

ACCIDENT

Aircraft Type and Registration:	Robinson R44 Raven II, G-SPAL	
No & Type of Engines:	1 Lycoming IO-540-AE1A5 piston engine	
Category:	2.3	
Year of Manufacture:	2004	
Date & Time:	19 September 2004 at 2057 hrs	
Location:	Kentallen near Oban, Scotland	
Type of Flight:	Private	
Persons on Board:	Crew - 1	Passengers - 1
Injuries:	Crew - 1 (Serious)	Passengers - 1 (Fatal)
Nature of Damage:	Aircraft destroyed	
Commander's Licence:	Private Pilot's Licence with Night Rating	
Commander's Age:	53 years	
Commander's Flying Experience:	492 hours (of which 401 were on type) Last 90 days - 25 hours Last 28 days - 18 hours	
Information Source:	AAIB Field Investigation	

All times in this report are local times (UTC + 1 hour)

Synopsis

The pilot was returning from Perth (Scone) Airfield to a private landing site at night with one passenger on board. As he was about to begin manoeuvring in the vicinity of the landing area, the passenger slumped across the flight controls and shortly afterwards, the helicopter impacted the side of a hill in level flight at slow speed. The pilot was able to free himself from the wreckage but the unconscious passenger was fatally injured in the subsequent fire.

History of the flight

Three days before the accident, the pilot flew the helicopter to a private landing site at Ardsheal near Kentallen. The site belonged to friends of the pilot and he spent the following days flying them on several local flights. On the day of the accident he flew the helicopter to the Island of Mull before returning to Ardsheal at about 1500 hrs having refuelled the machine at Oban (North Connel) Airfield. Whilst at Oban he had sought advice on a low cloud-ceiling route to Perth (Scone) Aerodrome and en-route alternates. The weather in the local area had been much the same all day and after

checking the weather forecast on a home computer at Ardsheal, he decided to fly again. At about 1600 hrs he departed the Ardsheal site for Perth Aerodrome with two passengers. Due to a forecast of inclement weather, an indirect route was flown via Loch Lomond, avoiding the more mountainous terrain. This flight was uneventful and after the aircraft had landed at about 1720 hrs, one of the passengers left the aircraft at Perth. The pilot's intention was then to return to Ardsheal with the other passenger. Whilst at Perth, the aircraft was refuelled to full tanks and a weather update obtained from the radio operator at Oban Aerodrome. The pilot was advised that the visibility had improved since the time he had passed Oban on the outbound flight. On preparing to leave Perth, the helicopter's engine failed to start; the problem was traced to a loose wire on the engine inhibitor circuit. This was rectified by a suitably qualified engineer and the pilot and his passenger boarded the aircraft as the sun set at about 1915 hrs. The helicopter departed Perth shortly afterwards for the flight to Ardsheal which the pilot expected to last for about one and a half hours.

The pilot's intention was to reverse the route he had flown earlier, knowing that the final part of the route and landing would have to be completed after nightfall. Night officially began at 1958 hrs at Ardsheal and the moon set at 2041 hrs. Having left Perth, the pilot made no further radio transmissions but monitored the Glasgow Radar frequency whilst transiting to the north of Glasgow Airport. At this stage the aircraft was cruising at around 1,500 ft amsl with its groundspeed reduced to approximately 70 kt by a strong south-westerly wind. The pilot considered the flight conditions "challenging" but he felt "comfortable" and "in control". He stated that the flight was uneventful until passing Lochgilphead (approximately 295°/35 nm from Glasgow Airport) when the passenger, who was seated in the front left hand seat, moved towards him and initially did not respond when

asked to move away. When physically shaken by the pilot, the passenger replied to his request and moved back into his seat but during that period some control of the aircraft was momentarily lost. During this brief period the pilot became disorientated and the aircraft gained height rapidly before full control was regained. With the aircraft back under control, the pilot told the passenger that if he was sleepy, it was in order for him to sleep throughout the remainder of the flight.

After commencing the final leg of the return route on a northeasterly heading, following the coastline by observing the surf, the pilot descended from about 1,000 ft to 500 ft agl or lower to obtain the best visual cues. By that time it was dark but the pilot stated that he had other visual cues such as silhouettes of higher ground. He reported "navigating 90% visually, just using the GPS as a back up".

