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FINAL REPORT

ACCIDENT

to

Bell 206B JetRanger II

EI-ONE

near

Lispole, Dingle, Co Kerry

28 August 2002

Notification of Accidents or Incidents should be made on the
24 hour reporting line
01-604 1293
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In accordance with Annex 13 to the International Civil Aviation Organisation Convention, Council Directive 94/56/EC, and Statutory Instrument No. 205 of 1997, the sole purpose of these investigations is to prevent aviation accidents. It is not the purpose of any such accident investigation and the associated investigation report to apportion blame or liability.

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FINAL REPORT

AAIU Formal Report No: 2003-016
AAIU File No: 2002/045
Published: 24/10/2003

Operator:	Private
Manufacturer:	Bell Helicopter Textron Inc
Model:	206B JetRanger II
Nationality:	Irish
Registration:	EI-ONE
Location:	Lispole, Dingle, Co Kerry
Date/Time (UTC):	28 August 2002 at about 18.06 hrs[1]

NOTIFICATION

The Duty Station Manager at Shannon Airport (EINN) notified the Chief Inspector of Accidents, Mr Kevin Humphreys, Air Accident Investigation Unit (AAIU), of this accident at about 18.30 hrs on the 28 August 2002. An investigation team, consisting of the Chief Inspector of Accidents, and two Inspectors of Accidents, Mr Graham Liddy and Mr Jurgen Whyte, arrived in the Lispole area at 04.00 hrs the following morning. The investigation commenced at 05.30 hrs. The Chief Inspector of Accidents appointed Mr Jurgen Whyte as Investigator-in-Charge (IIC) to carry out an investigation into the circumstances of this accident and to prepare a report.

On the 3 September 2002 the AAIU transmitted formal notification of this accident to the Irish Aviation Authority (IAA), the National Transportation Safety Board (NTSB) of the USA (State of Manufacture), Bell Helicopter Textron Inc., USA (Manufacturer) and the Air Safety Unit of the European Commission.

SYNOPSIS

The pilot had refuelled EI-ONE at about 17.15 hrs at Kerry Airport (EIKY), and had planned to return to Tralee Racecourse, where three passengers were awaiting collection and return to Dublin. EI-ONE departed EIKY at 17.38 hrs with a planned routing initially to the west and onward to Tralee.

At 18.07 hrs, a woman living in the southern lee of the feature Croaghskearda, which is located in the townland of Lisdorgan, near Lispole, Dingle, Co Kerry, made a 999 call advising that she had heard a helicopter flying low over her house, in very poor weather conditions, and that shortly thereafter she heard a very loud bang, followed by complete silence.

In a follow-up search by locals, helicopter wreckage was found on the south side of the Croaghskearda and was later identified by the Dingle Gardaí as EI-ONE. The pilot was fatally injured on impact. A post accident fire consumed most of the wreckage.

The probable cause of this accident was the pilot's inability to maintain clearance from terrain after inadvertently entering Instrument Meteorological Conditions (IMC) during Visual Flight Rules (VFR) flight.

Two Safety Recommendations were made during the course of the investigation.

[1] To convert Universal Time Coordinated (UTC) to Local Time add 1 hour

FINAL REPORT

1. FACTUAL INFORMATION

1.1 History of the Flight

1.1.1 Sourcing a pilot

One of the co-owners of the helicopter, who was rated and licensed on type, had originally intended to fly a group of his fiends in EI-ONE to watch their syndicate horse race at Tralee Racecourse. On the day prior to the accident, the co-owner discovered that he was unable to carry out the flight, due to a domestic commitment. Consequently, the co-owner and the secretary of a private operator (See section 1.17.1) sought another type rated pilot to do the flight.

The first pilot contacted initially expressed some concern about the weather, as it had been bad in the West during the previous few days. This pilot told the co-owner that he would check the weather in the morning and get back to him.

In the meantime, the accident pilot, who had been conducting an instructional detail with a student in a Robinson R22 at Weston (EIWT) on the evening of the 27 August 2002, became aware of the need for a pilot to fly EI-ONE the following day.

On the morning of the accident, the co-owner phoned the accident pilot who confirmed that he was available to do the flight. The secretary of the private operator then telephoned the pilot first contacted and advised him that they had a pilot for EI-ONE. As it subsequently turned out, this particular pilot had work commitments for the day and was in any event unavailable to do the flight.

1.1.2 Prior to Departure from EIWT

A technical check of the helicopter at about 09.00 hrs on the morning of the accident, determined that the battery had run down to such a degree that a start could not be assured. The battery was therefore removed and flown in a Robinson R22 across to the commercial operator's maintenance facility at Knocksedan Heliport, just north of Dublin Airport, where it received a boost charge. The battery was then flown back to EIWT in the company of a helicopter technician, who re-installed it in EI-ONE.

At about 11.30 hrs, the three passengers arrived at EIWT and met up with the co-owner. The accident pilot arrived at Weston at approximately 12.00 hrs, introduced himself to the three waiting passengers, and then went about his paper work for the flight. He was observed by those who knew him as being in good spirits.

The co-owner then went over to the General Aviation aircraft park, started up EI-ONE and flew one circuit, before re-positioning the helicopter onto the grass pad in front of the private operator's building.

1.1.3 Flight to Knocksedan Heliport

For technical reasons no Jet A1 fuel was available at EIWT on the day, so EI-ONE had to be flown over to Knocksedan Heliport for fuel prior to departing for Tralee. EI-ONE took-off from EIWT at about 12.30 hrs with the accident pilot at the controls and routed direct to the Knocksedan Heliport. The three passengers and one mechanic were also onboard. The flight to Knocksedan Heliport was uneventful. The helicopter mechanic refuelled the helicopter. A total of 97 Litres/25 US Gallons of Jet A1 fuel was up-lifted, giving a total fuel onboard of approximately 60 US Gallons. This equated to an endurance to unuseable quantities of approximately 2 hours 14 minutes at an economy cruise fuel burn of 28 US Gallons/hour.

1.1.4 Flight to Tralee Racecourse

At about 13.15 hrs, EI-ONE took-off from Knocksedan with the pilot and three passengers onboard and routed under Visual Flight Rules (VFR) at 1,500 feet to Tralee Racecourse. Observations by the passengers indicated that the en-route segment of the flight was uneventful. The pilot was described as being in good form, talkative and very enthusiastic about the flight. He took time to explain to the passenger seated beside him all the instruments on the instrument panel including the GPS navigation display. In addition, he described the route to be taken on the map.

Some shower activity was encountered in the general area of Cashel. However, other than that, the weather was clear all the way to Tralee. The pilot did make comment during the general conversation that if the weather became really bad he would just land and let it go through.

At about 14.50 hrs, EI-ONE landed in the Helicopter Park at Tralee Racecourse. The initial intention of the pilot was to remain at the racecourse until the end of the race meeting about 17.00 hrs. He then planned to take-off with the three passengers onboard and route direct to EIKY for fuel and onward to EIWT. The pilot declined an offer by the passengers to go into the race meeting, preferring instead to go over to talk to another pilot who was parked in the Helicopter Park. A brief account of the discussion which took place between this particular pilot and the accident pilot is presented at Section 1.1.8(2) Additional Interviews.

At about 15.15 hrs, the accident pilot rang the secretary of the private operator seeking the telephone number for EIKY so that he could enquire about fuel and closing times. After calling EIKY, the secretary phoned the pilot back and informed him that the airport would be closed between 17.30 hrs and 20.45 hrs.

The pilot then phoned EIKY to enquire if it was OK to come in around 17.30 hrs to refuel and that he would pay by credit card. The pilot was advised of the closing time at EIKY, and the pilot replied that he would be in before 17.30 hrs.

Following a number of routine calls between the pilot and the secretary, the pilot at about 15.56 hrs requested the secretary to call one of the passengers and ask for that passenger to ring him on his mobile number. At 15.59 hrs, the passenger rang the pilot and was informed by the pilot that he had changed his plan. He now intended to go over to re-fuel at EIKY, return to Tralee Racecourse at 17.20 hrs for a rotors running pick-up and then onward direct to EIWT.

1.1.5 Flight to Kerry Airport (EIKY)

At about 16.43 hrs, EI-ONE lifted off from Tralee Racecourse for EIKY (a distance of approximately seven nautical miles), with only the pilot onboard. People in the immediate vicinity of the racecourse at the time observed the weather as sunny with Tralee Bay being clear. Shortly after becoming airborne, the pilot encountered poor weather conditions southeast of the Racecourse and at one stage contemplated returning to the Racecourse (Refer to ATC Transcript Appendix B). However, by routing further east of track, the pilot worked his way towards EIKY. Due to the poor weather conditions and a period of holding for EIKY ATC at Castleisland (Northeast of the airport), EI-ONE eventually landed on Stand 1 (EIKY) at 17.08 hrs.

Refuelling of the helicopter commenced almost immediately after landing. A total of 230 litres/60.7 US Gallons was uplifted. See Section 1.1.8(6) Additional Interviews, for the refueller's account of refuelling. Some difficulties were experienced with the flight plan submitted by the pilot to ATC (Refer to ATC Transcript Appendix B). However, the pilot eventually resolved this with ATC over the radio.

1.1.6 The accident flight

1.1.6.1 General

A re-construction of the accident flight relies primarily on the ATC transcript and witness observations. An "approximate flight path", of EI-ONE from EIKY to the accident site is presented as **Appendix A** to this report. The Investigation recognizes that the pilot's, "track made good", would most likely have deviated at times from that track which has been re-constructed.

1.1.6.2 ATC transcript

A transcript of communications between EI-ONE and EIKY Air Traffic Control (ATC) is presented as **Appendix B** to this report.

1.1.6.3 Witness observations

The map location of each of the witness observations is presented as **Appendix C** to this report.

1.1.6.3.1 Witness No 1

This witness was in the bedroom of his house, which is located approximately three miles west of Castlemaine and just north of Boolteens. He recalled hearing a helicopter at about 17.40 hrs hovering over or near to his house. Due to his position he could not actually see the helicopter, but he did feel the vibrations of it through the house. In his opinion the helicopter had come from the Farranfore direction and moved away slowly towards the Dingle direction.

1.1.6.3.2 Witness No 2

This witness was working at the back of his farm at about 17.45 hrs, in the area of Shanahill, near Boolteens, Castlemaine. The witness told the Investigation that he heard a helicopter coming from the general direction of Inch (flying east). He described the visibility as *"Very poor, maybe 200 metres"*. The blue helicopter *"swung around in the field below the farm house and hovered for about 15 seconds"*. He could see the pilot inside the helicopter, which was between 30 and 40 feet off the ground. *"It then moved sideways, it looked like he was going to land, but then it moved off in the direction of Inch"*, (flying west).

