ACCIDENT

Aircraft Type and Registration:	Rans S6-ESD (Modified), Coyote II, G-MYSP
No & Type of Engines:	1 Rotax 582-48 piston engine
Year of Manufacture:	1992 (Serial no: PFA 204-12265)
Date & Time (UTC):	28 August 2013 at 1118 hrs
Location:	Redhill Aerodrome, Surrey
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - None
Injuries:	Crew - 1 (Fatal) Passengers - N/A
Nature of Damage:	Aircraft destroyed
Commander's Licence:	National Private Pilot's Licence (Aeroplanes)
Commander's Age:	57 years
Commander's Flying Experience:	63 hours (of which 4 were on type) Last 90 days - 9 hours Last 28 days - 3 hours
Information Source:	AAIB Field Investigation

Synopsis

The pilot was practising visual circuits and was climbing away after a touch-and-go landing when the aircraft's engine was heard to falter. The aircraft was seen to slow in a climbing attitude before stalling and entering a vertical dive from which it did not recover. The pilot was fatally injured.

History of the flight

The pilot was planning to practise some visual circuits at Redhill Aerodrome. Runway 26L was in use at the time and the weather was CAVOK with the wind variable at 4 kt.

The aircraft was stored in a hangar at Redhill. The pilot was assisted in taking the aircraft out of the hangar by another pilot who had not previously met him; the assisting pilot described the pilot of G-MYSP as being in good spirits and having a polite demeanour. Closed-circuit television on the outside of the hangar recorded the pilot moving the aircraft and it captured him carrying out the aircraft's pre-flight inspection, engine start and initial taxi.

The first takeoff and circuit progressed uneventfully but, as the aircraft approached the runway for its first touch-and-go, it was observed to be high on the final approach. It touched down firmly, about 500 m from the threshold, and bounced before settling onto the runway. The pilot converted the touch-and-go into a full-stop landing, coming to a halt about 720 m from the threshold of Runway 26L. The pilot then taxied back to Holding Point A1 for

Runway 26L for takeoff. One witness who observed the aircraft's first touch-and-go thought that, as a result of the firm landing, the propeller may have struck the runway.

The pilot completed another uneventful circuit for a further touch-and-go. The final approach appeared lower than the first but was still slightly higher than normal. The aircraft was seen to touch down smoothly about 180-240 m from the threshold before taking off. At approximately 500 ft aal witnesses heard its engine falter, one describing the engine's noise as "quickly revving in and out". Several witnesses later stated that the aircraft then decelerated as it remained in a climbing attitude until it appeared to roll slightly left, followed by the right wing dropping. The aircraft then rolled right into a near-vertical dive from which it did not recover. No transmissions were heard by ATC from the pilot.

The aircraft impacted the ground about 280 m from the end of Runway 26L, 350 m inside the airfield boundary. The aerodrome RFFS and local emergency services were quick to arrive on the scene but the pilot had been fatally injured in the impact.

Pilot's experience

The pilot commenced his training for his National Private Pilot's Licence (Aeroplanes) (NPPL(A)) in September 2011 on an Ikarus C42. His instructor commented that the pilot had progressed rather slowly through the syllabus but that his approach was methodical. His handling of slow-speed flying was described as satisfactory and he had practised numerous forced landings and emergencies, including engine failures after takeoff (EFATOs), completing these to a satisfactory standard. He flew solo in September 2012 having completed 29 hours of instruction and subsequently completed his Microlight General Skills Test on 28 April 2013 having completed 53 flying hours. He was issued with his NPPL(A) on 4 July 2013.

After the pilot obtained his licence he flew G-MYSP on four occasions, three of which were with a mentor pilot, for a total of 4 hrs 40 mins. The mentor pilot stated that during the three flights the pilot did not practise any slow-speed flying or stalling. Having learned to fly on an Ikarus C42 no difference training was required to fly the Rans S6.

Medical examination

The post-mortem examination was carried out by a consultant aviation pathologist. It concluded that the pilot died as a result of head and chest injuries sustained in the impact and toxicological examination revealed no evidence of alcohol, drugs or carbon monoxide.

