No: 10/92 **Ref: EW/C92/6/2** **Category: 2c**

Aircraft Type and Registration:	Hughes 369E, G-OPRO
No & Type of Engines:	1 Allison 250-C20R/2 turboshaft engine
Year of Manufacture:	1990
Date & Time (UTC):	6 June 1992 at 1454 hrs
Location:	1.8 nm south west of Lydd Airport, Kent
Type of Flight:	Private
Persons on Board:	Crew - 1 Passengers - 2
Injuries:	Crew - Minor Passengers - 1 serious, 1 minor
Nature of Damage:	Aircraft damaged beyond economic repair
Commander's Licence:	Airline Transport Pilot's Licence (Helicopters)
Commander's Age:	45 years
Commander's Flying Experience:	1645 hrs total, 1061 rotary (of which 164 were on type) Last 90 days - 68 hours Last 28 days - 52 hours
Information Source:	AAIB Field Investigation

History of the flight

The aircraft was returning to the UK after a visit to Greece in support of a motor sport event. On the day of the accident, the aircraft left Lugano, Switzerland, routing to Lydd with refuelling stops at Sion and Troyes. It was in company with another Hughes helicopter, G-OSOO ('OO'). Both machines arrived at Lydd for customs clearance and refuelling, G-OPRO ('RO') landing at 1334 hrs. The plan was that 'OO' would route direct to a private site at Banbury, with 'RO' routing initially to Shoreham to offload one passenger and pick up one other, before it too flew to Banbury.

The commander of 'RO' had no instrument flying qualification, and he stated that the helicopter's Attitude Indicator was unserviceable. The decision was thus made to fly under VFR throughout.

'OO' departed first at 1440 hrs on a VFR clearance, initially routing northwest from Lydd at 600 feet agl. 'RO' requested departure clearance five minutes later, but was held on the ground awaiting an Army helicopter which intended to depart IFR to the west, and for a fixed wing aircraft

making a practice instrument approach and go-around. During this period, the pilot of 'OO' called 'RO' on a prearranged discrete frequency advising him of power transmission cables running just west of Lydd Airport (Fig 1). The commander of 'RO' was aware of these, having previously visited Lydd Airport on several occasions.