1.1.6.3.3 Witness No 3

This witness was driving her car along the Inch to Castlemaine Road, at about 17.50 hrs. She described the weather at the time as *"desperate fog"*. As she neared her son's house, which was located near Lack Point, she saw a blue coloured helicopter flying low between the road and the shoreline. The witness described it as, *"creeping in a westerly direction, towards Inch"*.

1.1.6.3.4 Witness No 4

This witness was on an electrical services call to a house located approximately ½ a mile on the northern side of Inch Strand. He recalled that just before 18.00 hrs a helicopter passed over the house going west. He described the visibility at the time as 20 metres and stated, *" that he had found it hard to drive on the road"*.

1.1.6.3.5 Witness No 5

This particular witness was standing outside his father's house just before 18.00 hrs. The house is located near the eastern bank of the entrance to Trabeg, an inlet near Kinard. He told the Investigation that, *"He could hear the helicopter circling in the Trabeg Inlet"*. He heard the helicopter fly towards the southeast and then it passed over him and turned to port (North). He never saw the helicopter, but judging from the sound he estimated the helicopter to be flying at a low speed and near to the ground. He could hear the helicopter for a further five minutes as it flew inland.

1.1.6.3.6 Witness No 6

This witness was working in a garage, which was located in the town land of Flemingstown, on the main road between Dingle and Lispole. He recalled to the Investigation that around 18.00 hrs, he heard a helicopter coming from the general direction of the Skellig Hotel in Dingle. He described the weather as, *"Rotten, with visibility of 100 metres"*. While he did not see the helicopter, he did hear it flying slowly passed the garage and then off away to the northeast.

1.1.6.3.7 Witness No 7

This witness was sitting in his kitchen having his dinner, when he heard a helicopter coming from the Dingle direction. The time was just after 18.00 hrs. He described the weather conditions at the time as, *"As bad as he ever had seen, with visibility down to 50 yards"*. He heard the helicopter fly near the house and then away towards the east. He never actually saw the helicopter. But about two minutes after the helicopter passed by the house he heard a loud bang coming from the direction of the hills.

1.1.6.3.8 Witness No 8

This witness was in the kitchen of his brother and sister-in-law's house with the kitchen door open. Just after 18.00 hrs they heard a helicopter coming from the southwest. They described the weather as, *"desperate, about 100 metres in fog"*. The helicopter passed nearly directly over the house and flew off in a northeast direction towards the hills. Neither man saw the helicopter. However, the woman thought she saw flashing lights through the fog. As the helicopter flew away from the house, both brothers expressed concern to each other that the helicopter was flying in such bad weather so near to the hills. A few minutes later, they heard a loud bang followed by complete silence.

Both men immediately got into a car and drove to Moriarty's yard located at the foot of the mountain (approximately two minutes drive from the house). On arrival at the yard, they met Witness No 9, who pointed east in the direction where she had last heard the helicopter. The men then ran up the side of the mountain in a V-shape pattern. Visibility on the mountain was almost zero and to hold their line of direction the men relied on continuous shouts from Witness No 9 in the yard below. After about a 15-minute search, the man on the lower section of the V-shape came across a small fire burning amongst the gorse.

He immediately called out to his brother, who was higher up the mountain. A short time later his brother joined him at the fire site and they commenced a local search of the general area. Among the burning wreckage of the helicopter they found the remains of the pilot. The time was about 18.25 hrs.

Just after locating the main wreckage, both men heard a mobile phone ringing in the vicinity of the wreckage site. By the time they had located the phone in a nearby gorse bush, the phone had ceased to ring. The phone rang a second time and was cut off on answering. The third time the phone rang the caller identified himself as a passenger who was awaiting the arrival of the helicopter at Tralee. The Witness told the caller that he believed that the helicopter had been involved in an accident and that the pilot was fatally injured. The time of these three calls were recorded at 18.26 hrs, 18.28 hrs, and 18.28 hrs respectively.

1.1.6.3.9 Witness No 9

This particular witness was in her living room in her house, which was located at the foot of the mountain and the closest house to the accident site. She recalled to the Investigation that she had just sat down to watch a popular quiz show on television. The time was just a few minutes after 18.00 hrs. The back door of the house, which leads out to a small yard, was open. She heard a helicopter coming from the general direction of Dingle. Stepping out into the back yard, she noticed that the weather was very bad, about 50 metres of fog. As the helicopter approached towards the house she became concerned that the pilot was lost in bad weather and that he was getting very close to the mountain.

As the helicopter passed fairly slowly over the house, she went back into the living room to get her phone diary so that she could ring the Dingle Gardaí and tell them of her concern. As she walked back out to the yard with her mobile phone and phone diary she could hear the helicopter going further away to the east. Just as she was about to make the call to the Gardaí, she heard the sound of the helicopter change, then a loud bang and after that, total silence. She immediately dialled 999 and reported what she had heard. The 999 call was recorded at 18.07 hrs. The witness then made her way down to the lower yard (about 100 yards away) to see if anything was there. When she got to the yard, two locals who she knew well (one of whom was Witness No 7) arrived in a car. She pointed both men in the direction where she had heard the bang. As the men ran up the fields, she called out continuous shouts, so that the men could keep their direction as they ran up the side of the mountain.

1.1.7 Events immediately after the accident

At about 18.30 hrs, another two locals arrived at the accident site to offer assistance. A Garda Sergeant from the Dingle District, who lived relatively close to the accident site, arrived on-scene at about 19.00 hrs and took control of the site. The Local Authority Retained Fire Service arrived on scene shortly thereafter and put out what fire was remaining.

At about 20.30 hrs, a local doctor arrived on-site and after an examination of the pilot's remains, pronounced life extinct. In addition, a local priest attended the site and conducted a prayer service for the deceased.

At about 22.00 hrs, all persons vacated the accident site. A Garda presence was maintained at the access point to the site until the following morning when, at 05.30 hrs, the accident site was handed over to the AAIU personnel.

1.1.8 Additional interviews

1.1.8.1 The pilot's family

A member of the pilot's family told the Investigation that the pilot had arrived at their home from Weston the evening prior to the accident and informed her that he had been offered a flight to Kerry the following day.

She recalled that he had cancelled two instructional flights at Weston that evening due to poor weather and that he had expressed the view that the flight to Kerry was weather dependent. Notwithstanding that, he had said to her that he felt that this was his first big break in getting a long operational flight in a turbine engine helicopter. To the best of her recollection he had not flown to the Kerry area before.

She confirmed that over the previous 15 years, he had flown an assortment of fixed wing aircraft and helicopters. On four separate occasions he went to the USA to further his flying career. On attaining his USA/FAA licences for both fixed wing aircraft and helicopters he gained employment as an instructor on Robinson R22 helicopters. On his return to Ireland he continued instructing on R22 helicopters. He had expressed to her a desire to get out of R22 instructional flying and get into fulltime commercial aviation on either turbine engine helicopters or jet aircraft. Many of his friends were flying commercial jet aircraft and he wanted to do the same.

She told the investigation that on the day of the accident the pilot had left the house for his normal work at 06.30 hrs and was in good spirits. She was aware that he would ring his employer for a half day off in order to undertake the flight. She had no further communication with the pilot that day.

1.1.8.2 The co-owner

The co-owner, who was unable to carry out the flight himself, confirmed to the Investigation that on the evening prior to the day of the accident, both the private operator's secretary and he went about sourcing a pilot to fly EI-ONE.

He knew both pilots from flying activities at EIWT. He had received instruction from the accident pilot on the Robinson R22 and R44. Both pilots had previously flown EI-ONE, and the co-owner had also arranged for these pilots to undertake an "A Check"[2] course at the commercial operator's maintenance facility.

The co-owner was unaware of how many flying hours the accident pilot had on helicopters, in particular on Bell 206 type helicopters. However, he was satisfied that the accident pilot was certified to fly the Bell 206 and that he was a very experienced instructor.

When questioned by the Investigation as to whether any financial arrangements had been made between the accident pilot and the co-owner, he stated: *"We never got to that stage, I just asked him if he was available to do the flight and he said that he was. The subject of money was never discussed, none was offered and none was asked for".*

[2] The purpose of this course was to certify pilots to carry out an "A" Check (daily inspection) on a helicopter.

1.1.8.3 Pilot located at Tralee Racecourse Helicopter Park

This witness was a commercial pilot who had flown into Tralee Racecourse earlier in the day at about 12.00 hrs. He recalled EI-ONE landing in the Helicopter Park and dropping off three passengers.

A short time later, the pilot of EI-ONE came over to him and they chatted for a while. While he did not want to interfere in the business of the accident pilot, he did make some mention of refuelling in the general conversation, as he wondered why the pilot was not refuelling before he picked up his passengers.

At about 15.30 hrs, this witness took-off for Dublin. He described the weather on leaving Tralee as, *"No problem with the weather, Tralee Bay was clear as was the route home"*. He did observe that, *"the weather to the south looked bad and dark with low cloud"*.

1.1.8.4 Passenger

This particular witness was one of the three passengers who had most contact with the pilot on the day of the accident.

On landing at Tralee Racecourse, he invited the pilot into the race meeting but this offer was declined. The witness then asked the pilot what the arrangements were for the return trip. The pilot informed him that after the last race at 17.00 hrs he would take-off with all onboard and route to EIKY for fuel and then direct back to EIWT.

At recorded time 15.59 hrs, the witness received a call from the secretary of the private operator, asking that he call the pilot on his mobile phone. On ringing the pilot, the witness was informed by the pilot that it was now his intention to route over to EIKY for fuel, that he would be back around 17.20 hrs for a rotors running pick up and then they would return direct to EIWT. The witness recalled EI-ONE taking-off at around 16.40 hrs.

At about 17.20 hrs, the witness and the other two passengers were located in the Helicopter Park awaiting the arrival of EI-ONE.

At recorded time 17.32 hrs, the witness rang the pilot on his mobile phone. The pilot, who was located on the ramp at EIKY, informed the witness that he would be with them in 20 minutes.