Meteorology

At 1115 hrs the weather was CAVOK with the wind variable at 4 kt, temperature 20ºC, dew point 12ºC and QNH of 1023 hPa. '*Safety Sense Leaflet 14 - Piston Engine Icing*', published by the Civil Aviation Authority, indicates that these conditions can, in some circumstances, produce a risk of moderate carburettor icing with cruise power or serious carburettor icing with descent power.

Airport information

Redhill Aerodrome is located 4 nm north-north-east of Gatwick Airport. It has six grass runways, the longest (08R/26L) being 897 m in length (Figure 1).

Figure 1
Redhill Aerodrome

Aircraft information

The aircraft was operated by a syndicate, of which the pilot was secretary. The syndicate's procedures for operation of the aircraft included an instruction for it to be refuelled at the end of each flight to FULL. The pilot was known to be fastidious about refuelling the aircraft after flight and had sent a number of emails to syndicate members reminding them to do the same.

A syndicate member commented that when flying G-MYSP he would typically aim to take off at 35 mph, climb at 50 to 55 mph, approach at 55 to 60 mph and land at 50 mph. The aircraft's last annual check flight carried out on 22 April 2013, recorded that the onset of stall buffet was at 35 mph with the flaps UP and 28 mph with the flaps DOWN.

Engineering

Accident site

The aircraft had come to rest, nose down, 280 m from the end of Runway 08L, close to the extended centreline, with the nose of the aircraft pointing south. There was no evidence to show that the aircraft had made contact with the ground prior to this point. Examination of the runway surface did not identify any evidence associated with a propeller strike; however, the ground was dry and hard which may have prevented the formation of propeller strike marks.

The nose of the aircraft had been severely compressed and pushed upwards and rearwards, causing disruption to the cockpit area. Compression of the outboard leading edge of the left

wing indicated that the aircraft had probably been rotating to the right at impact and the fuel tank had ruptured, resulting in the loss of its contents. There was a strong smell of fuel on the accident site. A small quantity of fuel was recovered from the aircraft fuel filter and fuel lines. Two large containers, containing what appeared to be MOGAS, were recovered from the pilot's car. After the aircraft was recovered onto its main landing gear, examination of the propeller showed little evidence of rotational damage. Prior to recovery the continuity of the flying controls was confirmed.

Aircraft description

The Rans S6 Coyote II is a three-axis microlight aircraft. G-MYSP had been built in 1992 and accumulated approximately 681 flying hours at the time of the accident. The aircraft records indicated that there were no defects prior to the accident flight which would have had a bearing on the accident.

A Rotax 582 engine had been installed in the aircraft, driving a three-bladed propeller through a reduction gearbox. The engine was fitted with a carburettor heating system which used water from the engine cooling system to warm the body of both carburettors continuously, preventing ice build-up. The engine was fitted with a dual ignition system, comprising two capacitance discharge units operated by trigger coils located in the flywheel case. In the event of failure of a single ignition system the engine may run roughly at certain power settings, due to the uneven progression of the combustion flame front within the cylinder.

Records showed that the engine had been overhauled 54 flying hours prior to the accident. The engine had been modified in 2003 to incorporate an RK400 clutch in the reduction gearbox, before the purchase of the aircraft by its owners at the time of the accident.

This type of clutch (Figure 2) consists of a drive body secured to the engine output shaft, four friction pads (held together by two circular springs) which locate in the drive body, a locating plate and the clutch rim, which is secured to the gearbox coupling flange. The clutch is designed to remain disengaged until the engine speed reaches approximately 2,400 rpm, at which point the friction pads move outwards, contacting the clutch rim and causing the gearbox to rotate. The installation of this clutch reduces engine vibration during engine start and at idle speed, and allows the installation of a larger propeller than would normally be fitted to a 'direct drive' engine. In flight, however, the engine speed must be maintained above 2,400 rpm to prevent the clutch from disengaging and allowing the propeller to windmill. If this were to occur it would affect the gliding performance of the aircraft.