He had flown in this area in poor weather before but never at night. Passing Oban Aerodrome the pilot still felt content to continue the flight but he was agitated by the incident with his passenger. A strong tailwind component gave the aircraft a groundspeed of 147 kt, so the pilot prepared his arrival strategy for the landing site on that basis. The pilot provided a sketch map of his intended track and this is shown at Figure 1.

According to the pilot, not having landed at Ardsheal by night, he planned to follow the coast until he estimated he was abeam the landing site on his north-easterly track. He then planned to turn northwards, out into Loch Linnhe, towards the lights of the Corran Ferry. He would then continue this downwind leg on a northerly heading until the lights of Kentallen appeared from behind Ardsheal Hill on his right hand side which would be his cue to turn right, back into wind on a reciprocal heading towards the landing site. He intended to cross the shoreline just to

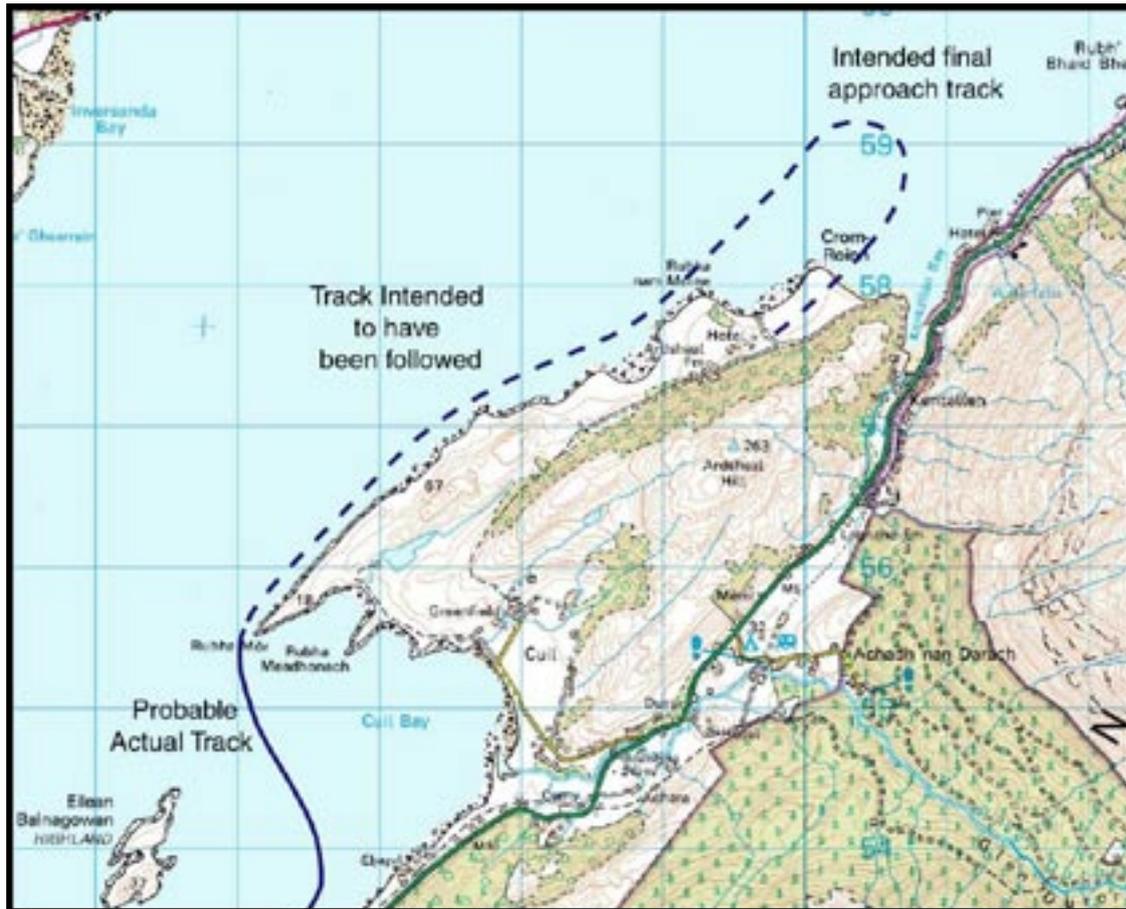


Figure 1

Pilot's intended approach path to landing site

the north of Ardsheal House and then descend towards the landing site, switching on the helicopter's landing and emergency lights at a height of about 100 ft or less. These manoeuvres were intended to allow an into-wind approach and to produce a long, slow, stable approach to the landing site. He was particularly concerned by the proximity of high ground to the north-east of Ardsheal Hill which extends towards the mouth of Kentallen Bay. Ardsheal hill rises to 864 ft amsl and is one kilometre to the south of the site (see Figure 1). He was aware that if he could not see the landing site having turned into wind, he had the option of switching on the landing light and/or the emergency night lights to assist him once he had crossed the shoreline. However, his main concern was avoiding the high ground of Ardsheal Hill.