At recorded time 17.51 hrs, the witness, who at this stage was concerned for the whereabouts of the pilot, called his mobile phone again. The pilot, who was in flight at the time, told the witness, *"I am coming around the headland. I'll be with you in 10 minutes"*. This witness recalled making a further three consecutive phone calls to the pilot's mobile phone. The first call (recorded at 18.26 hrs) was not answered. The second call (recorded at 18.28 hrs) was answered by an unfamiliar voice and the witness, believing it to be a wrong dialled number, cancelled the call. The third call (recorded at 18.28 hrs) was answered by a local at the crash site, who informed him of the accident.

1.1.8.5 The pilot's employer

The pilot's employer told the Investigation that the pilot had been working for the company as a phone engineer for approximately four years. The employer considered the pilot to be a hard working, honest, trustworthy and very reliable individual. In January 2001, the pilot discussed with his employer the fact that he wanted to pursue a career in full-time commercial aviation. In order to achieve this, the pilot needed to build up his flying hours.

It was agreed by the employer that the pilot could go on half-time work with the company. However, the events of 11 September 2001 marked a general downturn in aviation activity, so the pilot resumed full-time work with his employer in October 2001.

On the morning of the accident, the pilot reported for work normally and was working on the north side of the city. At about 10.00 hrs, the pilot called his employer by phone and requested a half-day's leave due to a domestic problem at home. The employer granted this request.

The following morning the employer heard on national radio that his employee had been fatally injured in a helicopter accident.

1.1.8.6 Commercial Helicopter Pilot

A commercial helicopter pilot who was familiar with EI-ONE was interviewed by the Investigation. This particular pilot is type rated for Instrument Flight Rules (IFR) on multi-engined helicopters and also type rated on single engine helicopters. He has a total of 5,000 flying hours, of which approximately 1,200 hours are on Bell 206, and 50 hours were on EI-ONE itself.

With regard to EI-ONE, he considered it to be in, *"great condition, one of the best 206's he had flown"*. The GPS Navigation equipment, which was installed on the helicopter, was in his opinion, *"very reliable and accurate"*. For long range navigation the range on the GPS display was normally set for 15 – 10 NM ahead of track. For detailed navigation (to include display of towns, roads, railways etc) the range would normally be set at 5 NM or less. During poor weather navigation conditions and at ranges of 5 NM or less, he considered that some scan time on the screen is required in order to fully focus on the navigation display.

Mindful that EI-ONE was certified for Visual Flight Rules (VFR) only, this pilot was asked about the possibility of using the basic flight instruments for instrument flight. He said that, in his opinion, the basic flight instruments were unsuitable to attempt instrument flight and that even for an experienced IFR pilot, he considered it highly unlikely that Instrument Meteorological Conditions (IMC) flight could be maintained, even for a very short period of time".

On the day of the accident, this pilot met the accident pilot at EIWT prior to the departure for Tralee Racecourse. Aware that the weather was, *"not great in the west"*, he asked the accident pilot if he had checked the weather. He replied, *"Yes, it's OK"*.

1.1.8.7 Refueller at Kerry Airport (EIKY)

A report by the refueller-man at EIKY provided the following information.

The pilot initially requested an uplift of 100 litres (26.42 US Gals). The pilot looked at the gauge and then said to, *"go to 130 litres (34.34 US Gals)"* and then he said, *"go to 170 litres (44.91 US Gals)"*, then he said, *"go to 200 litres (52.83 US Gals)"*, then, *"to 220 litres (58.12 US Gals)"* and finally he said, *"give me 10 more litres"*. Thus the total uplift of Jet A1 fuel was approximately 230 litres (60.76 US Gals).

While refuelling the helicopter the refueller spoke only briefly with the pilot. The pilot told him that he was picking up passengers in Tralee and then going on to EIWT. He was then brought to the Duty Office to pay for the fuel.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	1	0	0
Serious	0	0	0
Minor	0	0	0
None	0	0	-

1.3 Damage to aircraft

The helicopter was destroyed by impact forces and a post crash fire.

1.4 Other damage

Significant impact and fire damage was caused to the ground in the immediate vicinity of the accident site.

The AAIU reported to the Country Manager, Kerry County Council, that the wreckage site might be a cause of hazard to the general public. On the following day of the accident, the County Manager arranged for a crew to locate to the accident site. This crew assisted the AAIU in the recovery of the remaining wreckage and also fenced off an area approximately 40 feet by 50 feet in order to secure the site.

Information received by Bell Helicopter Textron Inc determined that the materials contained on EI-ONE did not constitute a health hazard in their post accident state. The site was then cleared of all materials relating to the accident, sod in the immediate area of the point of impact was turned and new grass seed was sown.

In early December 2002, Kerry County Council removed the fencing. A memorial cross, which had been erected by locals shortly after the accident, has since been fenced in, in order to provide protection to the cross from the local wildlife.

1.5 Personnel information

1.5.1 Pilot's flying history

A general summary of the pilot's flying history/activity is presented as **Appendix D** to this report.

1.5.2 Overseas flying

The Investigation determined that the pilot had flown in the USA during four separate periods, namely, March 1991 to August 1991, June 1993 to August 1993, September 1996 to December 1996 and September 1999. The majority of experience gained was instructional flying on Robinson R22 helicopters. In addition, USA/FAA Licence certificates were issued for single and multi-engine aeroplanes and single engine helicopters.

1.5.3 Current ratings, Helicopters

At the time of the accident, the pilot held valid ratings on the following helicopter types:

Robinson R22 renewed 13 October 2001 to 12 October 2002.
Robinson R44 renewed 1 December 2001 to 30 November 2002
Bell 206 renewed 13 June 2002 to 12 June 2003.
Flight Instructor's Rating (FIR I) on H269, Robinson R22 and R44, valid 17 June 2001 to 12 January 2004

1.5.4 Pilot's Log Books

The Investigation recovered the following logbooks belonging to the pilot.

Logbook Type	Number	Opened	Closed
Fixed Wing	1	09/08/86	20/05/99
Fixed Wing	2	28/03/99	18/07/02 (open)
Helicopter	1	06/03/91	30/07/96
Helicopter	2	09/10/93	16/10/96
Helicopter	3	17/10/96	28/10/96
Helicopter	4	29/09/96	27/08/02 (open)

In the course of an examination of these logbooks, the Investigation noted the following:

- A number of hours logged as "dual flying received" were also logged as mutual pilot-in-command (P1) flying.[3]
- On completion of Helicopter Logbook No 1 (30/07/96), a second Logbook was opened (9/10/93). A transfer of helicopter flying hours logged from the mid section of Logbook No 1 (Helicopters) to the new Logbook credited the pilot with approximately 330 additional hours flying experience, which cannot be accounted for by the Investigation as hours actually flown by the pilot.
- A transfer of helicopter flying hours achieved from Helicopter Logbook No 3 to Helicopter Logbook No 4, credited the pilot under section, "Aircraft Category and Class" with 55 hours turbine flying. Only 8 hours helicopter turbine could be accounted for through actual logbook entries up to that time. In addition, the final entry of Helicopter Logbook No 4, recorded under section, "Aircraft Category and Class, a total of 264 hours flying experience for turbine helicopters. However, only 21.8 hours turbine (inclusive of 2.5 hours flown on day of accident) could be accounted for through actual logbook entries. The Investigation is of the opinion that the 200 unaccounted turbine helicopter hours recorded in Helicopter Logbook No 4 were entered subsequent to the IAA issuing the Bell 206 renewal rating on 13 June 2002.
- A total of 1,402 helicopter hours were logged as instructional details carried out by the pilot.
- A total of 243 hours were logged as dual flying received.
- Approximately 160 hours operational type flying was accumulated mainly in the USA.
- A total of 61.5 hours were logged on simulators/procedural trainers such as the Beech 200, ATC 610/710/810.
- No record could be found in the logbook of the pilot having flown previously in the Dingle area.

[3] This point was identified by the IAA in the Pilot's Personal File.

1.5.5 Flying hours

Personal Details:	Male, aged 40 years
Licence:	CPL (Helicopter) issued by IAA
Licence Proficiency Check (LPC):	13 June 2002
Medical Certificate:	Class I, valid until 31 October 2002

Flying Experience Helicopters:

Total all types:	1,807.3 hours
Total all types PI:	1,564.0 hours
Total on type:	21.8 hours
Total on type PI:	10.4 hours
Last 90 days:	114.6 hours
Last 28 days:	41.0 hours
Last 24 hours (on type):	2.5 hours

Flying Experience Fixed wing:

Total all types:	289.2 hours
Total all types PI:	163.4 hours
Last 90 days:	3.3 hours
Last 28 days:	Nil
Last 24 hours:	Nil

1.6 Aircraft information

1.6.1 Leading Particulars

Manufacturer:	Bell Helicopter Textron Inc
Model:	Bell 206B JetRanger II
Serial Number:	1761
Year of Manufacture:	1975
Total hours Airframe and Engine:	10,090 hours
Engine:	Allison 250-C20
Engine Serial Number:	822584
Certificate of Airworthiness:	Valid, 26 July 2002/24 January 2003
Certificate of Registration:	Valid, 11 December 2001
Maximum Empty Weight:	1,892 lbs
Maximum Authorised T/O Weight:	3,200 lbs
Actual T/O Weight accident flight:	Approximately 2,500 lbs
Estimated Weight at time of accident:	Approximately 2,400 lbs

1.6.2 Registration history

A review of helicopter's history shows that on manufacture (in 1975) it was registered in the USA as N281C. In 1994 the helicopter was shipped to Ireland and was transferred onto the Irish Register as EI-CJM. In 1996, the helicopter was re-registered as EI-ONE.

1.6.3 Aircraft description

1.6.3.1 General

The Bell Model 206B JetRanger II is a gas turbine-powered light utility helicopter.

Accommodation consists of a forward cabin section made up of two side-by-side seats in the front and a rear bench seat for three persons. A baggage compartment aft of the rear seats has a capacity of 250 lbs with an external door on the port side.

The rotor system is made up of a two-blade semi-rigid see-saw type main rotor, employing pre-coning and under slinging to ensure smooth operation. These blades have a D-shaped aluminium spar, bonded aluminium alloy skin, honeycomb core and trailing edge extensions. Each blade is connected to the hub by means of a grip, pitch-change bearings and tension strap assembly.

The two tail rotor blades have bonded aluminium skin but no core. The rotors are driven through tubular steel alloy shafts with spliced couplings. Initial drive from the engine is through a 90º spiral bevel to a single-stage planetary main gearbox. The tail rotor drive shaft is connected through a single-stage bevel gearbox.

The tail unit consists of a fixed stabiliser of aluminium monocoque construction, with an inverted aerofoil section. The fixed vertical tail-fin is sweptback in the upper and ventral sections of the fin and is made of aluminium honeycomb with aluminium alloy skin.

