

Rans S7, Courier G-CBNF

AAIB Bulletin No: 11/2003	Ref: EW/G2003/08/15	Category: 1.3
Aircraft Type and Registration:	Rans S7, Courier G-CBNF	
No & Type of Engines:	1 Verner 1400 piston engine	
Year of Manufacture:	2002	
Date & Time (UTC):	10 August 2003 at 1500 hrs	
Location:	Near Bagby Airfield, Thirsk, North Yorks	
Type of Flight:	Permit to Fly test flight	
Persons on Board:	Crew - 1	Passengers - None
Injuries:	Crew - None	Passengers - N/A
Nature of Damage:	Substantial damage to forward fuselage and landing gear. Both engine drive belts failed	
Commander's Licence:	Private Pilot's Licence	
Commander's Age:	52 years	
Commander's Flying Experience:	442 hours (of which 3 were on type)	
	Last 90 days - 3 hours	
	Last 28 days - 3 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional AAIB inquiries	

The purpose of the flight was to complete the mandatory five hours test flying required for the issue of the Permit to Fly for the aircraft. An inspection of the aircraft, which was hangared at Bagby, was conducted prior to the flight, and this included a check of the two drive belts that transmit power from the engine crankshaft to the propeller.

The power checks and the subsequent takeoff were normal. However, at a height of around 400 feet agl, as the pilot was preparing to turn the aircraft into the circuit, the engine began a series of intermittent power bursts in which the maximum 5,000 RPM limit was exceeded. The pilot additionally noted a smell of burning rubber. He retarded the throttle and it became apparent to him that the engine was only transmitting a portion of its power to the propeller. The aircraft was turned into the circuit, but the rate of descent was such that it was clear that a landing on the runway was not going to be achieved. The pilot therefore turned back into wind, lowered the flaps and chose a stubble field in which to land. However, the windmilling propeller was causing considerable drag with a consequent high sink rate. As the aircraft approached the field, the pilot noted a substantial wire and post fence in the anticipated touchdown area and so he raised the nose in an attempt to clear it. This resulted in the right wing dropping rapidly, and the aircraft entered a spin at a height of around 30 feet and a speed of 40 kts. The pilot described the impact with the ground as severe, and was surprised to escape serious injury. He turned off the fuel and battery and vacated the aircraft.

Subsequent inspection of the engine compartment confirmed the pilot's suspicions of a loss of drive to the propeller shaft. The front drive belt was shredded into several circumferential strips and the rear one was stripped of its teeth. There was no obvious reason why this should have occurred, as the propeller shaft was still free to rotate.

According to a former UK agent for Verner engines, there are probably fewer than half a dozen engines of this type in the country. He was aware of one other case of broken drive belts; this was investigated by the factory, who attributed the cause to incorrect belt tension. However, the engine fitted to G-CBNF had been run only for a few hours and the pilot had not disturbed the tension as set by the manufacturer.

The engine has now been superseded by a model that replaces the drive belt system with a gearbox, although the engine configuration, ie twin opposed cylinders, is otherwise unchanged. The current UK distributor for this model has stated that the single example in the country is performing satisfactorily and is aware that the gearbox development was most likely prompted by problems with the drive belt system. The belt drive engine operating manual states that:

'The Heavy Duty reduction drive cog-belt requires no maintenance except regular tension check-out and is not subject to appreciable stretching during the recommended replacement intervals. Should the belt become suddenly and noticeably "slack" before it is due for replacement, it is almost certainly due to partial failure to some unknown extent of the reinforcing material and it must be replaced before the next flight regardless of its service time. This type of failure cannot be detected by visual examination of the external appearance of the belt...'

The pilot of G-CBNF did not detect any belt slackness during the pre-flight inspection. However, he considers that belt damage is likely to occur during the start procedure, as he has noted that large amplitude vibration of the engine typically occurs during the first few power strokes of the pistons, with associated violent accelerations imparted to the drive train.