The pilot followed the coast to within about two miles of the landing site when the passenger, who was wearing a lap and diagonal seat harness, "flopped" onto the pilot and had to be physically moved off the flying controls and back into his seat. This time the passenger showed no sign of response and the pilot temporarily lost control. He became disorientated for a period and the aircraft again climbed rapidly; this time it entered cloud momentarily but full control was regained. Once back beneath the cloud, the pilot re-orientated himself using visual cues and the GPS but he had lost sight of the coastal track that he intended to follow. He recalled that this time there was no response from his passenger and he then became "very stressed". There was no response from the passenger for the remainder of the flight.

The pilot reported that almost immediately afterwards, as he started to execute his turn northwards towards the lights of the Corran Ferry and Ardgour Peninsula, his passenger “fopped onto” him for a “second time” (it was the passenger’s third reported involuntary movement across the cabin but only the second time he had obstructed the controls). The passenger had to be physically pushed back into his seat as he appeared unconscious and control of the aircraft was lost. The pilot stated that having placed the passenger back into his seat, clear of the controls and against the passenger’s door, as he brought his head up to regain control of the aircraft there was a loud bang and the helicopter hit the ground.

When the aircraft came to rest, the pilot, despite multiple injuries, was able to free himself from the wreckage and he attempted, without success, to rescue his unconscious passenger. An explosion followed by intense heat and flames forced the pilot to leave the area and he slid down a steep slope to the top of a waterfall. He remained there until rescued by the local emergency services and was subsequently flown by helicopter to hospital.

Witness Information

Several people witnessed segments of the last part of this flight. Most reported the weather conditions as bad with heavy rain and strong winds. One described the weather as “atrocious” and said that it had been like that for most of the day. Some witnesses were attracted to the presence of the helicopter by its distinctive noise although others who saw its lights said they could not hear it; some of the latter attributed this experience to the overpowering sound of the wind. One witness who reported seeing the helicopter’s lights stated that it was so dark outside that the outline of Ardsheal Hill could not be seen from the witness’s house which was approximately 400 m east of the accident site.

The passenger’s wife observed what she believed to be the helicopter, flying between the landing site and Ardsheal Hill (see Figure 2), heading north-east. She had earlier switched on some of the house lights to assist the pilot with locating the landing area, approximately 400 m away. She thought it “seemed to be quite high” and that it was “a bit unusual that the helicopter seemed to be towards Kentallen Bay”. Another witness on the eastern side of Kentallen Bay observed the helicopter’s lights. The helicopter was flying down the Bay, on a steady heading at low height and with a groundspeed of between 20 and 25 mph. Further witnesses reported seeing the helicopter flying at a height similar to Ardsheal Hill in a south-westerly direction along Kentallen Bay. These witnesses, also situated on the eastern side of the Bay, stated that the helicopter “was coming up towards Ardsheal, it would have been from the Onich/Balachulish direction” meaning from the north-east. The only lights seen on the helicopter were two red/purple lights, possibly flashing. The helicopter was then seen to continue down the Bay before turning slowly to the right and impact the hillside. One witness saw it, when directly opposite him, drop about 30 ft followed immediately by flames appearing from the same location. Another witness said the helicopter “travelled diagonally across the Bay in front of our living room window. I then saw it drift into Ardsheal Hill. I did not think it fell from the sky”. She saw flames appear “within 5 to 10 minutes of hitting the hill”.

