ACCIDENT

Aircraft Type and Registration:	Robinson R44, G-SYTN
No & Type of Engines:	1 Lycoming O-540-F1B5 piston engine
Category:	2.3
Year of Manufacture:	2002
Date & Time (UTC):	8 May 2005 at 1220 hrs
Location:	Swansea Airport, West Glamorgan
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - None Passengers - 2
Nature of Damage:	Tail broken off and main rotor destroyed. Skids detached
Commander's Licence:	Private Pilot's Licence
Commander's Age:	39 years
Commander's Flying Experience:	58 hours (of which 7 were on type) Last 90 days - 1 hour Last 28 days - 1 hour
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

While hover taxiing the helicopter in a moderate tailwind towards the apron at Swansea Airport, the pilot initiated a right turn which developed into an uncommanded and uncontrollable yaw to the right. The pilot was unable to regain control of the helicopter before it hit the ground and came to rest on its left side, with substantial damage to the tail and rotors. There was no fire. The pilot was able to vacate the aircraft unaided and assist the two passengers, who exited the aircraft without major injury. In the absence of evidence of a pre-existing mechanical fault, the investigation determined that the most likely cause of the accident was a loss of tail rotor effectiveness while hover taxiing at low speed with a tailwind.

History of the flight

After completing two circuits on Runway 28 at Swansea Airport, the pilot brought the aircraft to a hover beside a taxiway intersection and hover taxied clear of the runway on a north-easterly heading. The helicopter then turned right onto an easterly heading in order to enter the apron for parking. Surface wind was reported as 300º/14 kt. As it turned from the taxiway onto the apron, the aircraft continued in an uncommanded turn to the right, which the pilot tried to correct with a left yaw pedal input. Despite full left pedal input, however, the aircraft continued to yaw to the right. During this manoeuvre the nose pitched down and the main rotor struck the ground. The tail struck the ground and broke off during the subsequent violent yaw to the right.

The pilot has no clear recollection of the control inputs he made at this point. The aircraft came to rest on its left side with substantial damage to the tail and rotors. There was no fire. The pilot was able to climb out unaided before reaching back into the cockpit to shut off the fuel. The passenger in the left rear seat was trapped briefly by her clothing but was freed without great difficulty and helped out of the aircraft by the pilot. The passenger in the left front seat was able to vacate the aircraft unaided. Paramedics and the airfield fire and rescue service were in attendance quickly.

Engineering inspection

A subsequent engineering inspection did not reveal any evidence of a pre-existing mechanical fault that could have caused the accident.

Loss of tail rotor effectiveness

A loss of tail rotor effectiveness (LTE) is said to occur if the tail rotor does not provide sufficient thrust to maintain directional control, allowing an uncommanded yaw to develop which, if not corrected, results in loss of control of the helicopter. LTE will cause a yaw in the opposite direction to the rotation of the main rotor. The yaw will be to the right in the case of the Robinson R44, whose single main rotor rotates counter-clockwise when viewed from above. LTE is likely to occur while hovering or moving slowly with a quartering tailwind from more than 30° behind dead abeam and may be initiated by an intentional turn. Full opposite yaw pedal input may not be sufficient to arrest the yaw unless it is applied positively and without delay. Any increase in power applied to the main rotor will increase the yaw tendency and complicate recovery. Conversely, reducing power to the main rotor will assist with recovery, but usually this is not practical during a hover taxi.

Previous occurrences

AAIB Bulletin 1/2004 contains a report (reference EW/C2003/05/07) into the accident to helicopter G-BAML. LTE was considered a possible cause and two safety recommendations were made.

Relevant extracts from the report of the investigation into the accident to G-BAML

In 1995, and in response to a number of helicopter accidents in the USA involving LTE, the FAA issued Advisory Circular (AC) 90-95 on the Subject of '*Unanticipated Right Yaw in (US Manufactured) Helicopters*'.

The report identifies four possible relative wind directions and resultant aircraft characteristics that can, either singularly or in combination, create an environment conducive to LTE:

1. Main rotor disc vortex interference occurs with a relative wind of 285º to 315º and involves changes in tail rotor thrust as the airflow experienced at the tail rotor is affected by the main rotor disc vortex.
2. Tailwinds from a relative wind direction of 120º to 240º will cause the helicopter to yaw into wind and may accelerate an established rate of yaw.
3. Tail rotor vortex ring state can occur with a relative wind of 210º to 330º. With the relative wind in this region, vortex ring state can cause tail rotor thrust variations.
4. Loss of translational lift with the relative wind in all azimuths results in an increased power demand and consequent increase in anti-torque demand from the tail rotor.

The recommended recovery technique, if a sudden unanticipated yaw occurs, is to apply full pedal to oppose the yaw whilst simultaneously moving the cyclic forward to increase speed. If altitude permits, power should be reduced. The AC also makes the point that the tail rotor is not stalled and full pedal to oppose the yaw should be maintained until rotation stops.

In the UK there has been little emphasis on the phenomenon, but most of the factors that can lead to LTE should be known by most UK helicopter pilots. However, the relationship of the various factors to the performance capability of Part 27 helicopters is probably less widely known. The pilot involved in this accident had been trained to cope with tail rotor failures, but he had not received training nor was he aware of the LTE phenomenon."

Safety Recommendations made in report EW/C2003/05/07(1/2004) and related CAA responses

Safety Recommendation 2003-126

The CAA should publish, as widely as possible within the UK, information on the Loss of Tail Rotor Effectiveness (LTE).

CAA response

The CAA has taken action to publish this information. This publicity has included inclusion of LTE at the helicopter flight instructor examiners (FIE(H)) seminar held in October 2003, the issuance of training communication to all helicopter flight instructors (FI(H)), and information on the provision of the appropriate training materials identified by the report for use at FI(H) seminars. In addition, all UK FIE(H) have been briefed to include LTE and tail rotor malfunctions in the mandatory section of the FI(H) rating revalidation process. Further to promulgate information on LTE, the CAA published Flight Operations Department Communication (FODCOM) 1/2004 on 9 January 2004. A comparable article for the general aviation community will be published in the first 2004 issue of the General Aviation Safety Leaflet (GASIL).

Safety Recommendation 2003-127

The European Aviation Safety Agency (EASA) should ensure that information on Loss of Tail Rotor Effectiveness (LTE) is included in helicopter pilot training syllabi.

CAA response

Although not specifically a recommendation for the CAA, the UK has, through its involvement with formulating the Joint Aviation Requirements for Flight Crew Licensing - Helicopter (JAR-FCL 2), gained the agreement of the other JAA Member States to an amendment to the helicopter pilot training syllabi to include LTE. The amendment will be subject to the Notice of Proposed Amendment procedure during 2004. It is anticipated that JAR-FCL 2 will form the basis of European requirements for flight crew licensing scheduled for adoption during 2005.

The full text of GASIL 1 of 2004 and FODCOM 1/2004 is available on the CAA website www.caa.co.uk. Previous AAIB bulletins are available online at www.aaib.gov.uk.

Conclusion

The helicopter was hover taxiing in a light quartering tailwind. Such conditions make a loss of tail rotor effectiveness more likely. Having initiated a right turn, the pilot did not maintain positive control of the aircraft, and an uncommanded yaw developed which could not be brought under control before the helicopter hit the ground.