AAIB Bulletin No: 12/94 **Ref: EW/G94/07/11** **Category: 2.3**

Aircraft Type and Registration:	Hughes 369HE, G-HSAA	
No & Type of Engines:	1 Allison C18 gas turbine engine	
Year of Manufacture:	1969	
Date & Time (UTC):	10 July 1994 at 0705 hrs	
Location:	Old Stratford, Northamptonshire	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 1	Passengers - 2
Injuries:	Crew - None	Passengers - None
Nature of Damage:	Severe; tail boom chopped by main rotors	
Commander's Licence:	Commercial Pilot's Licence	
Commander's Age:	36 years	
Commander's Flying Experience:	700 hours (of which 107 were on type) Last 90 days - 96 hours Last 28 days - 22 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and additional AAIB investigation of engine and components	

Whilst in the cruise at 1,000 feet agl the aircraft started to yaw rapidly from side to side. The pilot initially suspected a tail rotor problem and lowered the collective lever. The aircraft then pitched nose-down, and the pilot realised that the engine power was fluctuating. He lowered the collective lever fully and started to look for a suitable landing area. There was a lot of air traffic locally, due to the presence of a helicopter feeder site supplying the nearby Silverstone motor racing circuit. The pilot was constrained into conducting a downwind landing in a field straight ahead in order to remain clear of traffic. A run-on landing was made, but during the final stages the right skid entered a shallow depression which turned the aircraft through 90°. This caused the rotor disc to completely sever the tail boom. However, the helicopter remained upright and the occupants, who were uninjured, were able evacuate via the doors.

The maintenance organisation recovered the aircraft to their facility at Redhill. After verifying that the engine fuel system connections were all secure, they removed the fuel system components from the engine. These were then taken to an approved overhaul agent for rig testing under AAIB supervision.

No significant faults were found with the power turbine (PT) governor, the fuel control unit (FCU) or the fuel pump and filter assembly. The fuel nozzle failed the test schedule, due to a build-up of carbon deposits causing a 'streaking' effect in the spray pattern. However, this is a common feature of nozzles after a period in service, and was judged not likely to have caused the observed symptoms which led to the accident.

The only component that appeared to be completely non-functional was the double check valve (DCV). This is an 'on condition' item located in the pneumatic line between the PT governor and the FCU. It is connected to a 6 cubic inch accumulator (essentially just an empty chamber) and the purpose of the assembly is to modify the output pressure signal of the PT governor to the FCU. This is intended to damp out engine RPM instability that could result from the PT governor attempting to compensate for the minor RPM excursions arising from power train torsional transients which occur in flight. The rig test showed that the associated valves were apparently seized; thus the unit probably was not capable of performing its damping function, with an attendant risk of engine RPM instability, or 'hunting', which in turn could have resulted in the helicopter experiencing 'twitching' in yaw.

The airframe side of the fuel system was also investigated. No faults were found with the fuel feed between the left and right halves of the tank under the cabin floor, or with the tank venting system. Particular consideration was given to a fuel drain valve located in the fuel feed line to the engine. The electrically operated fuel boost pump is only used during engine start on this type of helicopter: subsequently, fuel is drawn from the tank by means of the engine driven pump, thereby creating a negative pressure (suction) in the line in which the drain valve is located. The possibility of this valve having sucked open, thus entraining air into the fuel line and in consequence, the engine, was investigated. This was achieved by running the engine driven pump on the test rig with the valve inserted in the fuel feed line at a representative distance below the pump. At no time was the negative pressure in the fuel line enough to overcome the spring force of the valve, which remained closed.

It was then decided to refit the fuel control components to the engine and run the latter in a test cell. The engine performed faultlessly at all power levels during the test. However, engine load was absorbed by a water dynamometer which could not be expected to reproduce the torsional transients in the power train such as occur in flight. Thus conditions under which the DCV normally operates could not be duplicated during this test, so that no valid conclusion as to its effect on the engine could be drawn.

The engine manufacturer has indicated that an inoperative DCV is unlikely to have a violent effect on engine operation. However, the DCV has been returned to them for additional examination and testing, and any pertinent information arising from such tests will be published in a future AAIB Bulletin Addendum.