

**AIRCRAFT ACCIDENT REPORT**  
**CAA OCCURRENCE NUMBER 11/5349**  
**Eurocopter AS350BA ZK-IMB**  
**Loss of control due to spatial disorientation**  
**Karikari Moana, Karikari Peninsula, Northland**  
**30 November 2011**



(Aerospatale AS350BA ZK-IMB. Photo: W Grant)

## Foreword

New Zealand's legislative mandate to investigate an accident or incident are prescribed in the Transport Accident Investigation Commission Act 1990 (the TAIC Act) and Civil Aviation Act 1990 (the CAA Act).

Following notification of an accident or incident, TAIC may conduct an investigation. CAA may also investigate subject to Section 72B(2)(d) of the CAA Act which prescribes the following:

### **72B Functions of Authority**

(2) The Authority has the following functions:

- (d) To investigate and review civil aviation accidents and incidents in its capacity as the responsible safety and security authority, subject to the limitations set out in section [14\(3\)](#) of the [Transport Accident Investigation Commission Act 1990](#)

The purpose of a CAA investigation is to determine the circumstances and identify contributory factors of an accident or incident with the purpose of minimising or reducing the risk to an acceptable level of a similar occurrence arising in the future. The investigation does not seek to ascribe responsibility to any person but to establish the contributory factors of the accident or incident based on the balance of probability.

A CAA Safety investigation seeks to provide the Director of CAA with the information required to assess which, if any, risk-based regulatory intervention tools may be required to attain CAA safety objectives.

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## Glossary of abbreviations:

AGL	Above Ground Level
CAA	Civil Aviation Authority
CAR	Civil Aviation Rule(s)
CPL(H)	Commercial Pilot Licence (Helicopter or Aeroplane)
DOC	Department of Conservation
ft	foot or feet
<i>g</i>	A force acting on a body as a result of acceleration or gravity, informally described in units of acceleration equal to one <i>g</i>
GPS	Global Positioning System
IFR	Instrument Flight Rules
m	metre(s)
NM	Nautical Miles
NaRFA	National Rural Fire Authority
NoRFA	Northern Rural Fire Authority
NVG	Night Vision Goggles
NZDT	New Zealand Daylight Time
SAR	Search and Rescue
°T	Degrees True <sup>1</sup>
VFR	Visual Flight Rules

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<sup>1</sup> All headings in this report are in degrees true.

## Data summary

<b>Aircraft type, registration:</b>	Eurocopter AS 350BA, ZK-IMB
<b>Serial number:</b>	2396
<b>Number and type of engines:</b>	One, Turbomeca Arriel 1B turbine engine
<b>Year of manufacture:</b>	1990
<b>Date and time of accident:</b>	30 November 2011, 21:39 hours <sup>2</sup> (approximately)
<b>Location:</b>	Karikari Moana, Karikari Peninsula, Northland Latitude <sup>3</sup> : S 34° 49'.045 Longitude: E 173° 22'.922
<b>Type of flight:</b>	Night VFR, Commercial Operation
<b>Persons on board:</b>	Crew: 1 Passengers: 1
<b>Injuries:</b>	Crew: 1 fatal Passengers: 1 fatal
<b>Nature of damage:</b>	Aircraft destroyed
<b>Pilot-in-command's licence:</b>	Commercial Pilot Licence (Helicopter)
<b>Pilot-in-command's age:</b>	68 years
<b>Pilot-in-command's total flying experience:</b>	17670 hours - 165 hours on type
<b>Investigator in Charge:</b>	Mr P B Breuilly

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<sup>2</sup> All times in this report are NZDT (UTC + 13 hours) unless otherwise specified.

<sup>3</sup> NZ Geodetic Datum 1949 (or WGS-84) co-ordinates

## **Executive summary**

On 30 November 2011, ZK-IMB was being used for fire-fighting on the Karikari Peninsula in conjunction with the Northern Rural Fire Authority (NoRFA)<sup>4</sup>. Approximately one hour into the aerial fire-fighting operation, the Pilot received information from the National Fire Service Communication Centre (Northcom) in Auckland, reporting that there were members of the public going into the sea to escape the fire and they required urgent evacuation. The Pilot ceased fire-fighting operations and along with a NoRFA Rural Fire Officer (the Passenger), attempted to assist the trapped people.

