

Acrosport 1, G-BTWI, 30 September 1996

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Aircraft Type and Registration:	Acrosport 1, G-BTWI
No & Type of Engines:	1 Lycoming O-290-D piston engine
Year of Manufacture:	1976
Date & Time (UTC):	30 September 1996 at 1529 hrs
Location:	Liverpool Airport
Type of Flight:	Private
Persons on Board:	Crew - 1 - Passengers - None
Injuries:	Crew - None - Passengers - N/A
Nature of Damage:	Damage to engine, landing gear, propeller and fuselage
Commander's Licence:	Private Pilot's Licence with IMC and Night Rating
Commander's Age:	59 years
Commander's Flying Experience:	1,768 hours (of which 102 were on type) Last 90 days - 28 hours Last 28 days - 12 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and enquiries by the AAIB

History of flight

On completing the fifth landing during a series of 'touch and go' circuits on Runway 27 at Liverpool Airport, the pilot selected the carburettor air from 'hot' to 'cold' and applied take-off power. All engine and fuel system indications appeared normal but, at between 150 and 200 feet agl, a marked reduction in power occurred co-incident with the onset of heavy vibration and the discharge of white smoke from the exhaust. He transmitted a Mayday call and, fearing that a turn to the left or a landing straight ahead would result in a ditching in the River Mersey, turned to the right and landed across an adjacent taxiway. The aircraft overran onto an area of rough ground, whereupon the landing gear collapsed. There was no fire and the pilot, who had been wearing a full harness, vacated the aircraft unaided and notified the tower that he was uninjured, using a handheld transceiver.

Engine examination

Subsequent examination and partial strip of the engine by maintenance personnel revealed that a failure of the No 3 cylinder exhaust valve had occurred, and that the head of this valve had become embedded in the piston crown. The fracture surface of the valve head had been severely damaged and yielded little information as to the cause of separation. The valve stem, however, had remained within its valve guide and had suffered little further damage; it was extracted and subjected to metallurgical examination. The head end of the stem and the fracture surface were covered in combustion products. After chemical cleaning, fatigue crack progression bands were identified in discrete regions across the fracture surface. Initiation of the cracking had occurred at a number of regions around the circumference of the stem and it appeared that over 90% of the sectional area had cracked through by fatigue before final separation of the head had occurred. Close examination revealed that the external surface of the stem, and the fracture faces in the initial areas of fatigue propagation, had been heavily corroded (Figure 1), initiation probably occurring from corrosion generated 'micro-pits' in the stem surface. Three secondary cracks were found close to the plane of failure and these exhibited evidence of long term 'crevice-corrosion' having taken place after associated propagation had ceased (Figure 2). The degree to which these secondary cracks had widened due to loss of material by corrosion and, probably, oxide 'jacking' indicated that this had occurred over a considerable period of time (probably some years). The number of valve operations was not estimated due to post-fracture mechanical damage.

Engine history

This aircraft had been manufactured in 1976, since when it had flown some 712 hours. The engine, however, was manufactured in the early 1950's, its first recorded 100 hr check being logged on 2 March 1954 whilst fitted to an American registered Piper Tri-Pacer. In January 1990, the engine was given a 'top end' overhaul, at 1243 hours total time, when all four cylinders were removed, overhauled and new pistons fitted. Later in the same year, after the engine had been removed from the Tri-Pacer, it was recorded that the cylinders had again been removed, cleaned, painted and the valves lapped, at an engine total time of 1344 hours. G-BTWI, with this engine installed, was imported into the UK in October 1991 and issued with a Permit to Fly. In July 1996, cylinder Nos 1 and 4 were removed for another overhaul, at an engine total time of 1526 hours but, at the time of the accident, cylinder Nos 1 and 3 had run for 296 hours 10 minutes since overhaul, over a period of some 6 years.