The leading gear is made up of aluminium alloy tubular skids bolted to extruded cross-tubes. A tubular skid on the ventral fin protects the tail rotor from ground strikes.

The power plant consists of one 298 kW (400 shp) Allison 250-C20 turbo-shaft engine. The fuel tank is located below and behind the rear passenger seat with a capacity of 97 US Gal (367 litres).

1.6.3.2 Equipment/Electronics

The following general and avionic equipment was installed in the helicopter:

1 x Very High Frequency (VHF) Communication Radio
1 x Very High Frequency (VHF) Navigation Set
1 x Automatic Direction Finder (ADF) Set
1 x Transponder
1 x Global Positioning System (GPS)
1 x Radio Altimeter
1 x Altimeter
1 x Air Speed Indicator
1 x Rate of Climb and Descent Indicator
1 x Artificial Horizon
1 x Turn and Slip

1.6.3.3 Performance

The helicopter's indicated airspeed (IAS) in the cruise is 105 kt. For flight planning purposes the pilot used IAS 100 kt. Fuel burn relates to power setting. An average economy cruise fuel burn for the helicopter is approximately between 27 and 29 US Gallons/Hour. For flight planning purposes, the pilot used a fuel plan fuel burn of 30 US Gallons/hour, which allowed for a margin of error. For fuel burn calculations, the Investigation used an economy fuel burn of 28 US Gallons/hour.

1.6.4 Maintenance

A major overhaul had been carried out on the helicopter by an approved maintenance facility between June 2001 and February 2002.

An annual inspection on the airframe and engine was completed at 9,902.8 hours on the 10 Jan 2002. The inspection was carried out by an approved maintenance facility and was done in accordance with the approved maintenance program and the manufacturers requirements for the Private Category.

On the 26 July 2002, EI-ONE was placed on a commercial operator's Aircraft Operators Certificate (AOC) and was also issued with a Public Transport Certificate of Airworthiness (C of A) by the Irish Aviation Authority (IAA) on the same day. The helicopter from this point on was maintained under a Public Transport Category maintenance schedule.

On the 21 August 2002, a 300-hour inspection was completed on the airframe and engine at 10,079.8 hours. The inspection was carried out by the commercial operator's approved maintenance facility and was done in accordance with the approved maintenance schedule.

On the 25 August 2002 the total flying time of the helicopter recorded in the airframe and engine logbooks was 10,087 hours. The next time the helicopter flew was on the day of the accident (28 August 2002).

1.6.5 Fuel

An examination of the fuel records and a calculation of fuel burn determined the following:

- Fuel on departure from Knocksedan Heliport was approximately 60 US Gallons, after up-lift of 94 litres/25 US Gallons (about 2 hours 14 minutes flight time)
- Fuel on departure from Tralee Racecourse was approximately 15.35 US Gallons (about 33 minutes flight time)
- Fuel on arrival at EIKY was approximately 4.0 US Gallons (about 8.5 minutes flight time)
- Fuel on departure from EIKY was approximately 64 US Gallons after up-lift of 230 Litres/60 US Gallons (about 2 hours 28 minutes flight time)
- Fuel remaining at time of impact was approximately 50 US Gallons

1.7 Meteorological information

1.7.1 Met Éireann, the Irish Meteorological Service, provided the following meteorological information after the accident:

1.7.1.1 General weather situation

The general weather situation at the time of the accident was as follows:

General Weather:	A depression of 988 hPa centered just southwest of Iceland maintained a southwest to west airflow over the area. The Lispole region lay in an extremely moist warm sector with a warm front aligned along the east coast of Ireland and a cold front approaching the west coast.

Surface Wind:	Surface: 240º/04 kt 2000 feet: 260º/10 kt
Weather:	Outbreaks of light rain and drizzle. (There were no significant radar echoes recorded by Met Éireann Radar at or around the time of the incident, indicating light rain or drizzle). Widespread coastal fog.
Visibility:	Ranged from 100 metres to 1,200 metres. However, away from the southwest-facing coasts the visibility would have risen to 3,000 metres to 10 km.
Cloud:	OVC001 (100 feet) with probability of cloud below 100 feet at times. The cloud base would have risen to BKN 400 to 1,200 feet away from southwest-facing coasts.
Temperature: Dew-Point:	17º Celsius 17º Celsius
MSL Pressure:	QNH 1019 hPa

1.7.1.2 Synoptic Report Valentia Observatory

The closest meteorological station to the accident site (approximately 15 nm due south) is Valentia Observatory and the synoptic report for there at 17.00 hrs UTC, approximately 1 hour prior to the accident, was as follows:

Location:	Valentia Observatory at 17.00 hrs UTC
Wind:	23008-10kt
Weather:	Drizzle
Visibility:	1,500 metres
Cloud:	OVC (Overcast) 200 feet
Temperature: Dew-Point: MSL Pressure:	17º Celsius 17º Celsius 1019 hPa

1.7.2 Pilot's Weather Report

1.7.2.1 Report No 1

A commercial pilot was carrying out an ESB power line inspection by helicopter between Killarney and Tralee on the afternoon of the accident. At about 17.00 hrs he was operating between Castlemaine and Farranfore. This pilot described the visibility as between 4 and 5 km. However, he did observe an extensive line of fog and low cloud running along the entire Dingle shoreline and out east towards Castleisland. Dingle Bay itself was clear. Due to the weather conditions prevailing ahead of his intended track (towards Tralee), the pilot aborted his mission and returned to Killarney.

1.7.2.2 Report No 2

A commercial search and rescue helicopter was transiting from EIKY to a point approximately 185 nm South West of Shannon on the day of the accident.

As reported to the Investigation by the Captain of the Helicopter, Rescue 115 departed EIKY at 16.54 hrs with an intended routing low level via Inch Strand, Inisvickillane and the Skilligs. Cloud base on departure from EIKY was approximately 500 feet agl. As the helicopter flew west the cloud base and visibility decreased to approximately 200 feet and between two and three kilometres. Crossing the coast at Castlemaine, the helicopter levelled at 200 feet and continued towards Inch using the onboard navigation and radar system. Visual contact with Inch Strand was made at approximately one nautical mile radar range. Approximately four nautical miles west of Inch Strand the weather deteriorated further and as visual references could not be maintained, the helicopter climbed to 500 feet for an IMC transit to the target vessel. On completion of the mission Rescue 115 returned to Shannon at 5,000 feet IFR.

1.7.3 Local Area Forecast (LAF) Kerry Airport (EIKY)

The local area forecast for EIKY on the 28 August 2002 and valid for the period 12.00 to 21.00 hrs UTC was reported as follows:

Location:	EIKY
Valid:	281200/282100 UTC
Wind:	200º/10kt
Visibility:	10 km OCNL (Occasional) 5-7 km
Weather:	OCNL RADZ (Rain/drizzle)
Cloud:	SCT (Scattered) 1,200 feet BKN (Broken)1,500 feet OCNL BKN 1,000 feet

1.7.4 Weather Observation at Kerry Airport (EIKY)

1.7.4.1 General

EIKY has a fully equipped automatic weather station (AWS), but the observations are performed by observers who are trained and are periodically re-certified by Met Éireann.

1.7.4.2 Weather Observation 16.00 hrs UTC

The following weather observation was recorded for EIKY at 16.00 hrs UTC on the 28 August 2002:

Location:	EIKY
Date/Time:	28 August 2002 at 16.00 hrs UTC
Surface Wind:	270º/07 kt
Visibility:	10 KM
Cloud:	SCT 1,500 feet BKN 2,400 feet
Temperature:	19º Celsius
Dew-point:	17º Celsius
QNH/QFE:	1019/1015 hPa

1.7.5 Shannon Terminal Area Forecast (TAF)

TAF 1600 – 0100 hrs Shannon

Surface Wind:		230º/12 kt
Visibility:		8 km in light drizzle
Cloud:		SCT 700 feet
Tempo	1800 - 2300 hrs	BKN 1,000 feet
Visibility:		4,000 metres in light rain
Cloud:		Overcast 500 feet
Becoming	2200 - 2400 hrs	
Wind:		260º/8 kt
Visibility:		10 km No Sig
Cloud:		SCT 1,000 feet
		BKN 1,800 feet

1.7.6 Significant weather Chart

A significant weather chart valid for 18.00 hrs UTC on the day of the accident is presented as **Appendix E** to this report.

1.7.7 Weather obtained by pilot

1.7.7.1 Telex weather - Flight Plan/Preparation Form

The pilot had access to and indications are that he used the telex weather facility that was available at the private operator's office. The weather available to the pilot would have been the short and long TAF's (Terminal Area Forecasts) and a Significant Weather Chart. The Flight Plan/Preparation Form, which was submitted by the pilot to the commercial operator on the day of the accident, presented the following weather conditions:

Wind:	230º/19 kt
Ceiling:	20,000 feet
Cloud:	Broken
Visibility:	10 + km

1.7.7.2 Weather briefing

Met Éireann confirmed to the Investigation that no record was found of the pilot having requested a weather briefing on the day of the accident or the previous day.

1.7.7.3 Weather transmitted by EIKY ATC

Prior to departing EIKY, the pilot requested at 17.28 hrs any recent weather that was available from EIKY ATC. ATC gave the following weather for the Kerry area:

LAF EIKY 18.00 to 24.00 hrs UTC

Surface Wind:	250º/10 kt
Visibility:	10 km
Becoming between 18.00 and 20.00 hrs	5,000 metres
and 20.00 and 24.00 hrs	1,500 metres
Weather:	Occasionally light rain and drizzle
Becoming from 18.00 to 20.00 hrs	Continuous rain and drizzle
Cloud:	SCT 400 feet BKN 700 feet
Tempo between 20.00 and 24.00 hrs	BKN 200 feet

1.8 Aids to navigation

1.8.1 Global Positioning System (GPS)

The helicopter was fitted with a Bendix King Skymap IIIC GPS. The physical configuration of the display unit is that of a high-resolution 5-inch diagonal active matrix thin film transistor (TFT) liquid crystal display (LCD) screen. The unit, which was mounted on top of the instrument panel, is sunlight readable with a wide viewing angle. See Section 1.16: Test and research for information pertaining to a flight test carried out on the GPS navigation system.

The Pilot Guide and Operating Manual for the Skymap IIIC contain specific warnings with regard to the use of the system. A brief technical specification of the system and notes on warnings are reproduced at **Appendix F** to this report.