One of the pilot’s rescuers stated that whilst he was assisting the injured pilot on the hillside before the fire service and mountain rescue teams arrived, the pilot said that “the crash had been caused by a gust of wind which made the helicopter uncontrollable” and that “they were trying to land anywhere at Ardsheal.” A different witness, also present during the early stages of the rescue, stated that he told the pilot he had done well to land the helicopter, to which the pilot replied that he “didn’t land it,

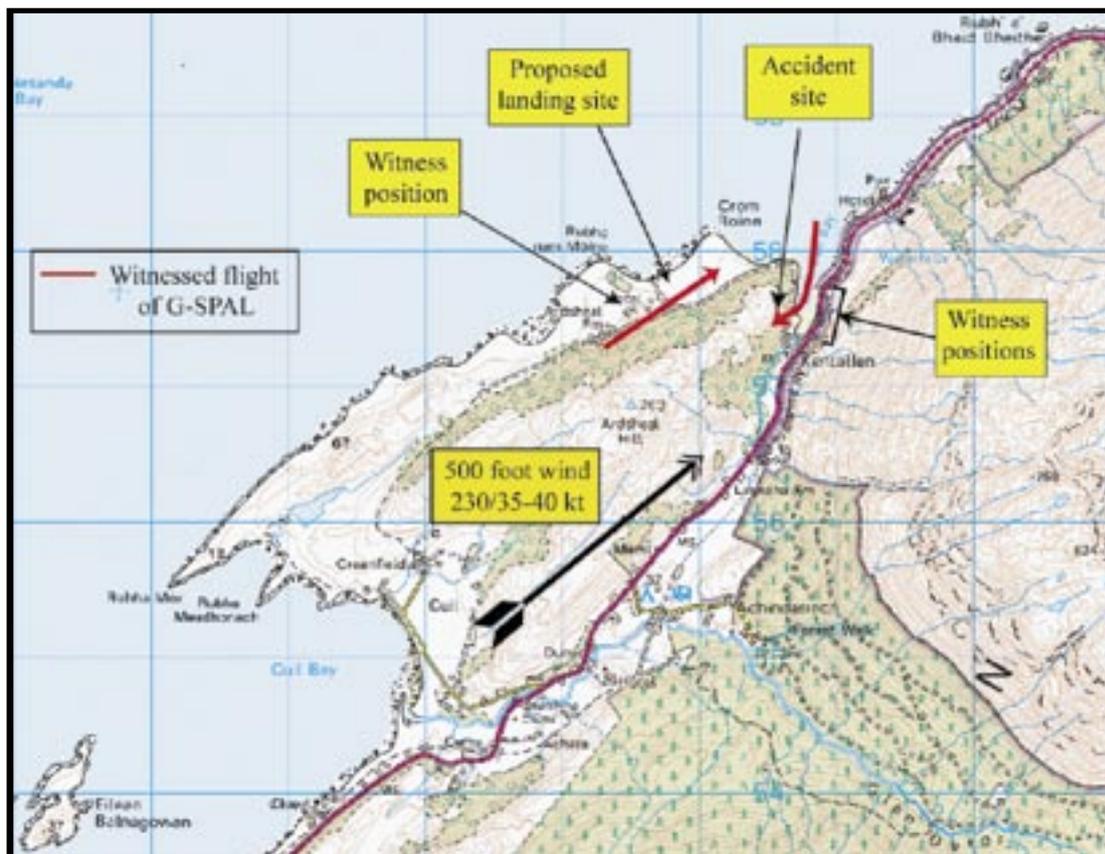


Figure 2

Witnessed flight path and position of accident site

it grabbed me or we just fell”. A few hours later the pilot explained to another witness that his passenger “had twice slumped over from his seat towards him”, that “there had been some interference with the controls” and that when the passenger slumped a second time, “he was unable to recover the helicopter”.

Radar information

Area radar data captured by the Lowther Hill and Tiree antennae were obtained. The helicopter was not equipped with transponder mode C and so no encoded altitude information was available. Radar coverage along the pilot’s return route was poor except along the west coast of the mainland where the track between Lochgilphead and Port Appin was consistent with the pilot’s recollection of his general routing. The irregular

flight path was suggestive of flight through the Crinan Canal valley and then following the coast over the water with occasional overflights of coastal features. The recorded data terminated some 7 miles short of the destination, probably because of terrain obscuration.

Accident site

The accident occurred on the eastern side of Ardsheal hill, at a point aligned with the southern end of Kentallen Bay. The initial rotor contact point was on a tree located some 300 ft above sea level. At the same time as the tree strike, one rotor tip had also struck the side of the hill. Shortly after this, the front of the helicopter’s right skid struck the hillside. This would have caused a downward pitching moment and the lower right side of the helicopter struck the rocky hillside, with damage to

the perspex canopy. This brought G-SPAL to a halt on the edge of a steep slope, the helicopter then slid down this slope, rolling onto its left side and uprooting small trees in the process; additionally the tail boom, from aft of the cabin bulkhead, detached during this sequence. The main body of the helicopter finally came to rest on its left side, supported by an uprooted tree, on a heading of 163°M. During the slide, the left main fuel tank had ruptured and a severe localised post-crash fire ensued that engulfed the majority of the helicopter's main airframe, with only the detached tail escaping the flames.

