AAIB Bulletin No: 9/95 **Ref: EW/G95/06/21** **Category: 2.3**

Aircraft Type and Registration:	Agusta Bell 206B Jet Ranger II, G-BHXU
No & Type of Engines:	1 Allison 250-C20B turbine engine
Year of Manufacture:	1980
Date & Time (UTC):	29 June 1995 at 1510 hrs
Location:	In the sea, north of Alderney
Type of Flight:	Private
Persons on Board:	Crew - 2 Passengers - None
Injuries:	Crew - None Passengers - N/A
Nature of Damage:	Unknown damage within engine gearbox; aircraft ditched in sea and lost
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	40 years
Commander's Flying Experience:	6,300 hours (of which 2,203 were on type) Last 90 days - 122 hours Last 28 days - 44 hours
Information Source:	Aircraft Accident Report Form submitted by the pilot

The helicopter was on a 1 hour 50 minutes positioning flight from Liskeard in Cornwall to Deauville in northern France, with one pilot and an engineer on board, and had departed at 1410 hrs. The flight proceeded without incident until, when close to the island of Alderney and cruising at a height reported as 500 feet amsl, there suddenly occurred a severe 'kick' in yaw. This was coincident with the onset of abnormal mechanical noises from the engine/transmission and the illumination of the ENG CHIP warning caption. The indicated temperatures and pressures remained unchanged but the engine noise was reported as no longer being normal. The pilot immediately transmitted a "MAYDAY" call, reporting an engine problem and his GPS derived position, started to climb and altered heading to towards Alderney. He asked the engineer to monitor the engine instruments, set 7700 on the transponder and warned him to expect a ditching. After approximately 2 minutes, there was another disturbance in yaw coincident with a maximum torque indication, and an extreme noise and vibration assessed as originating from the engine area. Within a few seconds the pilot became aware that power from the engine was slowly decaying and decided that a ditching was inevitable. He entered autorotation, closing the throttle and fuel valve, and transmitted a further "MAYDAY" call to Jersey confirming his intention. During the descent, both occupants removed their caps and sunglasses and

released the door catches. An engine off landing was carried out onto the sea surface with no forward speed and with a minimal rate of descent, at 1509 hrs. The helicopter, which was not fitted on this occasion with emergency flotation gear, immediately rolled to the left, filled up quickly with water and inverted. During this, the engineer escaped quickly but the pilot, who was wearing a Naval style lifejacket, experienced some difficulty in vacating the cockpit. However his lifejacket was fitted with a short term air supply system (STASS), which can supply up to 3 minutes of breathable air, and he later reported that this was extremely beneficial in aiding his escape by removing his immediate concern of being under water.

Another aircraft, a Piper PA-28 which was some 30 nm to the east at the time, heard the "MAYDAY" call and immediately diverted to the scene. After searching for approximately 10 minutes, the pilot saw both survivors in the water and the inverted helicopter a few feet away. In addition, SAR Sea King helicopter, Rescue 172, which had deployed from RNAS Portland in response to the "MAYDAY", arrived on scene at 1530 hrs and had winched both men on board by 1538 hrs. They were taken to a hospital on Guernsey for medical checks and released later that evening. The PA-28 remained overhead the scene for some 45 minutes before resuming its flight.

The wreckage of this helicopter was not recovered and thus was not available for examination. However, the information supplied by the pilot indicated that a major mechanical failure had probably occurred within the engine gearbox assembly. This gearbox is the primary structural, and most rigid, part of the engine as it provides mounting and support for the compressor and turbine assemblies. The gearbox contains most of the engine lubrication system components and contains two separate gear trains, one for the power turbine, the other for the gas producer. The gas producer gear train provides drives for the oil pumps, fuel pump, gas producer fuel control, gas producer tacho-generator and starter generator. The primary purpose of the power turbine gear train is to reduce the engine output shaft speed from 33,290 RPM to 6,016 RPM It incorporates a torquemeter to measure engine power output and drives the power turbine tacho-generator and governor, as illustrated in Figure 1. The oil system is designed to furnish adequate lubrication, scavenging, and cooling as needed for bearings, splines and gears regardless of attitude or altitude. Jet lubrication is provided to all compressor, gas producer turbine and power turbine rotor bearings, and to gear meshes of the power turbine gear train, with the exception of power output shaft bearings. These and all other gears and bearings are lubricated by oil mist.