During the attempt to assist the trapped people, communication was lost with the helicopter. The last known location of the helicopter was identified as over the sea. A search that night failed to locate the helicopter, however the following morning it was located approximately 0.37 NM from shore on the sea floor at a depth of 7m. Both the Pilot and the Passenger were found deceased in the helicopter.

The investigation did not identify any mechanical defects which may have contributed to the accident.

The CAA investigation considers that the Pilot probably experienced the effects of spatial disorientation resulting in a loss of control at low level over the sea.

CAA currently has no oversight regarding fire-fighting operations and recommendations have been made in this report to consider the implications of regulating such operations, or assisting the Civil Aviation sector with the construct of risk based planning. It is considered that risk based management is highly pertinent as these type of operations are generally multi-agency based and requires a common understanding of each participants' roles and capabilities.

## **Notification**

At 23:19 hours on 30 November 2011 the CAA was notified by the Rescue Coordination Centre of New Zealand (RCCNZ) that ZK-IMB, being used for a fire-fighting operation on

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<sup>4</sup> Department of Conservation, Far North District Council, New Zealand Fire Service and Forest Owners are constituent members of the Northern Rural Fire Authority. These organisations have operational responsibility. National Rural Fire Authority (NaRFA) is the rural component of the New Zealand Fire Service Commission and has an oversight for performance and the Operational Review.

the Karikari Peninsula in Northland, had crashed into the sea with two occupants on board. The Transport Accident Investigation Commission was notified and chose not to investigate.

Between 1 and 4 December 2011 the two occupants of the helicopter were recovered by New Zealand Police Divers. CAA Safety Investigators also attended the scene; salvaging the helicopter and commencing a CAA field investigation. Simultaneous investigations were commenced by Department of Conservation (DOC) and NaRFA.

## **1. Factual information**

### **1.1 History of the flight**

- 1.1.1 Salt Air Limited (the Company) based at Kerikeri Aerodrome was requested to assist NoRFA staff with a manuka/ti tree fire on DOC land on the Karikari Peninsula. The Pilot of ZK-IMB was contacted by the Chief Executive Officer (CEO) to carry out the fire-fighting operation which required the Pilot to fly from the Aerodrome to the scene of the fire approximately 36 NM to the north. At 20:22 hours the Pilot departed with a monsoon fire bucket slung underneath.
- 1.1.2 Once airborne the Pilot contacted his CEO who was to act as ground crew, advising that he was heading to the operation, the monsoon bucket was okay and commenting that “...*the weather didn’t look good...I don’t know how much I am going to get done...*”
- 1.1.3 At 20:44 hours the helicopter arrived at the fire-fighting operation and shortly thereafter commenced fire suppression with the monsoon bucket. The helicopter was initially tasked to protect a number of houses directly in the path of the fire front.
- 1.1.4 About 21:02 hours the Pilot was contacted by the Passenger<sup>5</sup> via NoRFA radio to organise a fly over, to get a perspective of the fire-fighting situation. Simultaneously the Pilot received information from Northcom<sup>6</sup> that people were trapped on a beach between the fire and the sea and requested the helicopter to assist. The Pilot is reported to have commented that the situation was “...*tricky...*” and arranged to meet the Passenger on the ground. Wind conditions at this time were reported by MetService and NoRFA personnel to be between 35-40 kts East-North-East (ENE).

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<sup>5</sup> DOC /NoRFA Employee.

1.1.5 At 21:10 hours the Pilot landed and remained on the ground until 21:22 hours. During this period, the Pilot removed the monsoon bucket and met with the Passenger at a prearranged location.

