engine runs were carried out and on each run the engine performed normally above 800 rpm but on a number of occasions when it was below 800 rpm it ran rich, stopped and fuel was observed running from the carburettor air box. The carburettor was removed and, along with the failed fuel primer hose, was sent to AAIB for examination.

Examination of the engine fuel primer hose indicated that the failure was as a result of the fire and did not contribute to the initial event.

The carburettor, a Marvel-Schebler model MA-4SPA, was taken to an authorised overhaul organisation and placed on a test bench, where it was found that the fuel level in the float chamber was well above the maximum level allowed and, in certain angular positions, fuel poured out from the inside of the carburettor's bore. The unit was dismantled and one arm of the horseshoe-shaped white plastic hollow float, part number 30-804, was found to be almost completely full of an AVGAS - a coloured fluid (Figure 1). It was later confirmed by chemical analysis that this fluid was pure AVGAS. Examination of the float revealed that a minute area of the plastic hot-weld joint between the float chamber and its lid had not been welded during manufacture. This minute gap in the weld was so small that when the float, containing the AVGAS, was placed in a vacuum chamber only a barely discernible amount of fuel escaped.

In late September 2006 the same overhaul organisation received a Marvel-Schebler/Precision Airmotive carburettor from an operator with the report '*Engine cuts on landing roll – engine seems to run rich*'. On examination one arm of the float, Part No 30-804, was found to be full of fuel.

Carburettor float history

The engine was supplied by the manufacturer as a zero-timed overhauled unit with an overhauled carburettor fitted. The engine had achieved 51 hours since the overhaul.

Review of occurrence reports, and other information, shows that Marvel-Schebler carburettor floats have a history of absorbing fuel and becoming heavy and therefore less buoyant. Consequently they do not fully close the needle valve between the fuel bowl and the main jets. This allows excess fuel to flow through the carburettor's jets giving a rich fuel mixture which can, at low power, cause the engine to suffer a fuel rich cut and fuel to pour out of the carburettor into the air box.

Over the years the Marvel-Schebler carburettor floats have gone through a number of design changes following incidents of the floats absorbing fuel, causing engine running problems and fuel leakage. In July 2002 the white hollow plastic float, part number 30-804, was introduced to replace the fabricated hollow brass float because of fuel ingress into the hollow arms around the soldered joints. After a period of time in service it was found that the white hollow plastic floats leaked fuel into the arms around the hot weld joints. A total of approximately 17,000 of these floats were manufactured.