The compact site and the small wreckage spread indicated that the ground speed of the helicopter was low; it was estimated to be between 10 and 20 kt. The tree strike, ground marks and damage were also consistent with either low or no vertical speed, with a level pitch attitude, but with about 15° of right bank on the rotor disc. Measurements taken from the front right skid, after it was inserted into the hole left by the skid when it struck the hill, indicated that the helicopter was on a heading of around 230°M.

Only one rotor blade had extensive damage, with a large piece of this blade being found some distance away, behind the wreckage and down the hill. This piece had separated during the initial rotor strike as the blade tip dug into the hillside. It had been thrown backwards and during its ballistic trajectory, struck a tree. Damage to the tree indicated that the rotor was under high power and had contained a lot of energy at the time of the initial rotor strike. The other main rotor blade had been damaged by the fire but still showed bending consistent with a rapid stop of the rotor disc.

Detailed aircraft examination

The aircraft was recovered from the hillside and taken to the AAIB facility at Farnborough for a detailed examination. The helicopter had been equipped with three GPS units,

two Skyforce 3 and one Garmin 250XL, unfortunately all three units were extensively damaged during the accident and the post crash fire, which precluded any data retrieval. The main fuel gauge showed its contents at ¼ full. However, the calculated fuel load on the helicopter at the time of the accident suggests that the auxiliary tank should have been empty and the main fuel tank should have contained about 19 US gal (slightly more than half full) which would have been sufficient for at least another hour's flight. The remaining instruments did not show any meaningful information, although the altimeter barometric setting was set to 997 mb.

The post-crash fire had destroyed the majority of the airframe and had melted many of the aluminium push rods used to control the helicopter. However, of the flying control items remaining, it was possible to establish that these were correctly connected. Both main rotor pitch control links had fractured in overload, most probably as a result of the rotor blade's contact with the hill side. G-SPAL was equipped with dual controls, but these had been disconnected and although carried, they were not fitted during the accident flight.

The rotor blade damage previously described indicated that the helicopter was under power at the time of the crash and further examination of the remains of the engine did not reveal any pre-existing problems.

G-SPAL had been equipped with an emergency night light kit; this consisted of two high power lights fitted to the rear of the skids. The right night light had smashed during the crash, but the left light remained intact.

The pilot and passenger harnesses on the aircraft were of the lap strap and diagonal type. Due to the extensive fire it was not possible to ascertain if the passenger's harness was securely fastened during the accident. Tests were

carried out in another Robinson R44 to establish the amount of 'play' in the diagonal seat belt strap. It was ascertained that a person of similar size to the passenger could fall across the right hand seat, thereby obstructing the cyclic and collective flying controls, whilst remaining strapped into the left hand seat.

Weather

On the day of the accident there was a deep area of low pressure centred near the Faeroe Islands with a cold front passing through western Scotland during the evening. At 1555 hrs Glasgow Airport promulgated a Terminal Aerodrome Forecast (TAF) to cover the period between 1700 hrs and 0200 hrs the following morning. It stated that the wind was expected to be 220° /18 kt gusting to 32 kt with 7,000 m visibility in rain and a main cloudbase of 2,400 ft amsl. The TAF also mentioned that there was a 40% probability that between 1700 hrs and 2300 hrs, the visibility would reduce to 3,000 m in heavy rain and the cloudbase would lower to 1,200 ft amsl. At 2050 hrs, seven minutes before the accident, Glasgow Airport, the nearest active airport, issued a weather observation of visibility 5,000 m in rain, scattered cloud at 1,100 ft and broken cloud at 1,800 ft. The QNH was 998 mb.

An aftercast provided by the Meteorological Office stated that the accident area would have been subjected to a fresh to strong west-south-westerly airflow with low cloud and often heavy rain. The aftercast also indicated that the wind at 500 ft agl was from 230° at 35 to 40 kt; there was a visibility of 5,000 m. The cloud structure was: scattered or broken stratus with base between 1,000 and 1,500 ft amsl plus broken or overcast stratus, base 2,000 ft. Above these layers there was multi-layered stratoform cloud up to 10,000 ft and layers of alto-cumulus rising to 27,000 ft.