1.1.6 When the Pilot again became airborne ZK-IMB was initially flown to the southern edge of the smoke<sup>7</sup> and tracked north to the rear of the smoke. The Pilot was again contacted by radio relayed from Northcom, urgently requesting assistance for the trapped people, whom were reported to be in the sea<sup>8</sup>. The Pilot flew to the western side of the peninsula, upwind away from the smoke. The Pilot then flew south east then to the west over the trapped people. (Refer Figure 1<sup>9</sup>)

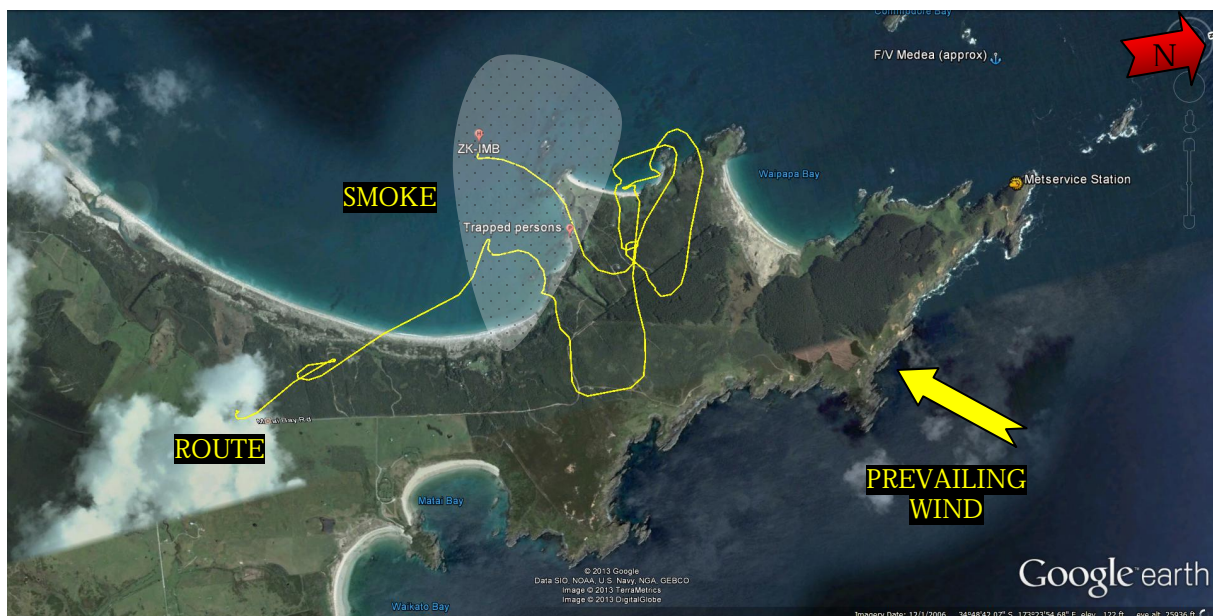


Figure 1. Google Earth image of Karikari Peninsula, Northland

1.1.7 Eyewitnesses on the beach heard the helicopter pass overhead, but due to the poor visibility caused by intense smoke<sup>10</sup>, they could not see it. This was the last reported position of the helicopter.

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<sup>6</sup> Fire Service Northern Communications is based in Auckland and has a role as a communications centre.

<sup>7</sup> Garmin 495 GPS recovered from the helicopter recorded routes along with SpiderTracks information.

<sup>8</sup> Excerpt of radio communication between Northcom and NoRFA staff on site at fire (CD).

<sup>9</sup> Yellow route line is representative of relative positions recovered from GPS data and eye witness reports. Smoke area is also representative from eyewitness accounts.

<sup>10</sup> Eyewitnesses estimates smoke extended from ground level to as high as 400-500 ft AGL and out over the sea.