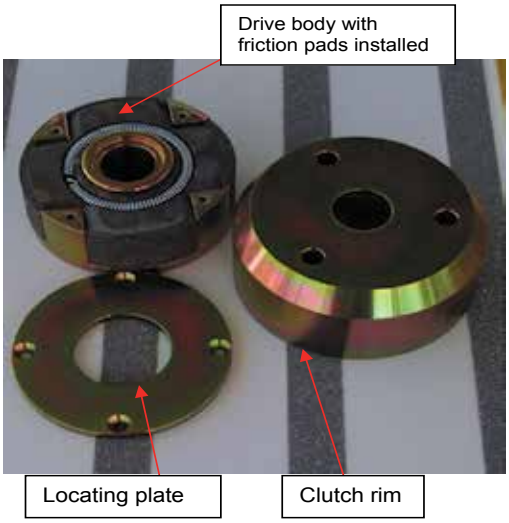

Figure 2
RK400 clutch assembly

Investigation

Based on the witness reports of rapidly changing engine noise, the investigation focused on the engine, engine controls, gearbox and aircraft fuel system.

Several small areas of damage were found on the tips and leading edges of the propeller blades, which could be attributed to propeller rotation at impact or a propeller strike during the previous landing. Examination of the engine identified scoring, made by the starter gear, on the inner face of the starter gear housing, which confirmed that the engine had been rotating at impact. Examination of the clutch assembly showed no evidence of overheating or damage associated with 'slipping'; this examination also showed further evidence of engine rotation at impact.

The engine controls functioned correctly and showed no evidence of pre-impact restriction. No evidence of a pre-impact defect was found in either carburettor.

Disassembly of the engine confirmed that it rotated freely and that there was no failure within the engine or the induction system. Damage to the engine's ignition system prevented any testing of the two capacitive discharge units, the ignition leads or the spark plugs. The two ignition trigger units functioned correctly.

No evidence of a restriction or blockage was found within the fuel supply pipes, fuel filter or fuel pump and tests carried out on the limited volume of fuel recovered from the aircraft confirmed that it met the general specification for MOGAS. Examination of the two containers recovered from the pilot's car confirmed that one container was full and that, assuming the other container had originally been full, seven litres of fuel had been used. Further testing confirmed that the fuel in both containers was MOGAS and that it did not contain levels of water, or any other contaminant, which would have affected the running of the engine.

Analysis

Operational aspects

The pilot's pre-flight preparation appears to have been normal, with all appropriate pre-flight checks carried out. The first landing was deep into the runway and the aircraft bounced. There is a possibility that during the bounce the propeller may have struck the runway. When the aircraft was at about 500 ft aal, climbing out from the second circuit, its engine faltered, appearing to result in a rapid and significant loss of power. The initial action of a pilot experiencing a power loss should be to lower the nose of the aircraft to prevent it stalling. On this occasion, the pilot appears not to have lowered the nose after the power loss; the aircraft continued in a climbing attitude and decelerated, until it stalled.

The abruptness of the loss of power meant that the pilot may not have been mentally prepared to carry out the actions required during an EFATO. The windmilling propeller would have created extra drag on the aircraft, reducing the aircraft's airspeed. Additionally, the lack of any radio transmission after the power loss may indicate that the pilot became overwhelmed by the situation. Nevertheless, if the pilot had been able to lower the

aircraft's nose before it stalled, he may been in a position to maintain a safe airspeed and perform a forced landing.

Engineering

The damage observed on the starter gear casing and the clutch rim confirmed that the engine was rotating at impact, although no indication of engine speed could be made. It could not be determined whether the rotational damage to the propeller blades was the result of a propeller strike or caused during the impact sequence. It was not possible to confirm whether the clutch was engaged at the time of impact.

The investigation did not identify any defect within the engine, gearbox or fuel system which would have prevented normal operation of the engine. The installation of the carburettor heating system on the engine, with its continuous operation, would have minimised the possibility of carburettor ice occurring at any stage during the accident flight. This installation, and the aircraft appearing to develop full power from the touch-and-go landing to 500 feet, make it unlikely that carburettor ice was a factor in this accident.

While no defects were identified with the ignition triggering mechanism, the inability to test the capacitive discharge units, ignition leads or spark plugs meant that the investigation could not rule out the presence of a defect in these components. If the engine speed falls below 2,400 rpm the clutch will disengage, allowing the propeller to windmill and cause a significant reduction in aircraft performance.

Conclusion

The engine appears to have faltered at about 500 ft aal. The sudden power reduction, the pilot's relative inexperience and the limited time available to react appropriately are likely factors in the pilot not lowering the nose before the aircraft stalled. There was then insufficient height available for the pilot to effect a recovery from the stall before ground impact. No definitive cause of the engine power loss could be determined.