Landing Site

The private landing site where the pilot intended to land was one of several large fields about 400 m from Ardsheal House, the nearest building. The fields resemble parkland with isolated trees within them and the site is almost at sea level. No specific lighting was available at the landing site and the absence of nearby buildings or lit roads meant there was no local ambient light. The pilot had operated from this site on numerous occasions, including in poor weather conditions but never previously by night.

Pathology

A post-mortem examination of the passenger concluded that he suffered debilitating injuries such as rib and sternum fractures, abdominal injuries and a superficial head wound which may or may not have rendered him unconscious. However, the helicopter came to rest on its side and his position within it, coupled with his injuries, would have made it difficult for him to vacate the aircraft even if he had been conscious. He died from the effects of the post crash fire.

The post mortem examination of the passenger also *'revealed narrowing of his left anterior descending coronary artery of sufficient degree to account for any collapse which he may have suffered during the flight'*. The examination was *'unable to provide evidence to confirm that he had indeed collapsed or to determine his level of consciousness prior to the accident'*.

Toxicological tests established that there was no evidence of alcohol, drugs or substance of abuse within the passenger's body.

Aircraft equipment

The aircraft was fitted with an emergency night light kit as previously described. The primary aim of the emergency night lights is to identify hazards such as trees and people

during the landing phase; they are not designed as an aid to acquiring the landing area. A familiarisation flight was conducted in a similar aircraft fitted with these lights to assess their effectiveness. With both landing lights and emergency lights switched on, ground features showed usable definition at heights up to 300 ft. When flying in precipitation, it is understood from the Chief Pilot of a UK Robinson Helicopter distributor, that their effectiveness is reduced, sometimes considerably, due to light being reflected and scattered by the visible moisture droplets.

Night flying regulations and licence privileges

Rule 22 of the current *'Rules of the Air Regulations 1996'* states that an aircraft flown in the UK at night *'outside a control zone shall be flown in accordance with the Instrument Flight Rules'* (IFR). Rule 29 of the Instrument Flight Rules which specifies minimum heights states that *'an aircraft shall not fly at a height of less than 1000 feet above the highest obstacle within a distance of 5 nautical miles of the aircraft.'* (This altitude is commonly known as Minimum Safe Altitude and abbreviated to MSA). If flying at or above MSA is impractical, an alternative means of complying with the IFR outside controlled airspace is afforded to aircraft under Rule 29(d). This clause permits an aircraft to fly IFR provided that *'the aircraft is flying at an altitude not exceeding 3000 feet above mean sea level and remains clear of cloud and in sight of the surface'*.

Joint Aviation Regulation—Flight Crew Licensing (JAR-FCL) paragraph 2.026 requires a pilot without a valid instrument rating to fly three circuits at night during the 90 days prior to flying a passenger at night. According to the pilot's logbook, he last flew at night on 1 November 2003 which was 323 days before the accident flight.

Helicopter manufacturer's information

The limitations section of the Pilot's Operating Handbook for the Robinson R44 Raven II states the following:

'Orientation during night flight must be maintained by visual reference to ground objects illuminated solely by lights on the ground or adequate celestial illumination'.

On 7 July 2004, the aircraft manufacturer re-issued a safety alert entitled *'Always Avoid Flying After Dark'* to all registered owners, operators and distributors of their aircraft. This safety alert emphasised the difficulties of flying cross-country flights in poor weather after dark. It referred to three R44 accidents in the USA during the previous two years involving seven fatalities and commented that these flights were undertaken over unfamiliar rural terrain with few visible ground lights and very little, if any, celestial illumination. Enclosed with the safety alert was the following safety notice:

NIGHT FLIGHT PLUS BAD WEATHER CAN BE DEADLY

Many fatal accidents have occurred at night when the pilot attempted to fly in marginal weather after dark. The fatal accident rate during night flight is many times higher than during daylight hours.

When it is dark, the pilot cannot see wires or the bottom of clouds, nor low hanging scud or fog. Even when he does see it, he is unable to judge its altitude because there is no horizon for reference. He doesn't realise it is there until he has actually flown into it and suddenly loses his outside visual references and his ability to control the attitude of the helicopter. As helicopters are not inherently stable and have high roll rates, the aircraft will quickly go out of control, resulting in a high velocity crash which is usually fatal.

Be sure you never fly at night unless you have clear weather with unlimited or very high ceilings and plenty of celestial or ground lights for reference.