- 1.1.8 Whilst travelling by road to the fire operation, a drive of approximately one and a half hours, the CEO made several attempts to contact the Pilot by cell phone and radio to establish his location. The CEO was unable to get a response from the Pilot.
- 1.1.9 At 22:00 hours the CEO arrived at the operation and met with a NoRFA staff member whom was acting as a forward liaison point for fire operations. The CEO again attempted unsuccessfully to contact the Pilot. Unsuccessful attempts were also made to contact the helicopter by NoRFA radio and by the crew of a second helicopter on the fire-fighting operation.
- 1.1.10 The CEO then reviewed the Spidertracks data on his laptop and found the last recorded position report for ZK-IMB was at 21:38 hours. The position indicator was grey in colour, indicating a loss of signal from the on-board system. The last Spidertracks position received, indicated the helicopter to have been 141 AGL, travelling at a speed of 7kts on a heading of 182°T<sup>11</sup>.
- 1.1.11 The CEO joined the pilot of the second helicopter and having entered the last known coordinates of the ZK-IMB into an on board GPS, they departed in the second helicopter in an attempt to reach the location. The flight was aborted due to the density of the smoke and darkness.
- 1.1.12 The decision was made to divert to the reported location of the trapped people on the beach. This was again prevented due to the poor visibility. The decision was then made to fly to the location of the monsoon bucket in an attempt to locate ZK-IMB. This aerial search continued for approximately one hour.
- 1.1.13 Post the search by the CEO, RCCNZ was advised that the helicopter was missing and a request was made for a Search and Rescue (SAR) helicopter to attend with specific search and rescue equipment such as night vision goggles (NVG). At 23:30 hours the SAR helicopter commenced an extensive search over the coastline and sea referencing to the last known location and flight path of ZK-IMB. This SAR operation was also hampered by the windy conditions and smoke affecting the use of NVG.

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<sup>11</sup> The navigational course for an aircraft measured from the geographical north pole.

- 1.1.14 Approximately 21:00 hours a fishing vessel moored near Tuputupugahau Island, was also requested by RCCNZ to assist with the trapped people, as it was believed the people would go to the beach and into the sea. However, due to the poor visibility caused by the intense smoke being blown by 25-30kts winds<sup>12</sup> and burning debris from the fire landing on the vessel, it was unable to come close enough to assist.
- 1.1.15 Assistance in searching for ZK-IMB was also given by the fishing vessel following the loss of communication with the helicopter. Crew on the fishing vessel believed they had "...heard..." the helicopter hit the water near to where they had been during the search for the trapped people and commenced a search there. However, the vessel was diverted by the RCCNZ to a different search area.
- 1.1.16 The Captain of the fishing vessel later chose to return to the area where the crew believed they had heard the helicopter crash. About 06:00 hours on 1 December the helicopter was located by the fishing vessel resting in 7m of water on the sea floor close to the last indicated Spidertracks location.
- 1.1.17 On 1 December Police divers recovered the Pilot and Passenger from the helicopter.
- 1.1.18 During 3-4 December the helicopter was recovered from the sea and transported to land by barge. It was subsequently taken by road to a secure CAA facility for a detailed inspection.
- 1.1.20 The accident occurred approximately 21:38 hours, 0.37 NM from shore at latitude S34° 49'.045, longitude E173° 22'.922.

## 1.2 Injuries to persons

<i>Injuries</i>	<i>Crew</i>	<i>Passengers</i>
Fatal	1	1

**Table 1. Injuries to persons**

## 1.3 Damage to aircraft

- 1.3.1 The aircraft was destroyed.

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<sup>12</sup> Conditions described by Captain of fishing vessel.

## 1.4 Pilot information

Flying hours	All types	Relevant Type
Last 24 hours	2.4	2.4
Last 7 days	11.2	11.2
Last 30 days	30.8	30.8
Last 90 days	61.8	59.3
Total hours	Approximately 17670	Approximately 165 <sup>13</sup>

**Table 2. Pilot flight hours**

- 1.4.1 The Pilot was aged 68 years and held a CPL (H) issued by CAA in 1972 as a type rating<sup>14</sup>. The Pilot had a current Class 1 Medical Certificate valid until 3 August 2012 and a Class 2 Medical Certificate valid until 3 August 2013.
- 1.4.2 The Pilot was current for the helicopter type and model. The Pilot also held a CPL (A) with an agricultural rating. The operation was conducted after ECT<sup>15</sup> and the Pilot had recent flying experience to conduct night VFR operations.
- 1.4.3 The Pilot was employed as a contract pilot with the Company and had held a close association with the CEO for many years. In the weeks preceding the accident, the Pilot had been involved in two other aerial fire-fighting operations in the Northland area which had each lasted for two to three days.
- 1.4.4 No information was obtained to suggest that the Pilot had undertaken training courses or tertiary education in regards to airborne fire-fighting operations or rescue operations<sup>16</sup>. CAA records showed that the Pilot had reported carrying out fire-fighting operations in 1990.