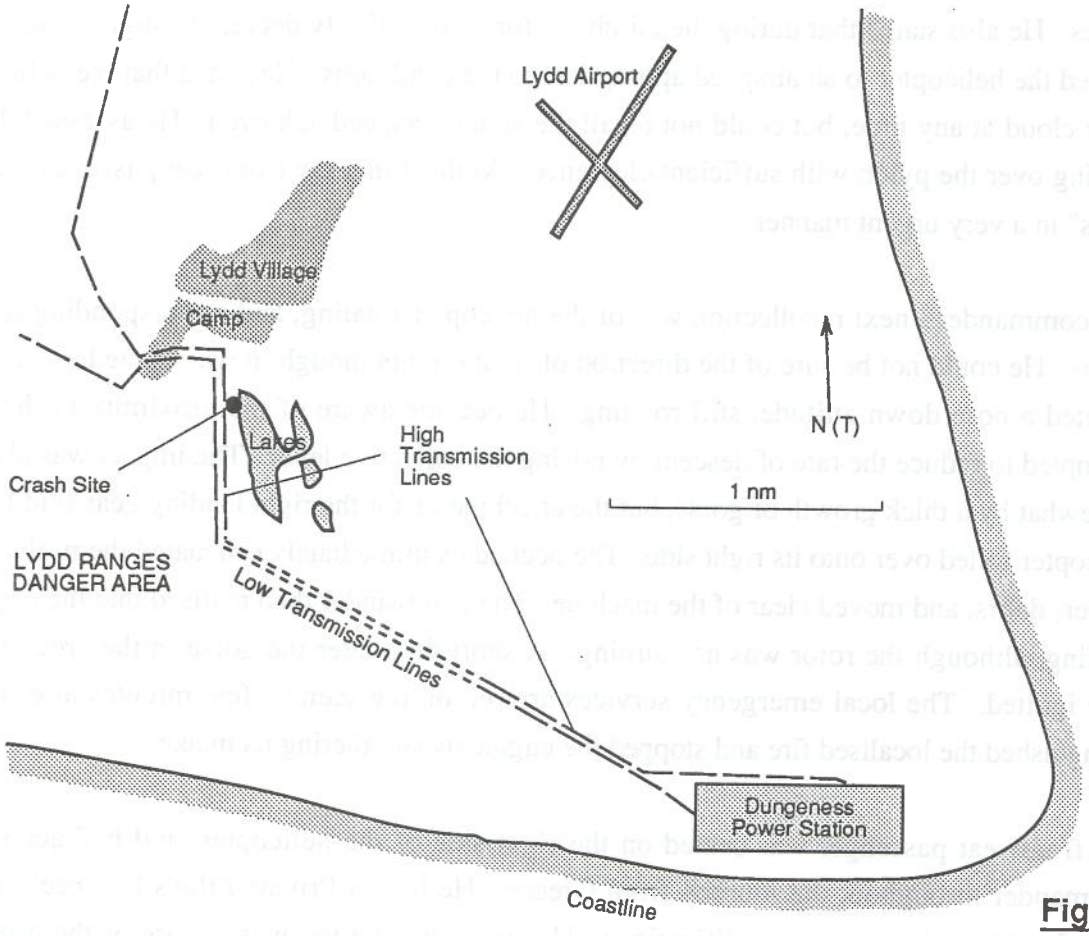

Fig 1

Two parallel sets of high voltage electricity cables supported by pylons originate from Dungeness Power Station, which is located some 2.5 nm south-southeast of Lydd Airport. In the climbout area of Runway 22, the pylons are shorter than those in normal use, in order to effect greater clearance for aircraft operating to or from Lydd. To the northwest of the climbout area, the pylons revert to the more typical structures in common use, these being approximately 185 feet in height agl. Both sets of cables exhibit two marked changes of direction in the vicinity of the accident site, in order to route around the boundaries of the Lydd Ranges Danger Area (D044).

After departure, the Army helicopter was cleared to climb to 1500 feet, and 'RO' was cleared for a VFR departure to the west, lifting off at 1448 hrs from the edge of the apron. Initially, 'RO' flew parallel to the main runway, before making a slow climbing turn towards the west, at approximately 60 kt. The commander of 'RO' reported his intention to remain below the cloud base to ATC, who

then requested a cloud base report from the pilot of the Army helicopter, the reply indicating that the base was between 400 and 600 feet agl.

The commander of 'RO' reported that he could see the power cables across his track after departure, and climbed so as to pass over the top of a pylon, a standard procedure for ensuring clearance from the cables. He also stated that during the climb the forward visibility decreased slightly, and therefore he slowed the helicopter to an airspeed appropriate to the conditions. He stated that the helicopter did not enter cloud at any time, but could not recall the actual airspeed achieved. He assessed that 'RO' was passing over the pylon with sufficient clearance. At this time, the front seat passenger called "wires, wires" in a very urgent manner.

The commander's next recollection was of the helicopter rotating, and not responding to any control inputs. He could not be sure of the direction of rotation, but thought it was to the left. The helicopter adopted a nose down attitude, still rotating. He became aware of the proximity to the ground and attempted to reduce the rate of descent by raising the collective lever. The impact was also cushioned somewhat by a thick growth of gorse, but the attachments for the right landing gear skid failed and the helicopter rolled over onto its right side. The occupants immediately evacuated themselves via the left (upper) doors, and moved clear of the machine. The commander then realised that the engine was still running, although the rotor was not turning. A short time later the gorse in the area of the exhaust flow ignited. The local emergency services arrived on the scene a few minutes after the accident, extinguished the localised fire and stopped the engine by smothering its intake.

The front seat passenger was seated on the right side of the helicopter, and had accompanied the commander throughout the journey from Greece. He held a Private Pilot's Licence for fixed wing aircraft with no instrument qualifications. He stated that he too was unsure of the direction of the initial rotation, but believed that the helicopter was rotating to the left just prior to impact. In retrospect, he considered that the helicopter had been clear of the top of the wires, and that his perception of their close proximity was caused by his inexperience in helicopter operations in the weather conditions prevailing at the time.

The rear seat occupant was a helicopter engineer, who regularly travelled as a passenger in helicopters. He recalled that the machine was passing close to the top of the pylon, but with a reasonable clearance, prior to the loss of control. He recalled that the helicopter initially pitched up and yawed to the right, while having little forward speed, the rotation continuing to the right until impact.

Retrospectively, the commander believed that he may have made both a cyclic and a large collective control input in response to the passenger's call, and that this may have caused the resultant initial

uncorrected yaw. He also commented that he believed the continued loss of control was due to a loss of tail rotor effectiveness coupled with a high engine power demand, rather than any form of disorientation in the poor visibility conditions.

