AAIB Bulletin No: 5/2005 **Ref: EW/G2004/06/22** **Category: 1.4**

Aircraft Type and Registration:	X'Air V2(2), G-CBTY
No & Type of Engines:	1 Simonini Victor II piston engine
Year of Manufacture:	2002
Date & Time (UTC):	27 June 2004 at 1620 hrs
Location:	Newtownards, Northern Ireland
Type of Flight:	Training
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Damage to fibre glass pod, propeller blades and nose landing gear
Commander's Licence:	Private Pilot's License with Instructor Rating
Commander's Age:	55 years
Commander's Flying Experience:	1,550 hours (of which 30 were on type) Last 90 days - 140 hours Last 28 days - 50 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot and examination of the aircraft engine by the AAIB

An instructor and student, who was also the aircraft owner, were flying a circuit detail. During the downwind checks the instructor noted that the engine was performing normally and that the Exhaust Gas Temperature (EGT) was within limits. After the first touch-and-go the aircraft climbed normally, but at 300 feet the engine stopped abruptly. A forced landing was carried out into a field of three feet high standing crops. As the main wheels entered the crop, the aircraft pitched forward onto its nose, which then dug into the soft ground, causing the aircraft to pitch inverted. There was no fire and both occupants were able to exit the aircraft without difficulty

After the accident the instructor rotated the engine by hand and noted that there appeared to be no compression. Neither occupant recalled any unusual EGT or coolant temperature indications prior to the engine failure. The engine was examined more closely the next day and two small burn holes were found in the head of the rear cylinder. The engine had been inverted following the accident and there was no coolant remaining.

Engine description

The Simonini Victor 2 engine is a 2-stroke, twin cylinder, twin ignition, water-cooled engine with two 'Bing' double float carburettors. The engine is designed to run on leaded or unleaded petrol or avgas mixed with 2-stroke oil. The manufacturer recommends that a 3% mixture with a fully synthetic 2-stroke oil is used with unleaded fuel, or 2.5% mixture is used with leaded fuel or avgas. The liquid cooling system includes an integral belt-driven pump with coolant being pumped under pressure around the cylinder water jackets. Two heat dissipators route the coolant to and from the radiator. The top dissipator is fitted with a coolant temperature sender and a thermostat. The thermostat is designed to open at 65°C. The coolant should be a mixture of 70% water and 30% anti-freeze, suitable for aluminium. The maximum coolant temperature should not exceed 80ºC. The coolant system also has a radiator filler/expansion bottle with an overflow tube.

The Operator's Handbook contains the following advice on storage procedures if the engine is not going to be used for a period of two months or more:

> *'Start the engine and remove the air filters from the carburettors. Spray 2-stroke oil … directly into the carburettor throat until the engine stalls. This will ensure that all parts in the crankcase and the top and bottom conrod bearings are well lubricated. Reinstall the air filters and after the engine has cooled down cover with suitable covers. You may also cover the exhaust opening with suitable cover to stop foreign material from entering.'*

Aircraft history

The aircraft had first flown in 2003 when it flew a total on 5 hours 15 minutes during August and September. The aircraft did not fly again until May 2004 when it completed a one hour flight. No inhibition of the engine, as described in the Operator's Handbook, was carried out. A further brief flight was made on the day before the accident. The aircraft had completed a total of 6 hours 35 minutes and the engine 6 hours 45 minutes at the time of the engine failure.

The fuel used on G-CBTY is 2-stroke motor gasoline. The aircraft owner recalled that prior to the accident flight he had added a cup of water to the coolant system and replaced the filler cap. This was the first occasion he had had to add liquid to the coolant system.

Engineering investigation

The engine without the cooling system and the propeller was returned to the AAIB in August 2004 for further examination. Two burn holes were observed in the side wall of the rear cylinder head (see Figure 1). The engine could not be rotated by hand. The plating on the top end of the inner

walls of both cylinders was cracked and partially detached in places. The burn holes passed through both walls of the liquid cooling jacket and the seal between the head and the block. The seal, an elastomeric O-ring, had suffered thermal degeneration. The front cylinder seal had suffered similar degeneration although no gas leaks from the cylinder had apparently occurred.

The ignition timing was checked in accordance with the manufacturer's drawing and found to be correctly adjusted. The coolant system pump was free to turn. The carburettor float chambers contained liquid and some white deposits, which were found to consist primarily of corrosion products of zinc, with lesser amounts of copper and aluminium. The liquid samples were analysed and shown to consist mainly of water. One sample that contained a larger percentage of fuel was found to contain approximately 3% of the 2-stroke additive.