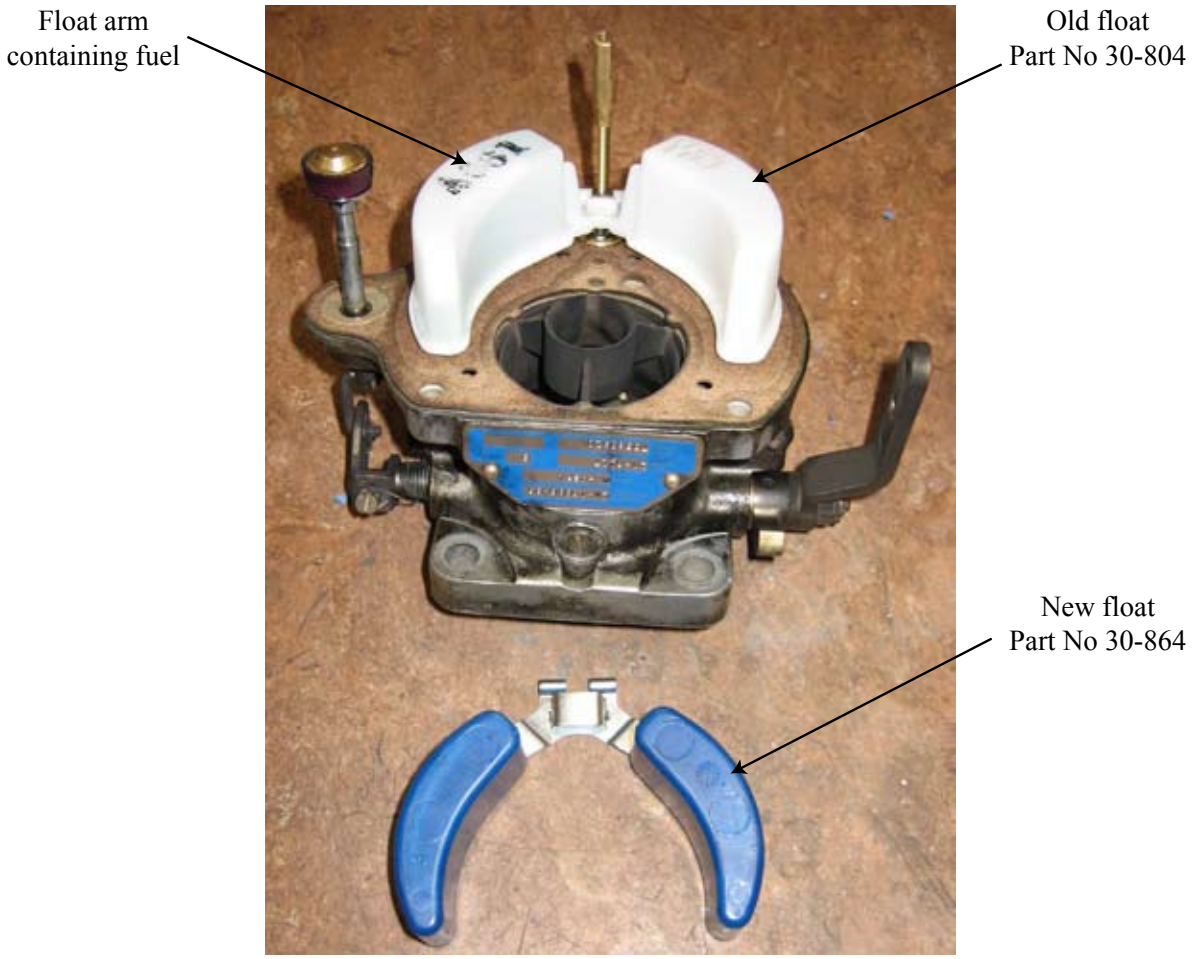

Figure 1

Float arm containing fuel

In September 2005 a blue sealed solid float, Part No 30-864, was introduced and, to date, there have been no reported cases of ingress of fuel into the float arms.

In March 2006 the Federal Aviation Administration issued a Special Airworthiness Information Bulletin (SAIB), No CE-06-33. This alerted repair stations and mechanics, holding Inspection Authorisation, of service difficulties and safety issues associated with certain Marvel-Schebler/Precision Airmotive float-type carburettors. In the SAIB the following statements were made:

> *'We have received several reports of poor idle cut-off or of fuel leaking from the carburetor after shutdown. The conditions reported were the result of fuel leaking into the carburetor float, a damaged or worn float, or a damaged or worn float valve. Since this condition, if uncorrected, can lead to in-flight fire or loss of power due to an overly rich fuel mixture, we are issuing this SAIB to assure timely dissemination of this information to maintenance personnel. While such issues are not new or specific to any particular carburetor float design, it is possible that mechanics and operators with little or no exposure to carburetors*

could fail to recognize the potential cause and possible effects of such conditions. Precision Airmotive LLC has issued Service Letter (SL) SIL MS-12, dated February 24, 2006, to provide information regarding these problems.

OPERATOR ACTION: Operators of aircraft equipped with float type carburetors should be aware of the potential for these conditions to exist and should immediately remove an aircraft from service if fuel leakage or poor idle cut-off are evident. The operator should have qualified maintenance personnel inspect the aircraft prior to return to service.

MAINTENANCE ACTION: Mechanics addressing these issues should inspect the carburetor for signs of fuel leakage. This may be evidented by fuel stains from the bowl vents in the throat of the carburetor and/or fuel in the air box. Remove carburetors with signs of fuel leakage and send them to a qualified repair station for inspection and repair.'

This FAA SAIB raises awareness of the issue and the implications of defective carburettor floats but does not require corrective action. In view of the apparently high rate of safety occurrences with this particular design of carburettor float:

Safety Recommendation 2007-040

It is recommended that the Federal Aviation Administration (FAA) review the continued airworthiness of the Precision Airmotive float, part number 30-804, fitted to Marvel-Schebler/Precision Airmotive carburettors.

Further information

On 9 September 2006 a Robin R2120, F-HAPC, suffered a power loss during initial climb at Ferrieres en Brie, in France, and the aircraft was destroyed in the subsequent forced landing. The carburettor float (Part No 30-804) was found to contain a large amount of fuel and the BEA (Bureau d'Enquetes et d'Analyses) has formed safety recommendations to the EASA and the FAA relating to the withdrawal of this particular design of float.