A met aftercast for the time of the accident showed that there was a frontal system lying east to west across mid Sussex, with a moist southwesterly airstream over the Lydd area, giving visibility around 1800 metres in mist with occasional drizzle. The surface wind was 220°T/12 kt, and the wind at 2000 feet was 260°T/10 kt. The cloud conditions were overcast stratus base 400 feet, tops 3000 feet.

The meteorological aeronautical radio codes recorded for 1450 hrs were as follows:

LYDD - 220°/12 kt, 1800 metres, drizzle, 8/8 stratus base 400 feet, temperature 13°C, QNH 1012 mb.

SHOREHAM - 230°/10 kt, 2500 metres, mist, 5/8 stratus base 600 feet, 8/8 stratus base 800 feet, temperature and dew point 14°C, QNH 1012 mb.

Aircraft Details

The helicopter (Serial No 0360E) had a Certificate of Airworthiness in the Transport (Passenger) category. Records indicated that it had been maintained in accordance with the Light Aircraft Maintenance Schedule and had flown 569 hours from new. At the time of the accident, it was loaded to 2857 lbs all-up weight with a centre of gravity of 102.6 inches aft of datum, both of which are within the permitted envelope.

Wreckage and Impact Information

G-OPRO crashed at a point 1.8 nm on a bearing of 237°T from the centre of Runway 22, approximately 50 metres east of the eastern high voltage power line in an area where the lines run almost north-south. The crash site was a short distance south of the 90° turn in the run of the lines. The helicopter came to rest just inside the security fence of a Ministry of Defence establishment located on the southern edge of Lydd village. The fence consisted of 7.5 feet high steel chain link tensioned between reinforced concrete posts 9.5 feet apart, and bordered a minor public road alongside a lake. The whole area, including the airport, the site and the terrain on which the power line pylons stand, is effectively level.

Inspection of the wreckage and accident site indicated that the helicopter had first contacted the fence while erect, pitched nose up and descending at a relatively high rate with low forward speed, while tracking and heading north-westerly. No evidence was found to indicate significant fuselage rotation at ground impact. Two main rotor blades had sustained severe damage from contact with the fence

posts. The right skid and its attachments had failed, and the aircraft had rolled to the right causing sequential contact of the five main rotor blades with the gorse and then the ground. The helicopter had come to rest on its right side with the main rotor blades destroyed and with blade parts spread up to 30 metres from the main wreckage, with the tail boom fractured, and with a number of areas of local fuselage deformation. A small amount of local fire damage to the aircraft was sustained from the gorse fire ignited by the engine exhaust flow. There was no sign of fuel spillage at the accident site. However, it was noted that the fuel tank drain probe appeared somewhat vulnerable to being opened by ground contact in the event of the aircraft rolling onto its left side. Approximately 54 US gallons of Avtur were recovered from the aircraft, with both main and auxiliary tanks containing appreciable quantities.

Examination revealed that the main rotor mast had fractured, in a manner consistent with the effects of torsional overload resulting from main rotor blade contact with the fence and ground. Inspection of the flying control system, manually operated in all four channels, revealed no evidence of pre-impact failure or malfunction. With the exception of the attitude indicator, no indications were found of any failure of the aircraft or its equipment that could have contributed to a loss of control.

There was no evidence to suggest that the helicopter had contacted with the power cables or pylon structure at any time.

Certification Aspects

This helicopter was the first in the UK to be fitted with the optional four bladed tail rotor, the 'Quiet Knight' kit, intended to reduce external noise by operating at a lower RPM than that of the two bladed version (2210 RPM instead of 2933 RPM). In order to compensate for the consequent reduced thrust, the pitch angle of the blades was increased. The manufacturer stated that the four bladed tail rotor system is capable of producing the required amount of thrust, based on the performance charts in the relevant Flight Manual Supplement, throughout the approved flight envelope.

In order to certificate this modification for operation in the UK, this helicopter was test flown by the CAA after installation of the four bladed tail rotor system. The flight tests concluded that in the forward flight envelope the directional stability and yaw damping characteristics were improved compared to those of the two bladed variant. However, in the low speed envelope, tests showed that in certain crosswind and quartering wind conditions, uncommanded heading changes could occur. The CAA therefore required that a cautionary note be added to the Flight Manual supplement for the four bladed tail rotor modification, stating that *"when operating with left or right crosswinds or left quartering winds, large undemanded heading changes may occur."* This supplement was included in the Flight Manual for G-OPRO.