AAIB Bulletin No: 11/94 **Ref: EW/C94/8/1** **Category: 1.3**

Aircraft Type and Registration:	Morane Saulnier MS.733, G-BMVX	
No & Type of Engines:	1 Potez 6D02A piston engine	
Year of Manufacture:	1953	
Date & Time (UTC):	1 August 1994 at 1555 hrs	
Location:	Parham, Suffolk	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - Fatal	Passengers - Fatal
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	66 years	
Commander's Flying Experience:	704 hours (of which 87 were on type) Last 90 days - 13 hours Last 28 days - 5 hours	
Information Source:	AAIB Field Investigation	

History of the flight

The aircraft was constructed in 1953 for use by the French Army as a basic trainer; it was also capable of carrier operations and its robust construction reflected this role. The aircraft was registered in the UK by the pilot in 1986 and had been maintained by him since then under the supervision of a licensed engineer. On the day of the accident, the pilot had carried out minor maintenance on the aircraft in preparation for the renewal of its Permit to Fly. This work included a series of engine runs and taxi tests. No major rectification was found to be necessary and, following a detailed inspection, the local CAA surveyor signed the required paperwork prior to the test flight that was required as part of the Permit renewal process.

The pilot then completed his pre-flight checks including a further power check. This check was heard by the engineer who had supervised the preparation of the aircraft and he stated that the engine sounded normal. The weather was fine with a light southwesterly wind and aircraft was seen to takeoff on the westerly runway before climbing away. Several witnesses, who were used to seeing

the aircraft takeoff, stated that the takeoff and climb away were quite normal except for a slight turn to the left which pilots usually avoided doing because of the proximity of farm animals. The landing gear was seen to retract and the witnesses then heard the engine note change as power was reduced to the climb setting. At a height of about 200 feet the aircraft was seen to enter a steep turn to the left before rolling and yawing further to the left and entering a vertical dive from which it failed to recover. Witness evidence relating to the sound of the engine during the last few seconds of the flight was contradictory. A post-mortem examination of both occupants failed to identify any pre-existing condition that could have either caused or contributed to the accident.

Engineering investigation

The disposition of the wreckage indicated that the aircraft had hit the ground on a heading of 205° and an attitude of approximately 40° below the horizon. The aircraft fuel, which was stored in a fuselage tank below the cockpit, had ignited after the impact and had destroyed the cockpit area. The landing gear was up and flap actuator was in the 'UP' position although the ground fire had caused the flaps surfaces to droop. All flying controls were connected from the control surfaces to cockpit area, and the failures found within the cockpit area had all resulted from the fire.

A partial strip of the engine and its accessories indicated that the engine had not suffered a mechanical failure before impact. The propeller pitch change mechanism was found in the fully fine position which indicated that engine oil pressure had been available to it. This position, together with the blade damage, showed that the propeller was rotating, but not under significant power at the time of impact.

During the course of the investigation two potential airworthiness problems were discovered.

These were:

a) Pitot Static

The pitot static system had been leak checked before the flight as part of the inspection leading to the renewal of the permit to fly. The pitot probe was removed from its position under the wing after the accident and the rubber hose connecting it to the alloy aircraft piping was found to have lost its elasticity and come off the pipe; when replaced it was a loose sliding fit. It was not possible to determine whether the hose had come off after the leak check or as a result of the crash.

The hose was examined by a polymer materials specialist who reported that: "The hose showed a permanent set in an 'S' shape and a marked lack of flexibility. Permanent set was also present where the tube had been pushed over the aircraft alloy pipe, this end of the tube also showed a great amount of ozone cracking. The interior of the rubber tube was dry and with a crackled, 'orange peel' type

surface finish. There was a fracture of the rubber tube occurring at approximately one third of its length at a position coincident with the distorted wing front spar flange, through which the tube passed. The surface of this fracture was typical of a brittle fracture. The rubber material had aged (degraded) to be no longer serviceable. The ageing mechanism had been a combination of ozone and oxidative attack. Ozone attack had occurred at both ends of the tube, particularly at the end where the alloy pipe had been inserted. Oxidative attack was present inside the tube and the effects were apparent in the brittle failure. The effect of ozone is concentrated at the surface of a rubber and requires the rubber to be under stress. Ozone attacks the polymer at the carbon-carbon double-bonds, forming a physically weak link in the polymer chain. This link ruptures under stress, breaking the polymer chain, allowing further ozone attack deeper into the rubber mass. Thus cracks develop which relieve the stress on the rubber article. The effect of air (oxygen) is also to break the polymer chain but at selected sites, adjacent to side-chains. There is no stress necessary and a network of fine cracks, resulting in a crackled or 'orange peel' surface finish, appears. The surface of the rubber mass turns powdery as the polymer, fillers etc. become unbound. Over a long period of time the rubber becomes harder all through its mass. The stiffness increases and it becomes less flexible and rubbery. Under deformation it is likely to crack because it is brittle."

Although natural rubber components usually have a shelf life before use, typically 5 years, they do not normally have an in-service life, instead a visual inspection and test of flexible hoses every 3 years is called for in the CAA's Light Aircraft Maintenance Schedule.

b) Aileron Bellcrank Supports

The aileron bellcrank support in each wing comprised a structure with four tubular legs, each capped by a plate carrying a stud which passed through the front spar web. The bellcrank support in the left wing showed signs of incipient failure - metallurgical examination indicated that this had been caused by inferior welding techniques coupled with the ingress of moisture. The CAA and the French airworthiness authorities have been informed.