1.8.2 Aeronautical Charts

An ICAO Aeronautical Chart 1:500,000 was found in close proximity to the wreckage site. A track was marked out on this chart from Dublin to Tralee. Position checks/reporting points were marked for Rathcoole, Kilcullen, Stradbally, Thurles, Limerick Junction, Charleville, and Abbeyfeale. No other navigation planning marks were found on the chart.

A Jeppesen Navigation Flight Planning sheet, which was attached to a small metal clipboard, was recovered from the accident site. The navigation plan mirrored the track as presented on the aeronautical chart. The pre-prepared plan calculated the total distance to Tralee as 136 nautical miles (NM). Fuel burn was recorded as 30 US Gallons (Gals) per hour, with a trip fuel stated as 41 US Gals. One check time was marked into the plan (using a different colour pen) at 14.25 hrs for the checkpoint at Charleville.

1.9 Communications

Normal communications existed between EI-ONE and EIKY on frequency 123.325 MHz. The transcript of these communications is presented as **Appendix B** to this report.

1.10 Aerodrome information

Kerry Airport (EIKY) N52º11'N W009º32'W is a licensed public airport and is located 8 NM southeast of Tralee and 7 NM North of Killarney. The one runway (RWY) 08/26 is 2,000 metres in length with an ILS/DME approach to RWY 26. The airport is at an elevation of 100 feet above mean sea level (AMSL).

Opening hours are variable and mainly depend on scheduled operations. On the day of the accident the airport was scheduled to close between 17.30 hrs and 20.45 hrs. Kerry Airport remained open 11 minutes over its planned closing time in order to facilitate the departure of EI-ONE.

1.11 Flight Recorders

No Cockpit Voice Recorder (CVR) or Flight Data Recorder (FDR) was carried onboard the helicopter, nor were they required to be carried under existing requirements.

1.12 Wreckage and impact information

1.12.1 Location and recovery

The helicopter struck the mountain at a height of approximately 950 feet above sea level (AMSL) at position N52°.09.58', W010º10.80'. The bulk of the wreckage was airlifted from the accident site using an Irish Air Corps helicopter. A small number of other items were recovered by hand. The site was then cleared and the bags containing small amounts of debris and soil from the impact area were recovered. All the recovered material was subsequently transported to the AAIU facility at Gormanston, Co Meath for detailed examination.

1.12.2 Impact information

The impact area sloped to the South at a gradient of 26°. Ground marks indicated that the initial impact took place on a heading of approximately 330° Magnetic (M). The helicopter's gyro compass was found seized on a heading of 335°(M).

Calculations based on the impact marks indicated that the helicopter was banked about 10° to port (left) and a nose pitched-up angle of approximately 15° at the time of impact. The airspeed indicator needle was stuck on approximately 80 m.p.h. (69.5 kt).

The wreckage was mainly contained in a relatively small area. The main rotor blades were the only significant items that had departed the immediate impact area. One rotor blade was found approximately 20 metres to the right of the impact area. The other blade was found approximately 50 metres upslope from the impact area.

The impact marks indicated that the helicopter made initial contact with the mountain with the front section of the undercarriage skids. The skids and their associated cross beams separated from the fuselage. The bottom of the fuselage then struck the mountain, and the fuel tank ruptured. The helicopter partially bounced at this point, and finally came to rest approximately 10 metres further up the slope. The cabin doors were all found within the main impact area.

1.12.3 Main Rotor marks

There were three significant impact marks to the left of the wreckage trail, which were consistent in shape and location with the main rotor blades striking the ground during the impact sequence. There was also slight damage to a raised wire fence to the right of the impact path. The location of this damaged fence is consistent with the main rotor blade lightly striking the fence immediately before the undercarriage skids struck the mountain.

1.12.4 Fire Damage

The helicopter suffered an intense post accident fire. This destroyed the fuselage forward of the tail boom. All fuselage components were subject to intense heat, and widespread melting took place. This included the casing of the main gearbox. The engine then suffered intense fire damage, including burnout of the magnesium casings used in the construction of this engine type. No evidence of pre-impact fire was found.

1.12.5 Examination of dynamic components

The wreckage contained several shaft failures in the transmission system. These included separation of the main rotor shaft above the main gearbox, the engine-main gearbox shaft, and shafts in the tail rotor transmission.

All such failures were examined and showed that failure was, in all cases, consistent with torsional overload, indicating that power was being transmitted through the shafts at the time of impact. No evidence of pre-impact failure was found. Information relating to the metallurgical examination carried out on the recovered components are presented at Section 1.16, Tests and Research.

1.12.6 Aircraft instruments

The instrument console suffered major impact and fire damage. The airspeed indicator and gyro compass, in spite of severe damage, gave some indication of parameters at the time of impact. No other useful information could be obtained from any other instruments, which were largely destroyed beyond recognition.

1.13 Medical and pathological information

A post mortem examination was carried out on the deceased pilot at Tralee General Hospital, Co Kerry at 15.00 hrs on the 29 August 2002. Dental charts confirmed identification of the deceased. The examination revealed no pathological evidence of any medical or physical condition that may have caused or contributed to the accident.

No alcohol, ethanol or prescribed drugs were detected in the blood or urine. Carbon monoxide saturation was recorded as 0%. This, taken in conjunction with the findings of the autopsy are strong indications that the pilot was in fact deceased before the fire began and died directly as a result of injuries sustained in the crash and not as a result of fire.

1.14 Fire

A post accident fire consumed the majority of the helicopter wreckage. The fire was contained within the wreckage pattern. The local authority retained Fire Service arrived on scene just after 19.00 hrs and put out the remaining fire with sods of earth.

1.15 Survival aspects

The impact forces were such that the accident was not survivable.

1.16 Tests and research

1.16.1 General

A metallurgical examination was carried out on a number of key components, which were recovered from the accident site.

1.16.1.1 The Main Rotor drive

The shaft, which is constructed of tubular steel, fractured under the head. There was evidence of bending in the shaft. The fracture surfaces had a cup and cone appearance, with fracture in the tube wall at an approximate angle of 45º. In addition, there appeared to be some necking associated with the fracture. These fractures are indicative of overload in tension/bending.

1.16.1.2 The Rotor Blade on one side of Rotor Head

The wire rope type attachment (tie-bar) for this rotor blade had fractured. The fracture in the bearing component was typical of overload failure, most probably in bending.

1.16.1.3 Tail Rotor drive shaft

The tail of the helicopter was essentially intact, with the end (including the tail rotor) having detached. The drive shaft was distorted at the forward end and a number of the flex plate joints showed evidence of torsional overload. Fracture of the shaft adjacent to the tail rotor was indicative of overload, in bending.

There was no indication of any material or manufacturing defect, or of any pre-existing defect (such as fatigue cracking), associated with the fractures in any of the components examined.

1.16.2 Flight Test

1.16.2.1 General

The Investigation carried out a flight test using a similar make and model of helicopter, which was equipped with the same GPS navigation system that was installed on EI-ONE. The flight instruments and cockpit layout was also similar to that of EI-ONE. The purpose of the flight test was to:

(a) Determine whether the use of a cellular telephone in the cockpit could have an adverse effect on the accuracy of the GPS navigation system and avionic suite.

(b) To view the quality and accuracy of the GPS navigation display, in particular, with regard to the mapping overlay.

1.16.2.2 Cellular telephone test

Use of the cellular telephone on continuous standby and in the transmit/receive mode, showed no effect whatsoever on the GPS navigation display or the avionic suite. The test was conducted from the cabin and the cockpit, with the cellular telephone at times placed in very close proximity to the GPS navigation receiver.

1.16.2.3 GPS navigation test

The helicopter was flown along the reconstructed flight path from EIKY to the accident site. Rather than insert specific route waypoints, it was decided to navigate using the predicted track facility. This was done as a worse case scenario where a pilot may not have had time to input specific waypoints, which were not contained in the system database. In basic terms, the predicted track facility is a line on the navigation display that is projected out along the centreline of the helicopter symbol (actual position). When used in conjunction with the mapping overlay the track projection can provide the pilot with flight path information in relation to major ground features, such as cities, towns railways, roads, rivers, lakes and coastal outline. However, it provided minimal and only approximate high terrain information.

In general terms the GPS navigation system was found to be very user friendly. The display was very clear and easy to read and the accuracy of the system in relation to known position, actual position and mapping overlay was very impressive.

As the test flight helicopter was flown along the southern shoreline, mapping of the entire Dingle Peninsula was present when viewed at an extended range/scale of 25 NM. As the range/scale was reduced, the detail of the mapping increased to a degree that features such as Trabeg Inlet, Dingle Harbour, Ventry Harbour and Slea Head were clearly visible and distinguishable from each other.

With regard to the depiction of terrain, it was found that this is achieved through the use of changing colours. Normal low-level terrain is presented as green on the display. As terrain height increases the colours change from yellow to darker shades, such as brown. The terrain depicted on the display is considered by the Investigation as merely an indication of the presence of higher ground and could not be used as a means to ensure terrain clearance.

1.17 Organisational and management information

1.17.1 The helicopter owners

The owners of EI-ONE at the time of the accident purchased the helicopter from a private operator on the 3 May 2001. At that time the helicopter had 10 hours remaining before major overhaul. A major overhaul was carried out on the helicopter by an approved maintenance facility between June 2001 and February 2002. The helicopter was then operated by the owners in the Private Category, until July 2002.

In order to offset the high running cost of the helicopter, the owners sought to make EI-ONE available to an Air Operator Certificate (AOC) holder, thereby making it available for use as public transport/hire and reward flights. A mutual friend of one of the co-owners, who operated his own helicopter company (Eirecopter) facilitated in seeking out an AOC holder for EI-ONE and also provided some of his facilities for the private operation of the helicopter.

On the 26 July 2002, EI-ONE was formally put on the Celtic Helicopters AOC and a Public Transport Certificate of Airworthiness (C of A) was issued for the helicopter by the IAA.

1.17.2 The Operator/AOC Holder

The Operator/AOC Holder operated EI-ONE in the Public Transport category from the 26 July 2002. In addition, the helicopter was made available to the owners for use in the Private Category.