Light helicopter accidents

Analysis of accidents occurring in light helicopters registered in the United Kingdom shows that a significant number of serious accidents result from pilot disorientation in conditions of low cloud and poor visibility, with 18 out of 44 fatalities (40.9%) in the period 1997 to 2003 being attributed to this cause.

Analysis

On departing Perth the aircraft appeared to have been fully serviceable and the engineering investigation was able to confirm the pilot's report that the accident was unlikely to have been caused by mechanical failure. The pilot reported that the accident occurred due to loss of control as a direct result of the passenger's unwitting interference with the flying controls followed by his loss of concentration and heightened levels of stress and fear as he attempted to reposition his passenger.

Although the pilot's original intention was to fly the return route by daylight, the engine starting problem at Perth, which incurred a delay in departure of at least an hour, meant that he departed Perth knowing that the majority of the route to Ardsheal would have to be flown at night. Since flight at night outside controlled airspace must be conducted IFR, the pilot had to observe the provisions of Rule 29 but because there was an overcast layer of cloud below MSA, flying in accordance with the basic Rule 29 at 1,000 feet above obstacles was impracticable. Consequently, he had to rely on the provisions of Rule 29(d) which are, in practice, similar to those for day VFR flight outside controlled airspace (Rule 26(b)). In practical terms the main difference at night is the reduction in available visual cues. Consequently, pre-requisites for safe, visual, transit flight in darkness are reasonably good weather, suitable topographical charts, pre-flight planning, natural or cultural light and accurate navigation.

Despite the improved visibility at Oban relative to the outbound flight, the forecast general weather, particularly the strong gusty winds, the 40% probability of 3,000 m visibility in heavy rain and a 1,200 ft cloud base, would have suggested that conditions along the West Coast could be problematic. Indeed, after the accident, the pilot reported that he had found them "challenging", especially on the final north-easterly leg after he had passed Lochgilphead. Nevertheless, until his passenger's involuntary movement across the cabin and the subsequent disruption to the pilot's intended track, he was feeling comfortable, relaxed and fully capable of operating safely in the prevailing conditions. At that point, some 2 nm from the landing site, his situation deteriorated due to the collapse of his passenger leading to temporary control problems.

It was also dark. The coastal area north of Lochgilphead has minimal cultural lighting and numerous obstructions above 500 ft amsl, the upper limit of the pilot's en-route altitude. Moreover, the sun had set about 1 hr 45 mins before the accident, the moon had set about 15 mins before the accident and evening nautical twilight, the time after which the horizon becomes indistinguishable at sea, began at 20:53 hrs, four minutes before the accident. The extensive layers of rain cloud in the Ardsheal area would have obscured any starlight so the visible external cues in the vicinity of Ardsheal would have been restricted to the sparse cultural lighting. Nevertheless, the required weather minima were maintained with the exception of a brief, unintentional entry into cloud. The validity of the pilot's Night Rating when flying with a passenger and his currency for night navigational and landing techniques, were doubtful because, before the day of the accident, the pilot had not flown at night for more than 10 months. However, he had been night flying during the 59 minutes preceding the accident.

The strong tailwind from 230° at the pilot's cruising height of 500 ft or thereabouts contributed to the abnormally fast 147 kt groundspeed (for a helicopter with a maximum permitted airspeed of 130 KIAS) during the leg towards Ardsheal on a track of about 050°. The meteorological aftercast indicated that the wind at 500 ft agl was from 230° at 35 to 40 kt which in turn suggests that the helicopter was cruising at an airspeed between 107 and 112 KIAS. This speed would be consistent with the advertised cruise speed of 'up to 113 kt'. This south-westerly wind component would have much reduced the helicopter's ground speed during its flight down Kentallen Bay on a heading (at impact) of 230° so, if the helicopter had maintained a constant cruising IAS, the groundspeed should have been in the order of 70 kt. However, the pilot stated that he was trying to regain control whilst repositioning the passenger so the airspeed under those circumstances was unlikely to be steady. Moreover, the helicopter's flight path was also unlikely to be steady.

