ACCIDENT

Aircraft Type and Registration:	Agusta A109E, G-TYCN
No & Type of Engines:	2 Pratt & Whitney Canada PW206C turboshaft engines
Year of Manufacture:	2001
Date & Time (UTC):	18 January 2010 at 1115 hrs
Location:	Private field, Blandford Forum, Dorset
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 1
Injuries:	Crew - None Passengers - None
Nature of Damage:	Landing gear, tail rotor, tail rotor gearbox, left horizontal stabiliser
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	39 years
Commander's Flying Experience:	8,530 hours (of which 980 were on type) Last 90 days - 176 hours Last 28 days - 41 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

Synopsis

At approximately 100 ft agl during an approach to land, the pilot noticed an increased rate of descent, which he tried to arrest by raising the collective control and the aircraft nose. This had little effect and the aircraft landed heavily despite the application of maximum torque just before touchdown. The aircraft bounced into the air and swung through approximately 250° before coming to rest. It is likely that the aircraft entered a votex ring state from which it was unable to recover in the height available.

History of the flight

The aircraft took off at 1030 hrs from the private site at which the accident would later occur to fly to Henstridge to refuel. The pilot reported that as he departed the site there was little or no wind, good visibility, clear skies and "relatively low temperatures". After refuelling at Henstridge, the aircraft takeoff weight was calculated to be 1 kg below the maximum takeoff and landing weight of 2,850 kg. The aircraft departed from Henstridge at 1105 hrs to return to the private site.

The pilot was familiar with the ground features and obstacles at the private site and began a continuous right turn to intercept an approach angle similar to the one he had used when landing there an hour earlier. The approach continued normally until, at approximately 100 ft agl, the pilot noticed that the rate of descent had "begun to increase markedly". He attempted to reduce the rate of descent by increasing collective pitch and raising the aircraft's nose slightly but by 30 ft agl the rate of descent had reduced only marginally. The pilot applied "maximum torque" and raised the nose further but, when it became clear that the aircraft was going to contact the ground, he levelled the aircraft attitude. The aircraft touched down heavily and skidded briefly before becoming airborne again, at which point a "rapidly increasing yaw" to the right developed. The yaw was not correctable using the anti-torque pedal and the pilot assessed that the tail rotor had probably struck the ground. He lowered the collective lever to reduce the yaw and the aircraft touched down again and came to rest after rotating through approximately 250°.

After exiting the aircraft, the pilot noticed that from time to time there were gusts of wind from the south which he estimated to be approximately 10 kt. He reported that the gusts were not present when he had departed the site approximately one hour earlier and he had seen no visual indication of them prior to landing. In assessing the cause of the accident, the pilot believed that the aircraft had entered a vortex ring state during the very late stages of the approach. He thought that flying a normal approach at high aircraft mass and low airspeed with a slight tail wind had led to the high rate of descent which he had been unable to arrest.

Vortex ring state

A vortex ring state requires a helicopter to have power applied while it descends at slow airspeed. Air re-circulates through the main rotor, which reduces total rotor thrust and increases rate of descent. A vortex ring state is more likely to be encountered at high aircraft mass and with a tailwind. The high aircraft mass increases the power requirement, and the tailwind leads to a higher rate of descent for a given approach angle. During the early stages of vortex ring development, recovery might be achieved by applying a large amount of excess power. However, if the rate of descent is high enough there might not be sufficient power available to arrest the rate of descent. Recovery can be accomplished by lowering collective pitch and increasing forward speed. Both methods require sufficient altitude to be successful.