On the initiative of the Operator/AOC Holder, a memorandum of understanding (April 2002), in the form of, *Operational Procedures - All aircraft Owners with Aircraft on the Company AOC*, was put in place when EI-ONE was placed on his AOC. Specific terms and conditions were laid down for the operation of an aircraft when flown in the Public Transport, Aerial and Private Category. These included:

a. That the Operator/AOC Holder be notified prior to each flight conducted on the Aircraft;

b. All flights shall be recorded in the Operators/AOC Holders Flight Plan/Preparation Form and Flight Log Sheet;

c. All operations, whether Public Transport/Aerial/Private on the aircraft must comply with terms and conditions set out in the Operators/AOC Holder Operations Manual;

d. That the Operator/AOC Holder must be supplied with current Certificate of Insurance and an Insurance Indemnity to the Operator/AOC Holder must be supplied;

e. All pilot's who fly Aircraft must be base checked by the Operator/AOC Holder, must be current and must have prior approval from the Operator/AOC Holder;

f. A list of all pilots names/address/phone contact numbers;

g. All pilots must supply details of duty hours;

h. An audit of paperwork will take place monthly; and,

i. All permits i.e. for Aerial Work/Pleasure Flights/Feeder Site Activities must be applied for by the Operator/AOC Holder.

The Investigation determined that the majority of the above mentioned terms and conditions were complied with by both the Operator/AOC Holder and the owners. However, it was noted that while the accident pilot had completed an "A" Check Course (Daily Aircraft Inspection) with the Operator, he had not been base checked.

1.17.3 The Irish Aviation Authority

1.17.3.1 General

The Irish Aviation Authority (IAA) carries out a range of operational and regulatory functions and services relating to the safety and technical aspects of civil aviation in Ireland.

The regulatory services include aircraft airworthiness certification and registration; the licensing of personnel and organisations involved in the maintenance of aircraft as well as the licensing of pilots and aerodromes. Also included is the approval and surveillance of air carrier operation standards and of general aviation.

1.17.3.2 Regulations relevant to AOC holders

In response to a query put by the Investigation to the IAA regarding regulations pertaining to AOC holders, the following response was received:

"The applicable regulations pertaining to AOC holders at the time of the accident included the Irish Aviation Authority Air Operator Certificate (AOC) and the (Operations) Orders, S.I. No 420 and S.I. No. 19 of 1999 respectively, as amended. Aeronautical Notice A2 also refers-see below. The carriage of passengers or cargo for hire or reward may not be undertaken in an aircraft[4] unless the operator of that aircraft is in possession of an AOC. That certificate authorises the operator to conduct commercial carriage for hire or reward with the aircraft type or types annotated on the certificate, which also specifies therein the number of each type authorised for use. An operator is required by the AOC Order to provide the Authority with a list of the aircraft being operated under the terms of the AOC.

[4] The use of the term aircraft relates to both fixed wing and helicopter aircraft.

I can confirm EI-ONE was notified by the operator concerned to the Authority as being one such aircraft in May 2002. An operator may add or remove aircraft from the AOC or change the identity of aircraft of the same type on the AOC provided that the Authority is informed in accordance with the Order and has no regulatory interest or objection in a particular instance, (e.g. a change in type or significant change in numbers of a type). An aircraft must have a Certificate of Airworthiness (COA) in the public transport category in order to be eligible for commercial operation on an AOC. It is, however, important to note that an aircraft with a COA in the Transport of Passengers category may also be flown for private purposes (Aeronautical Notice A2, Appendix A, Issue 9, dated 28 March 2001).

In the subject case, the operator had informed the Authority, initially in May 2002, that the helicopter would be operated by that company on its AOC and did not subsequently inform the Authority that it wished to discontinue operating that aircraft on the AOC. The Authority does not presently see a need to change the existing arrangements or legislation with regard to the operation of aircraft on an AOC but has and will continue to remind such operators of the necessity to maintain an accurate and current record with the Authority of aircraft being operated by them.

1.17.4 Operator/AOC holder comments

In response to the Draft Final Report and in specific regard to information provided in the report regarding the operation of an aircraft on an AOC when flown privately, the operator stated that, *"we cannot find any regulation or direction that states an aircraft on an AOC with a transport category C of A cannot be flown privately".*

1.18 Additional information

1.18.1 Rules of the Air

1.18.1.1 General

S.I. (Statutory Instrument) No. 568 of 2001 is cited as the IAA's (Rules of the Air) Order, 2001.

Under Introduction, Section 7 (Extract) it is stated that, *" It shall be the responsibility of the pilot-in-command to determine whether the weather conditions expected or encountered during the flight are such as to enable him to conduct or continue the flight in accordance with the Visual Flight Rules, or will require him to comply with the Instrument Flight Rules."*

1.18.1.2 Minimum heights/Visual Flight Rules (VFR)

Rules of the Air, Part II, Section 3, specifies rules for Minimum Heights, while Part III, Section 34 specifies the Visual Flight Rules. Both these rules are reproduced as **Appendix G** to this report.

1.18.2 Flying Logbook entries

The IAA's S.I. 420 (since superseded by S.I. 437 of 2002) (Operations) provides rules pertaining to the keeping of flying logbook and entries made therein. Under section 17 of the Order, the following is stated:

A person shall not-

(1) mutilate, alter or render illegible any journey logbook or other record, required to be kept under this Order or any entry made in such logbook or record, or destroy any such logbook or record during the period for which it is required under this Order to be preserved;

(2) wilfully make, or procure to be made, or assist in the making of any false entry in, or material omission from, any journey logbook or any other record kept, or required to be kept, under this Order.

1.18.3 Use of cellular telephones in flight

1.18.3.1 General

The UK Civil Aviation Authority (CAA)[5] has commissioned and published two reports on the use of cellular telephones in flight.

The first report, dated 2 May 2000, recommended – based on its findings – a blanket prohibition on cellular telephone use while aircraft engines are running.

The second report, dated 30 April 2003, found that the use of mobile cell phones can adversely affect navigation and communication functions, producing significant errors on instrument displays and background noise on audio outputs. The tests that exposed a set of avionic equipment to simulate cellular telephone transmissions, revealed various adverse effects on the equipment performance. Although the equipment demonstrated a satisfactory margin above the original certification criteria for interference susceptibility, the margin was not sufficient to protect against potential cellular telephone interference under worst-case conditions. The results of tests carried out into the effects of interference from cellular telephones on aircraft avionic equipment endorses current policy that restricts the use of cellular phones in aircraft.

1.18.3.2 Warnings related to use of cellular telephones in flight

The IAA issued an Aeronautical Information Circular **(**AIC) on the use of mobile telephones in April 2000. AIC Number 17/00 is presented as **Appendix H** to this report.

[5] Reference to these reports are through kind permission of the UK CAA. The latest version of the second report (CAA Paper 2003/3) is available in electronic format at www.caa.co.uk/publications. Further enquiries regarding both reports should be addressed to: Research Management, Safety Regulation Group, Civil Aviation Authority, Aviation House, Gatwick Airport South, West Sussex, RH6 OYR.

2. ANALYSIS

2.1 Wreckage and maintenance examination

The nature of the wreckage distribution and ground impact marks at the wreckage site, combined with the metallurgical examination of the fractures in the various shafts/ dynamic components, and the absence of any evidence of a pre-impact fire, indicate that the helicopter was functioning normally up to the time of impact. The fire damage was consistent with a post-impact fire. In addition, the helicopter had flown satisfactorily for some 2 hours and 30 minutes prior to the accident with no reports of any problems.

Evidence provided by Witness No 9 determined that the helicopter was flying in an easterly direction just prior to the sound of impact. The impact heading was recorded as approximately 330ºM. This suggests that the helicopter made a turn during the very final phase of flight.

Ground scars also determined that the helicopter's attitude during the initial crash sequence was in the order of approximately 10º to port, with a pitch-up of about 15º.

The wreckage distribution and the extent of damage suffered by the helicopter is consistent with an impact speed in the region of 50 to 70 kt. The post accident airspeed indicator reading of 70 kt may have suffered a slight over-read as a result of earth entering the pitot tube during the accident sequence.

A review of the maintenance history of the helicopter determined that EI-ONE had been initially maintained in the Private Category by an approved maintenance facility in accordance with the manufacturer's schedules. In the weeks prior to the accident the helicopter was maintained in the Public Transport Category (T.P. 3) by an approved maintenance facility in accordance with the manufacturer's schedules.

2.2 Weather

Weather data provided by Met Éireann and evidence gathered from witness observations indicate that the weather conditions around the time of the accident in the Lispole area were extremely poor.

In addition, it is clear that the pilot encountered poor weather conditions on his transit from Tralee Racecourse to Kerry Airport and for the majority of the flight from Kerry Airport to the accident site at Lispole.

Around the time of the accident, the Dingle Peninsula lay in an extremely moist warm sector with a warm front aligned along the east coast of Ireland and a cold front approaching the west coast.

The Lispole area was affected by an onshore flow in a very moist warm sector, so conditions would have been expected to be very poor. These poor conditions were reflected in the Met Éireann Significant Weather Chart (Area B), issued at 11.00 hrs on the day of the accident and valid for 18.00 to 24.00 hrs, which was commensurate for the time of the accident.

The local area forecast for the Kerry area, valid 18.00 to 24.00 hrs, which was transmitted by ATC to the pilot just prior to start-up, also indicated poor weather for the area and forecasted a general deterioration in the weather conditions.

The meteorological report for Kerry Airport at 16.00 hrs is considered to be both accurate and reasonable for the reporting time. The relatively good conditions can be explained by the temperature/dew-point difference, caused by an increase in surface temperature due to daytime heating through a shallow cloud layer in the warm sector. This also explains why conditions were significantly better away from onshore coastal areas. Parts of Tralee Bay and Dingle Bay remained in the clear.

While the pilot did have access to telex weather information prior to leaving Weston, the Investigation was unable to determine to what degree the pilot was self-briefed for the prevailing and forecasted weather conditions for the transit to/from Tralee and more specifically for operating in the Kerry area.

No record could be found of a request by the pilot for a forecaster briefing by Met Éireann for either the day of the accident or the previous day.

2.3 The accident

Shortly after his departure from Tralee Racecourse, the pilot encountered weather conditions, which initially precluded him from transiting directly to EIKY for fuel. While the immediate vicinity of Tralee and the Bay was reported as clear, the low lying ground between Tralee and EIKY provided weather conditions of low cloud and reduced visibility. In his initial attempt to route to EIKY, the pilot advised ATC that, "*Ah we're still just ah south of ah Tralee this time trying to get ah break in the weather here we'll end up having to go around the head I think"* (ATC Transcript Appendix B – 16.50:03 hrs). In addition, the pilot, on the prompt of the ATC controller at EIKY advised that, "*We may just have to do that ah yeah we'll set back down at the racecourse I think and we'll just sit it out"* (ATC Transcript Appendix B – 16.50:23 hrs).