From the symptoms described by the crew, it would appear that failure of the engine and its control systems, lubrication system, and main rotor gearbox (in view of the successful autorotation) may be discounted. The fact that the torquemeter at one point was seen to indicate excessive torque, that the ENG CHIP light illuminated (the sensor for which is in the accessory gearbox), suggested that the failure might have occurred downstream of the torquemeter assembly in the gearbox, but before the main rotor gearbox.

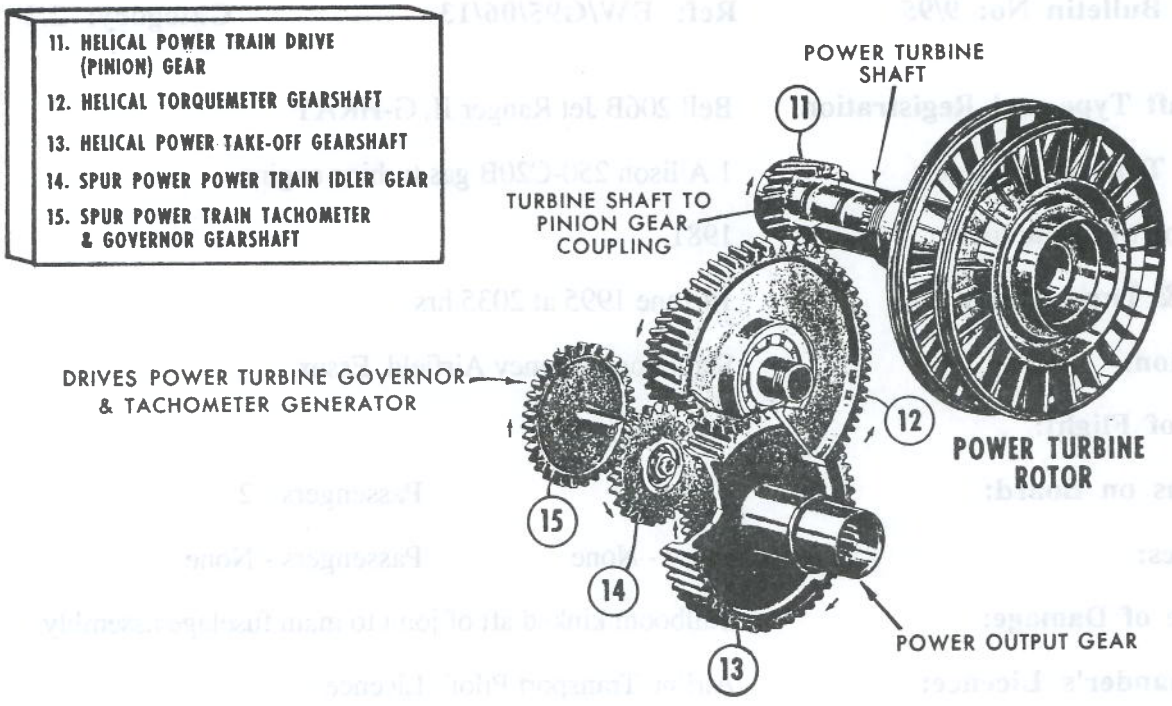
Two non-mandatory but recommended 'Commercial Engine Bulletins' (CEBs) issued by the manufacturer are possibly relevant. CEB1150 is a Bulletin which concerns the replacement of the power take-off helical gearshaft assembly (item 13, Figure 1) with one of a larger hub diameter. This reduces stress in the shaft by 50% when compared to the earlier standard, as several were known to have fractured in service at the forward internal spline. According to the manufacturer, this failure could result in loss of power or uncontrolled power turbine overspeed. This modification had been embodied. CEB 1226 addressed the problem of the securing bolt of the spur power train idler gear (item 14), which has been known to come loose in service. This modification had not been embodied.

