ACCIDENT

Aircraft Type and Registration:	Robinson R22 Beta, G-THLA	
No & Type of Engines:	1 Lycoming O-360-J2A piston engine	
Year of Manufacture:	2003 (Serial no: 3462)	
Date & Time (UTC):	13 February 2015 at 1113 hrs	
Location:	In a field off Snargate Lane, Romney Marsh, Kent	
Type of Flight:	Training	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Substantial damage to rotor system and tailboom	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	37 years	
Commander's Flying Experience:	960 hours (of which 857 were on type) Last 90 days - 14 hours Last 28 days - 6 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot	

Synopsis

After the instructor demonstrated a 360° autorotation exercise, his student attempted a similar manoeuvre. At some point during the turn the 'low rotor rpm' warning sounded and, although the student further lowered the collective control, the airspeed and height reduced to the point where the instructor intervened by applying power. However the aircraft continued to descend, so he applied full power and pushed the nose down to gain speed. When it appeared that a landing was inevitable he attempted a flare at a height of around 40 ft with the intention of conducting a low speed landing. The landing area was a ploughed field and the skids dug in, causing the rotors to strike the ground, with the helicopter ending up on its right side. The instructor considered that, with a 25-30 kt wind blowing over the area, he had encountered severe windshear in the final stages of the autorotation.

History of the flight

The purpose of the flight was to focus on autorotation techniques in preparation for the student's General Flying Test. The instructor stated that the wind over the Romney Marsh area was from 150/160º at 25-30 kt, a cloud base in excess of 2,000 ft and hazy visibility. The sortie commenced with two gentle autorotations, which were conducted satisfactorily, before moving onto advanced exercises that included constant attitude, standard (ie 60 kt) range and extended range autorotations. The instructor then demonstrated a 360° autorotation,

which is used when the desired landing area is directly below the helicopter. During the demonstration the instructor explained how the 30 kt headwind would tend to push the helicopter back and that during the turn there would be a reduction in airspeed and rotor rpm. The instructor completed the manoeuvre with a flared recovery at around 55 kt.

The student initiated her autorotation in the correct position for the chosen landing area (which was different from that used for the instructor's demonstration) and then entered a left turn, losing airspeed as predicted. At some point during the turn, the 'low rotor rpm' warning horn sounded, indicating that rotor rpm was below 96%. The student adjusted the collective pitch control downwards to bring the rpm indicating needle back into the green sector. On lining up for the landing field the instructor noted that the airspeed was a little slow and the height was now around 250 ft. He 'joined' the engine and rotor rpm needles together by applying power and asked the student to go around. After 2-3 seconds he further assisted by applying considerably more power. However, the helicopter was now at around 150 ft, so he applied full power and pushed forward on the cyclic control in order to gain airspeed. The machine continued to fall and the instructor attempted a flare at around 40 ft with the intention of conducting a landing at as low an airspeed as possible due to the ploughed surface of the field. Despite landing on the rear of the skids, the nose pitched down, causing the front of the skids to dig in. The main rotors cut into the ground and the helicopter rolled over onto its right side. The instructor turned off the fuel and electrics and, whilst doing so, noted that fuel was escaping from the cowling around the rotor head. The occupants helped each other out of the aircraft.

The instructor subsequently stated that he considered that the helicopter had experienced severe windshear in the final stage of the autorotation, causing a loss of lift that prevented a recovery/go-around.

Discussion

The instructor's report on the accident indicates that a high rate of descent developed in comparison with the demonstrated autorotation; this may have had its origin in the reduction in collective pitch that was required following the low rotor rpm warning. The reported reduction in airspeed may have been the result of windshear but, with the height rapidly reducing, the instructor was forced to lower the nose in order to increase airspeed, further increasing the rate of descent.

The cloud base, at 2,000 ft, would have permitted a higher entry to the autorotation manoeuvre, which would have given the student additional time and space in which to choose a more suitable landing area. However, the instructor subsequently commented that although this was true, the student had been performing well in previous sessions and was thus capable of conducting something more advanced. In the event, several potential landing areas were missed whilst the instructor was attempting to explain which field the student was to aim for. This resulted in the helicopter lining up on the ploughed field but, whilst it is possible the instructor underestimated the depth of the furrows, he had in any case intended to go around from approximately 300 ft.

It is noteworthy that the flight conditions may have been conducive to the formation of 'vortex ring' state, in which a 'doughnut' of recirculating air forms around the rotor blade tips. A helicopter needs three conditions to enter vortex ring state, namely a high rate of descent (typically more than 300 ft/min), applied power and low airspeed. The incipient stage results in symptoms that include random yawing, pitching and rolling and an increase in the rate of descent. The instructor, having thought further about the event, stated that he was confident the go-around was initiated at 45 kt, with the helicopter accelerating towards 60 kt, which was the ideal point on the power curve to arrest the descent. He therefore concluded that vortex ring did not contribute to the accident.