On positioning back towards the racecourse, it is clear from the ATC transcript that the pilot found some improvement in the weather towards the northeast and decided to continue towards the airport via Castleisland. EI-ONE landed at EIKY at approximately 17.08 hrs with approximately eight and a half minutes fuel remaining. The flight from the racecourse to EIKY took 25 minutes (including six minutes holding). Ordinarily, the seven nautical mile flight should have taken about five minutes.

On landing at the airport, EI-ONE was refuelled with 60 US gallons, the pilot paid for the fuel and then filed a flight plan. While the pilot did have some time constraints due to the closure of the airport at 17.30 hrs, the investigation considers, particularly in the light of the weather experienced between Tralee Racecourse and the airport, that time was available to seek further clarification on the weather by ringing a forecaster. Instead, the pilot relied on the local area forecast valid 18.00 to 24.00 hrs, which was transmitted by ATC to EI-ONE just prior to his departure for Tralee Racecourse. This particular forecast did, however, show a general deterioration in the weather for the Kerry area. On receipt of this weather information the pilot advised EIKY ATC that, "*Yeah understood right we copy that am OK what we'll do is we'll just depart out of here. I might ah I'm gonna try to get a break out to maybe ah out towards the west and then head around the headland maybe towards Tralee racecourse that way"* (ATC Transcript Appendix B – 17.29:40 hrs).

EI-ONE was confirmed airborne by EIKY ATC at 17.38 hrs and was requested to report approaching Tralee. At 17.41 hrs EI-ONE reported four miles west of the airport, followed by EIKY ATC advising that the Kerry Control Zone was closed, that he was operating in the Flight Information Region (FIR) and that there was no traffic to affect him.

Regional Airports such as EIKY generally incorporate planned opening and closing times outside normal working hours. When an airport is closed, ATC and Rescue and Fire Fighting Services are normally not available, therefore the airport should not be planned for use. Navigation aids, such as VOR, NDB and ILS located at airports remain on during the airport closure and can be used by over-flying or transiting aircraft.

In the event of an aircraft emergency, closed airports have been known to open at very short notice, once contact (normally by telephone) can be made with the particular airport. In an emergency situation, a pilot could consider the use of a closed airport once he made ever effort to contact the airport and on arrival assured himself that he was not encroaching on any ground or airborne traffic.

In the case of EI-ONE, the pending closure of the airport may have put some additional pressure on the pilot. However, the pilot was aware of the closure times of the airport and therefore he should have planned his flight around these times accordingly. The subsequent closure of the airport after the EI-ONE departed EIKY and the clearance to operate in the FIR is a common practice, particularly at Regional Airports. While the closure should not of had any direct implications for the safe conduct of the onward flight to Tralee, the pilot may have developed a mind set whereby he felt that he had lost the option to return to the airport, if the weather deteriorated further. The fact that the pilot was flying a helicopter allowed him the option to land anytime he was over suitable ground. In addition, in an emergency case, the pilot had the option to return to the closed airport, albeit without the possible availability of ATC or the Rescue and Fire Fighting Services.

The mention on two separate occasions on the ATC transcript of the pilot considering to go around the headland is a strong indication to the investigation that when the pilot was unable to make it directly to Tralee, due to the prevailing weather conditions, he opted to route low level around the Dingle Peninsula.

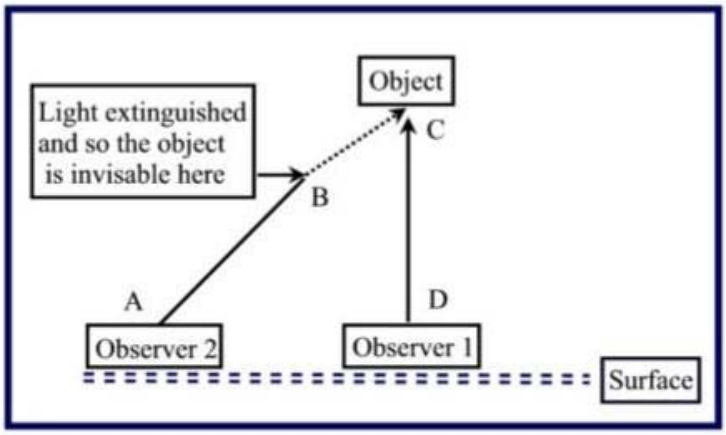
The Dingle Peninsula is in itself a formidable landmass jutting out on the western reaches of Ireland's Atlantic Ocean. A range of mountains stretching out its length has peaks from 1,657 feet to 3,124 feet. Weather systems flowing over its ocean-surrounded rugged terrain can generate extreme weather conditions for flying. The weather can also be localized within or near the peninsula itself. Due to its topography, it is considered virtually impossible to transit directly over or through the peninsula in poor weather conditions. Generally, the only option for VFR operations, where low cloud or visibility persists, is to transit the low-lying ground between EIKY and Tralee or route out around the headland (Slea Head).

A transit from EIKY out around the headland and back to Tralee entails a journey of approximately 70 nm (about 40 minutes at 100 kt). The majority of this transit would require flight on or near the shoreline and in some cases even prolonged flight over water. EI-ONE was not equipped to fly over water for any prolonged period of time.

The majority of the eyewitnesses were interviewed at the location where they first made their observations. Their estimate of the visibility at the time of the observation was referenced by an air accident investigator against known targets such as hedgerows, poles and houses located in the immediate vicinity. The average visibility recorded was between 100 and 200 metres in fog.

Some of the eyewitnesses confirmed to the investigation that they did not actually see the helicopter, but they could clearly hear it close by.

Visibility reduction is a function of light scattering and absorption from fine particles and fine water droplets. From this, it is obvious that, for a relatively uniform airmass of high humidity, an object visible vertically upwards would not necessarily be visible if the observer were offset from the vertical. This is because the light to the "offset" observer has to travel through a greater distance and so through a greater amount of fine water droplets. (See Fig 1 below)



Note: The distance from A to B equals the distance from C to D

Fig 1.

As viewed by a pilot in flight, dense fog or cloud may obliterate the entire surface and therefore continued flight would require sole reference to instruments. EI-ONE was not equipped for instrument flight and it is considered unlikely that the pilot attempted instrument flight at such low level. Bearing in mind that the pilot had no experience of helicopter instrument flying and the fact that the helicopter was not equipped for instrument flight, it is also considered unlikely that the pilot could have maintained controlled flight in Instrument Meteorological Conditions (IMC) with the basic flight instruments available to him.

Less dense, shallow or patchy fog may permit a pilot observation of part of the surface just below or slightly forward of the helicopter, which would allow him to maintain his position in flight in relation to the ground references. However, if surface contact is lost, the pilot will lose his only means of attitude/height/position reference, and control will most likely be lost.

Evidence gathered from witnesses located along the reconstructed accident track indicates that, shortly after departure from EIKY, the helicopter was flying at low speeds and at very low heights in varying poor visibility. At times the helicopter was seen following definite features such as roads and the shoreline, while at other times it would appear that the helicopter was transiting over open ground. Witness No 5 heard the helicopter in Trabeg Inlet. It then passed over him and flew off in a northerly direction. Some time prior to this manoeuvre, one of the intending passengers confirmed that he had talked to the pilot in flight on his mobile telephone and was informed by the pilot that, *"I am coming around the headland. I'll be with you in 10 minutes"*. The investigation considers it possible that the pilot, on entering Trabeg in very poor visibility, mistakenly believed that he was rounding the headland at Slea Head.

The lack of visual clues may have obscured his view of the shoreline on the far side of the inlet. The helicopter was heard flying away towards the north, followed by witnesses hearing the helicopter fly on a northeasterly heading. This constant northeasterly heading equated to a general heading for Tralee. While maintaining the northeasterly heading, the helicopter was flying over gradual rising ground. When flying at low speeds, in poor visibility, the lack of clear horizon clues can make it difficult for a pilot to determine whether the aircraft is climbing or not. This situation can be compounded by the fact that in order to maintain visual clues under the poor prevailing conditions, virtually all of the pilot's scan is required outside of the cockpit environment. Reference to instruments that provided navigation, heading, speed, rate of climb and height information may not have been afforded the attention that they would normally received under better in-flight conditions.

Shortly before the final impact, the helicopters heading turned east, where the line contour feature on the left side of the helicopter rises sharply up towards the summit of Croaghskearda. Moments later the sound of the helicopter is heard to change, followed almost immediately by a loud bang. Final impact was recorded on a heading of 330º M at a height of approximately 950 feet AGL.

Taking into account the post accident weather analysis and the witness observations, it is clear to the investigation that the pilot was not operating in compliance with the Rules of the Air for minimum heights and Visual Flight Rules (VFR). A condition of the pilot's licence was that he should not fly out of sight of ground or by sole reference to instruments. For safe conduct of the flight surface visual references were essential.

Bearing in mind that the aircraft was being flown for a prolonged period of time on the final leg at low speed and near the ground in very poor visibility conditions, it is considered highly likely that, as the helicopter rose with the line contour, the pilot lost visual contact with the surface and inadvertently entered cloud. The most probable cause of the accident was that the pilot lost adequate visual references and permitted the helicopter to impact the ground because of induced false sensations arising from spatial disorientation[6]. The change in sound observed by Witness No 9 just prior to impact was most likely the point in time when control was lost.

2.4 Navigation system/use of cellular telephones

Consideration was given by the investigation for possible errors in the navigation system. Recovery of a GPS receiver can at times assist an investigation when stored data of moving map and position points are retained in its memory. Due to an intense post accident fire virtually no useful evidence from the avionics or instrumentation was available for further analysis by the investigation.

Evidence gathered during the course of the investigation indicates that the pilot had his cellular phone switched on during flight. In addition, it can be confirmed that the pilot received and answered a cellular telephone call at 17.51 hrs, approximately 15 minutes prior to the accident.

[6] Spatial disorientation is a term used in aviation to describe a condition when a pilot does not know his attitude in space (which way is up). Orientation - the ability to determine your position in space – is usually achieved by some combination of the three senses: vision – the most powerful sense of all; balance – the vestibular sense (gravity, acceleration, and angular acceleration); and 'seat-of-the-pants' (bodily feel or the proprioceptive sense). In most situations, each of the three senses reinforces the other, but this is not always the case in flight. Each of these senses can sometimes have its messages misinterpreted by the brain, and pilots must guard against this. Usually, the most reliable sense is vision, hence the need to rely on visual surface references or flight instruments

Reports commissioned by the UK CAA have determined that in extreme cases cellular telephones can interfere with avionic and audio equipment. In addition, the use of cellular telephones in-flight can act as a distraction to the pilot. This distraction can be of greater significance for helicopter pilots operating at low height/speed or in poor weather conditions where normally the continued manipulation of both the cyclic and collective controls is required.