Further disassembly revealed that the front engine roller bearing could not be rotated by hand and the rear roller bearing was rough in operation. The front bearing is fitted into the crank case end plate; internal staining on the end plate indicated that a liquid had been present in the crankcase for a prolonged period. The bearings were removed from the end plate and metallurgical examination revealed that they had been contaminated with an oxygen carrying liquid for prolonged periods which had resulted in general and crevice corrosion at and around the position of the balls within the roller bearing whilst the engine was stationary.

It was considered that the engine failure was caused by the loss of coolant allowing hot gases to burn through the cylinder casing. The evidence of corrosion in the bearings indicated that liquid had been present in the crankcase for some time. The accumulation of liquid in the crankcase probably resulted from a leak past one or both of the cylinder head elastomeric seals.

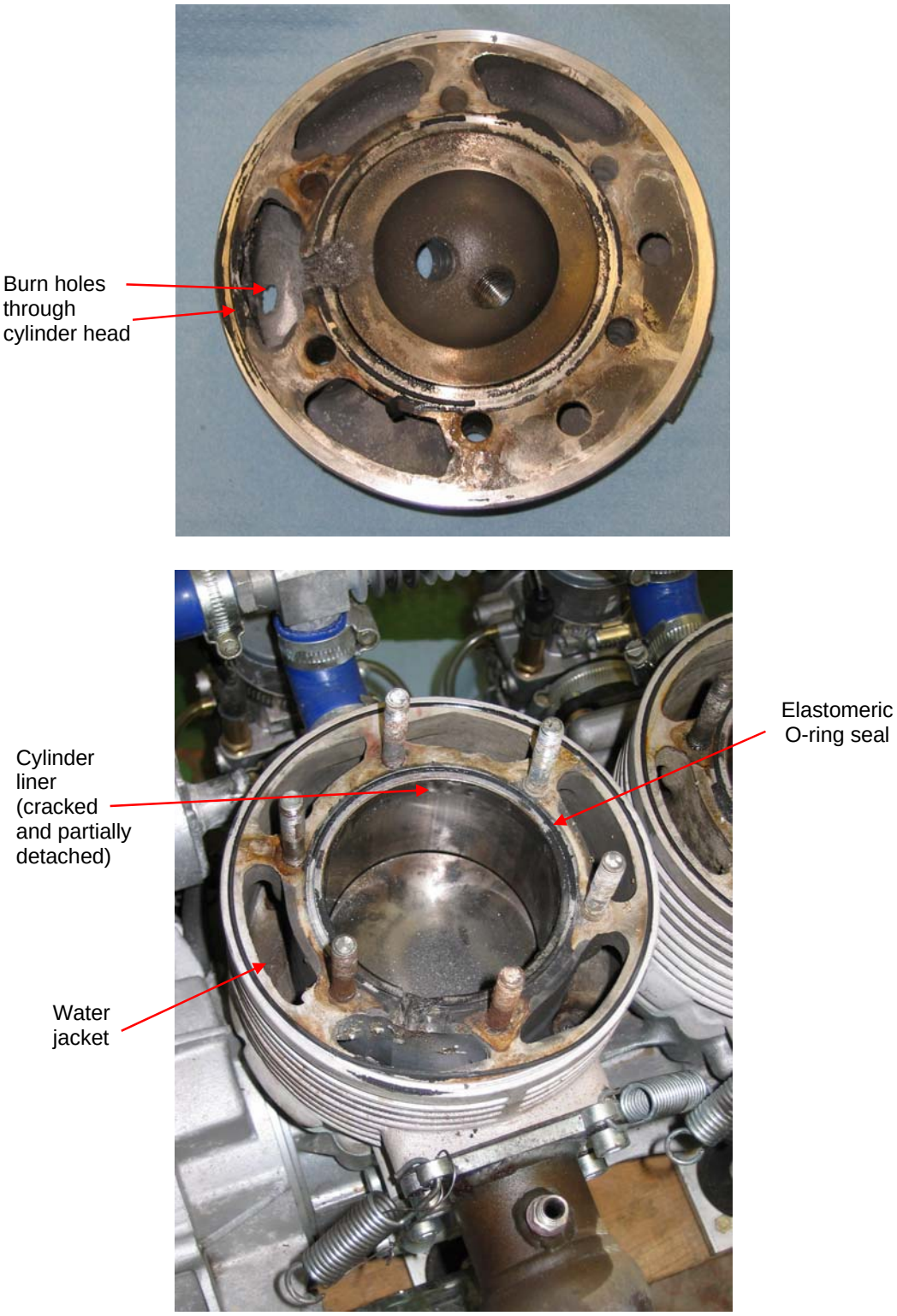

Figure 1 Rear cylinder with cylinder head removed (shown above)