Witnesses thought the machine was closing with Ardsheal Hill in level flight at a speed of about 20 kt. The accuracy of witness estimates of the height and speed of a black-liveried helicopter judged solely by the movement of its lights may be questionable but the narrow confines of Kentallen Bay limit the scope for misjudging the machine's distance from the witness. Therefore, estimates of its speed, height and height keeping by interpretation of its apparent angular movement within the Bay area were unlikely to be compromised by any inability to discern the helicopter's size or silhouette. Consequently, it is likely that the helicopter's airspeed had significantly reduced for some reason and none of the witnesses reported that it appeared to them to be out of control. Their general impression of a slow-speed, apparently controlled flight into the ground is supported by analysis of the accident site impact marks.

The pilot stated that his passenger's first obstruction of the controls occurred when the helicopter had about 2 nm to run to abeam the landing site and at this time he became disorientated when repositioning the passenger. Consequently, when the aircraft was observed flying between the landing site and Ardsheal Hill, it was either only under partial control or control had been regained temporarily between the passenger's two involuntary movements across the cabin. In either case the pilot had lost sight of the coastline and the helicopter was to the east of his desired track due to the temporary control difficulties and consequent loss of navigational accuracy. Therefore, unless the pilot turned left for a period before turning 180° to the right, as he had intended to do, the helicopter was bound to be further east than the pilot intended when he crossed the shoreline inbound to the landing area. Indeed, the displacement to the east was such that had he not allowed for it, a right turn into wind would have brought the helicopter into the vicinity of Kentallen Bay.

However, the pilot reported that he was starting a left turn towards the lights of the Corran Ferry when the passenger collapsed again and obstructed the flight controls a second time. This time control was not regained before the machine struck the hillside.

When the helicopter was seen by witnesses in Kentallen it was observed for some time in apparently level flight and proceeding slowly down the Bay before starting a gentle right turn and then hitting the ground. It may have been cruising much slower along this last leg because of the unintentional manoeuvres that disorientated the pilot. If the meteorological aftercast and the witness's estimates of the helicopter's speed are accurate, then it must have been flying at an airspeed of about 55 to 60 KIAS to make good a groundspeed of approximately 20 to 25 mph (about 20 kt). This airspeed would also

be consistent with an interim approach speed and not so slow as to significantly compromise the helicopter's directional stability in forward flight.

The inherent instability of all types of light helicopter means that level flight cannot be sustained without frequent, corrective, cyclic control inputs, particularly in gusty wind conditions. The investigation considered the pilot's own conclusion that he was spatially disorientated and unaware that the aircraft was in relatively level flight during this period. He stated that he was still struggling to re-position the passenger a second time and to regain control when the helicopter hit the lower slopes of Ardsheal Hill. He also stated that "while contending with his passenger the Pilot felt that his control inputs were more instinctive than controlled, but his efforts on both occasions were clearly more effective than he might have dared to hope". The helicopter was observed flying at low speed up Kentallen Bay for a distance of at least 200 m to the accident site. If this distance was flown at a groundspeed consistent with the evidence, the machine was out of control for 20 seconds or more whilst it flew up the Bay. This is a long time for a helicopter to be out of control and yet appear to witnesses to be under control in reasonably level flight. However, since the pilot was still 'head down' at impact, he would not have seen the cultural lights in Kentallen.

Conclusion

The accident occurred before the pilot commenced his approach when, having encountered problematic lighting and forecast weather conditions, his task was complicated by the collapses of his passenger and the latter's obstruction of the flight controls. Although it is not

possible to plan or legislate for passenger distraction or interference with the flying controls, the lack of ambient lighting, the poor weather and the pilot's lack of night flying recency would, in combination, have been likely to degrade his ability to cope simultaneously with an out of control situation and a navigational displacement. Flying at night in the prevailing conditions would have been demanding and would have left little spare mental capacity for dealing with an emergency.

Moreover, although the pilot had developed a strategy for his arrival at the landing site, it is not a recommended procedure to land at night without ground lighting or adequate celestial illumination; indeed it is contrary to instructions in the pilot's operating handbook. Not only does ground lighting provide a geographical reference, it also allows the pilot to monitor closing speed, provides a means of attitude reference, allows judgement of the angle of approach and early recognition of aircraft drift.

Related safety action

In view of the high accident rate involving light helicopters in poor weather conditions, the UK CAA is currently reviewing the minimum flight visibilities authorised for flight by visual reference in helicopters and gyroplanes.

Also, the pilot stated that had the helicopter passenger's seat been fitted with a four-point seat harness, it is likely that the enhanced restraint would have prevented an incapacitated passenger from obstructing the controls. A manufacturer's representative stated that four-point harnesses are a factory-fitted optional extra for the type.