The IAA did issue an AIC warning relating to the use of cellular telephones in April 2000. At that time all Irish Commercial License holders would have been issued with a copy of the AIC. Also, for a number of years passengers boarding public transport flights would be familiar with the PA announcements regarding the switching off of cellular telephones prior to take-off.

The possibility of error in the navigation system, in particular due use of the cellular telephone in flight, cannot be ruled out conclusively. However, in consideration of the following points:

- The pilot of EI-ONE demonstrated the use and accuracy of the GPS to the front seat passenger during the leg from Dublin to Tralee;
- Pilots who had previously flown EI-ONE reported to the investigation that the GPS was very accurate and reliable;
- The pilot of EI-ONE did not report any problems with his navigation system in the hours leading up to the accident; and,
- A flight test carried out using a similar model helicopter and identical GPS navigation system, confirmed a very high degree of navigation display accuracy, which was free from interference from cellular telephone use

the investigation concludes that GPS navigation display error is unlikely to have been a contributing factor in this accident.

The flight test did provide a clear indication to the Investigation that, had the GPS navigation display been used correctly on the day of the accident, the observed accuracy was such that the pilot should have been able to navigate safely around the Dingle Peninsula, even in reduced visibility conditions.

The probability therefore exists that, due to the in-flight conditions at the time, the majority of the pilot's scan time was focused on maintaining visual references outside the cockpit environment and not on the onboard instrumentation.

2.5 Logbook entries

During the course of the investigation a number of anomalies were found regarding the pilot's logbook entries. In general these entries sought to increase his overall flying experience and, in particular, his experience on turbine engine helicopters.

The responsibility of accurate logbook entries lies with the licensee. The IAA's S.I. 420 clearly sets out the rules pertaining to the keeping of logbooks and entries made therein. The volume of licences processed by the Authority each year militates against the carrying out of detailed checks for each pilot's logbook. However, it has been confirmed by the IAA that random audits are carried out on selected logbooks.

2.6 Management issues

At the initiative of the Operator/AOC Holder, Operational Procedures relating to all aircraft owners with aircraft on the company AOC were developed. These procedures covered operations such as Public Transport, Aerial and Private flying. During the course of the Investigation, it was determined that the accident pilot had not been base checked. This was contrary to the Operator/AOC Holder's own operational procedures.

It is recognized by the Investigation that many commercial operators rely and benefit from the use of privately owned aircraft for use in the Public Transport Category. These helicopters are maintained to a Public Transport Category, which would be in excess of the maintenance requirements for the Private Category.

Additionally, one would expect that the oversight carried out by the commercial operator on the private operator would in itself enhance safety. However, the investigation does have some concern regarding a commercial operator/AOC holder ensuring the conduct and control of an aircraft on an AOC, which is also regularly flown in the private category by holders of private licences.

2.7 Interpretation of Regulations

In correspondence between the Investigation and the IAA, the IAA considers that if an aircraft is operated on an AOC in the Public Transport Category, the rules pertaining to the AOC remain in force until the operator advises the Authority that it wishes to discontinue the operation of the aircraft on the AOC.

The Operator/AOC holder confirmed that, as they could not find any regulation or direction that states that an aircraft on an AOC with a transport category C of A cannot be flown privately, they believed that it was permissible to operate an aircraft privately while it was on its AOC.

It is clear that there is a difference in the interpretation of the rules on this matter between the commercial Operator/AOC Holder and the IAA.

The investigation therefore considers that there is a need for the IAA to clearly specify the rules pertaining to this arrangement and that these rules be enforced.

2.8 Discussion

The reason why the pilot of EI-ONE allowed himself to lose visual references before landing or turning back cannot be determined by this Investigation. For the majority of the flight from Tralee Racecourse to the airport and for the final leg of the flight, the weather conditions were well below the stated limits for VFR (**Appendix G**). On encountering deteriorating weather conditions a pilot must determine the point at which he can no longer comply with VFR. Witness observations and weather data provided clearly indicate that the pilot persisted in flying in very poor weather conditions in an attempt to get back to Tralee Racecourse.

No evidence was found to indicate that pressure was put on the pilot by either the owners of the helicopter or the passengers to complete the mission. No evidence was found that the pilot had operated in the Dingle area before.

A review of the pilot's flying record shows that the majority of his flying experience was instructional flying on helicopters. The Investigation recognizes the difficulties faced by "self improver" pilots, in their attempt to amass flying hours in order to qualify for entry into mainstream commercial aviation. In many cases, the excessive cost of flying hours necessitates the need for pilots to subsidise these costs by engaging in instructional type flying.

The nature of instructional flying is such that while the instructor has overall responsibility for the flight, and is engaged in the decision-making process, the student does the majority of the flying. In addition, nearly all of the flying is related to specific lessons that are flown in suitable weather conditions on or in close proximity to an airfield or at known training areas. Generally little operational or commercial type pressure is presented to the instructor during instructional flying. Cross country navigational exercises do provide some insight into operational type flying. However, many of these routes consist of short legs, over known terrain, to well-defined waypoints and are normally conducted in benign weather conditions.

Operational type flying, on the other hand, does bring additional challenges and pressures to a pilot. The routes are generally longer, and are sometimes flown over difficult and unfamiliar terrain. The ever-changing Irish weather is a significant factor in the operational pilot's decision-making process. Outside factors such as time constraints, lighting, refuelling, payload and general operational demands all add to the pilot's workload.

Pilots who are building up operational type experience should proceed with a high degree of caution and must abide by the rules and limits laid down by the IAA.

Helicopter pilots in particular would appear to have a higher exposure to risk than their fixed wing counter parts. This is in part due to the type of operations that helicopters conduct, but also due to the fact that the capabilities of the helicopter are such that it can be flown at very low speeds and hover at very low heights. These capabilities in themselves can tempt pilots into flying in conditions that are below that which are set for helicopter VFR. The VFR limits are set for the protection of the pilot, the passengers and the general public. Pilots need to maintain their discipline with regard to the limits laid down.

Why the pilot of EI-ONE persistently engaged in the high risk manoeuvring of the helicopter in very poor weather conditions during the last two legs of the flight must remain a matter for conjecture. The investigation is, however, of the opinion that the offer of a flight in a turbine engine helicopter, the future possibilities of further offers of flight time on type and the pilot's overall declared desire to gain full-time employment on turbine engine aircraft, may have influenced his judgement on the day.

The ultimate pressure on the pilot was probably self-induced in that this was the pilot's first long range operational mission in a turbine engine helicopter and clearly he would have wished to recover his passengers back to Weston.

3. CONCLUSIONS

(a) Findings

1. The pilot was properly licensed by the IAA and medically fit to conduct the flight.

2. The helicopter had a valid certificate of airworthiness, issued by the IAA, and had been maintained under a valid aircraft operator certificate to the Public Transport Category in accordance with the approved and appropriate schedules.

3. Anomalies were found in the pilots flying book, which sought to overstate his overall flying experience on helicopters.

4. The helicopter was on a commercial operator's AOC, issued by the IAA, but the flight was operated in the Private Category.

5. A difference exists between the commercial Operator/AOC Holder and the IAA with regard to the interpretation of the rules pertaining to an aircraft that is operated on an AOC and is also flown privately.

6. There was no evidence found of any helicopter malfunction defect or fire prior to impact.

7. The helicopter was well equipped with flight instruments and navigational aids but was certified only for land operations under Visual Flight Rules (VFR).

8. A condition of the pilot's licence was that he should not fly out of sight of ground or by sole reference to instruments. For the safe conduct of the flight, therefore, surface visual references were essential.

9. The pilot did not hold a current instrument rating on fixed wing aircraft at the time of the accident nor had he ever held an instrument rating on helicopters.

10. No record was found of a request by the pilot for a forecaster briefing by Met Éireann for a route forecast on either the day of the accident or on the previous day.

11. No evidence was found to indicate that the pilot had operated previously in the Dingle area.

12. Information provided by the ATC Transcript indicates that it was the intention of the pilot to fly to Tralee Racecourse via the headland at Slea Head.

13. Evidence provided by a mobile telephone conversation between the pilot and one of the intending passengers indicates that the pilot believed that he was rounding the headland at Slea Head, when in fact in was entering Trabeg Inlet.

14. EI-ONE struck the southern lee of the feature Croaghskearda at a height of 950 feet AMSL in dense fog conditions.

15. Observations gathered from witnesses located along the reconstructed flight path of the final leg of the flight determined that the helicopter was being manoeuvred for a prolonged period of time at low altitude and low speed in conditions of varying and restricted visibility, which were below VFR limits.

16. The pilot did not comply with the limitations laid down by the IAA for minimum helicopter heights and helicopter VFR.

17. A flight test carried out by the Investigation using a similar model helicopter and identical GPS, indicated a high degree of accuracy of the system, which was free from cellular telephone interference.

(b) Causes

The investigation identified the following causal factors:

1. The accident probably occurred when the pilot lost adequate visual references and permitted the helicopter to strike the ground in CFIT[7].

2. The pilot's inability to maintain clearance from terrain after inadvertently entering Instrument Meteorological Conditions during Visual Flight Rules (VFR) flight.

(c) Contributory Factors

1. Manoeuvring of the helicopter in mountainous/hilly terrain in poor weather conditions.

2. Non-compliance with the rules of the air pertaining to minimum heights and VFR for helicopters.

3. A lack of operational experience in the demanding conditions that confronted the pilot.

4. SAFETY RECOMMENDATIONS

It is recommended that:

4.1 The IAA should provide clarification regarding the rules and procedures pertaining to the arrangement whereby an aircraft on a Public Transport AOC can also be flown in the Private Category. **(SR 30 of 2003)**

The IAA should consider re-issuing AIC Nr 17/00 (Use of mobile telephones in aircraft) to the general aviation community and include an emphasis that use of mobile telephones may act as a distraction to pilots. **(SR 31 of 2003)**

Click on Appendix Required to Access it

Appendix A	Appendix C	Appendix E	Appendix G
Appendix B	Appendix D	Appendix F	Appendix H

[7] CFIT is defined as an event in which a mechanically normally functioning aircraft is inadvertently flown into the ground, water or an obstacle.