

Aircraft type and registration: Bell 222 G-META

No & Type of engines: Lycoming LTS 101-650C-3 turboshaft

Year of Manufacture: 1979

Date and time (UTC): 6 May 1987 at 1448 hrs

Location: Lippitts Hill, Loughton, Essex

Type of flight: Police patrol

Persons on board: Crew — 1 Passengers — 4

Injuries: Crew — None Passengers — None

Nature of damage: Extensive damage to engine bays, severance of tail rotor drive shaft and distortion of tail boom

Commander's Licence: Airline Transport Pilot's Licence (H)

Commander's Age: 42 years

Commander's Total Flying Experience: 11305 hours (of which 613 were on type)

Information Source: AIB Field Investigation

The aircraft was engaged on a routine police patrol in the Metropolitan area. It had taken off from its base at Lippitts Hill at 1335 hrs with the pilot and four police officers on board. About one hour and ten minutes later, whilst flying at a height of 1000 feet in the vicinity of Greenwich, the pilot noticed that the needle indicating the rpm of the No 1 engine power turbine (Np) fell to 40%, returned to 100% and then fell again to zero. All other engine and transmission indications appeared to be normal. The pilot decided to return to his base which was some 4 minutes flying time away. During this transit the pilot became aware of an increased noise through his headset. It sounded like a rushing of air and was less obvious when the police observer in the left hand front seat selected the radio station box to 'Conference' thus isolating the rearmost passenger headsets. As the helicopter neared its base and was flying at 60 knots the rear seat observer declared that the noise could be heard becoming worse in the rear cabin. As the pilot continued his approach to the landing pad and at a height of 50 feet agl there was a loud explosion and bits were seen to fly from the aircraft. The pilot simultaneously closed both engine twist grip throttles, fully lowered the collective pitch lever and applied right yaw pedal. The helicopter landed heavily some 10 metres short of the concrete pad and came to rest on the pad.

With the pilot's permission, the police officers evacuated the aircraft and then he, having completed the shut down selections and applied the rotor brake, left the aircraft. Ground personnel detected a fire burning in the engine area and this was extinguished using portable appliances.

Examination of the aircraft revealed that the No 1 engine power turbine had burst and

departed the aircraft, severely disrupting the engine. Severe damage also resulted to the adjacent No 2 engine, to the fuselage near the plane of the turbine, and to the tail rotor drive shaft, which was severed as a result. Main rotor and tail rotor blades sustained minor nicking and the fuselage tail boom had buckled.

Examination of the No 1 engine revealed that a number of gears within the engine gearbox had been severely damaged, with teeth broken off or grossly deformed. Evidence was found that many of the failed teeth had suffered extensive fatigue cracking prior to failure. The drive train within the gearbox transmits torque from the power turbine to the helicopter's main rotor gearbox. The power pinion gear, which is the first gear in the drive train, had lost all its teeth, resulting in complete disconnection of the drive from the power turbine. One of the two roller bearings supporting the power pinion was found to have all of its rollers worn grossly undersize.

Both magnetic chip detectors fitted to the common engine and gearbox oil system were found packed with metal fragments. The chip detectors are intended to operate a cockpit annunciator light when electrically bridged by metal debris, but the light did not illuminate when electrical power was restored to the aircraft after the accident. An electrical cable was found detached from the gearbox chip detector. Disconnection at this point in the circuit disabled both of the No 1 engine chip detectors. The aircraft had provision for a cockpit operated pre-flight check of the annunciator system, but this did not check the integrity of the wiring to the chip detectors.

Shortly after the accident the Civil Aviation Authority issued Airworthiness Directive 007-05-87 aimed at preventing a recurrence. Subsequently the Federal Aviation Administration issued Airworthiness Directive 87-10-04 and Bell Helicopter Textron issued Alert Services Bulletin 222-87-42. Both of the Directives and the Bulletin require action in the event of detection by the engine magnetic chip detectors of metal particles in the oil. It is noted that oil scavenged from the engine gearbox must pass through a coarse screen before reaching the chip detectors. Evidence was found that the results of a spectrometric oil analysis programme (SOAP) can provide a warning of a high rate of bearing wear.

The Chief Inspector of Accidents has ordered an Inspector's Investigation into this accident.