The maintenance history of this helicopter, which had been operated and maintained by the same company since new, contained the following relevant information:

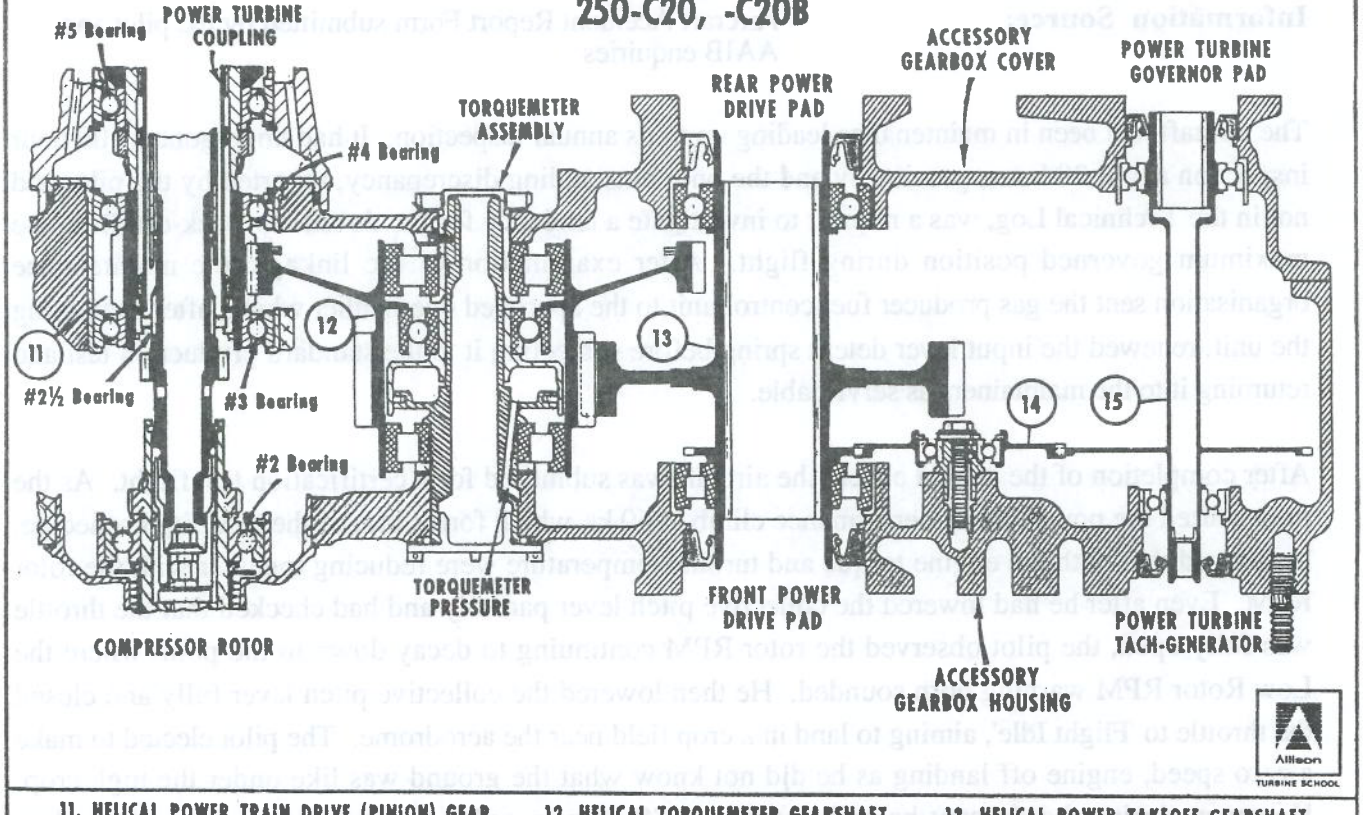
Engine	Allison 250-C20B	T.S.N. -- 4,119:00 hrs
Accessory Gearbox	T.S.N -- 4,119:00	Since Last Inspection -- 1,844:40 hrs
		Both gearbox cases renewed due to insert fretting.
		No other history of defects.

The accessory gearbox on the Allison 250 C20B engine is an 'on-condition' item, the last inspection of the aircraft being a 50 hour check in accordance with the Light Aircraft Maintenance Schedule (LAMS) at 4,108:00 hrs on 16 June 1995. Enquiries made of the engine manufacturer, and the CAA accident/incident database, has not revealed any history of failures of a similar nature.

POWER TURBINE GEAR TRAIN
250-C18, -C20, -C20B



POWER TURBINE GEAR TRAIN SCHEMATIC
250-C20, -C20B



11. HELICAL POWER TRAIN DRIVE (PINION) GEAR
12. HELICAL TORQUEMETER GEARSHAFT
13. HELICAL POWER TAKEOFF GEARSHAFT
14. SPUR POWER TRAIN IDLER GEAR
15. SPUR POWER TRAIN TACHOMETER & GOVERNOR GEARSHAFT

Figure 1