## 1.6 Aircraft information

- 1.6.1 Eurocopter AS350BA, ZK-IMB serial number 2396 was manufactured in France in 1990. The helicopter had been operated in France and arrived in New Zealand in

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<sup>13</sup> The Pilot's Pilot Logbook was being carried in the helicopter and was lost in the accident sequence.

<sup>14</sup> In 1979 Civil Aviation Safety Order Nr 12 was enacted separating Pilot licencing categories from each other creating stand-alone licences between aircraft categories. Therefore a helicopter licence came into being.

<sup>15</sup> Evening Civil Twilight commences when the sun has dropped 6° below the western horizon. Night Flying Rules commence at this time.

<sup>16</sup> There is currently no prerequisite to have had any specific training for fire-fighting operations.

2010 following service in Japan and the Philippines. The helicopter had entered service with the Company during 2010.

- 1.6.2 On 24 November 2011 at 1310 total airframe hours, a scheduled 200 hour inspection was carried out. The helicopter had accrued approximately 1340 total airframe hours at the time of the accident. Review of the helicopter Maintenance Logbooks revealed no notable maintenance issues.
- 1.6.3 The helicopter was equipped in a standard configuration with the exception of an under slung hook assembly, which on the night of the accident had been used to carry a monsoon bucket. The helicopter was fitted with the minimum instruments as required by CAA Rules<sup>17</sup>.
- 1.6.4 The helicopter was fitted with a standard landing light which provides 250 watts of lighting. In normal circumstances this light would provide sufficient luminesce to assist the Pilot when landing the helicopter. The light provides approximately one and a half times more watts than a standard car headlight. Examination of the switch panel showed that navigation lights and the rotating beacon were also on.

## **1.7 Meteorological information**

- 1.7.1 Records and analysis of the prevailing weather conditions were provided by MetService New Zealand.
- 1.7.2 Data recorded between 21:00 and 21:50 hrs was reviewed from a weather station approximately 2.2 NM<sup>18</sup> NNE of the accident site. Wind velocity readings were reported between 30-35 kts (measured over 1 minute intervals) from ENE.
- 1.7.3 However, it is not inconceivable that localised wind conditions could be have been affected by the fire and orographic influences.
- 1.7.4 Weather satellite infra-red readings showed the cloud base to be approximately 4000 ft and tops around 7000 ft in the vicinity of Karikari, with a variable cloud coverage

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<sup>17</sup> Part 91.509 Minimum instruments and equipment and 91.511 Night VFR instruments and equipment.

<sup>18</sup> Station was approximately 2 NM north of the fire front and therefore unaffected by the "fire wind".

formed with: scattered (3-4 oktas<sup>19</sup>) and broken cloud (5-7 oktas). The moon was in a waxing phase with 36% of visible disk being illuminated.

- 1.7.5 The high cloud cover and obscured luminosity of the moon-phase would have created an overcast night. The addition of smoke from the fire would have had the effect of reducing the level of ambient light available to Pilot.

## **1.8 Aids to navigation**

- 1.8.1 Nil.

## **1.9 Communications**

- 1.9.1 The helicopter was fitted with appropriate aviation radios and a radio dedicated to operations involving the NoRFA. Communications had been made with the Pilot and the ground crews prior to the accident via the radios and as such the investigation concluded that they were serviceable.

- 1.9.2 The Pilot was also in possession of a cell phone operated through the helicopter communication system.

- 1.9.3 No emergency calls were received from the Pilot or Passenger.

## **1.12 Wreckage and impact information**

- 1.12.1 The helicopter was located on the sea floor at a depth of 7m approximately 0.37 NM from shore. All components were located at the scene and recovered. An initial underwater assessment found the tail boom partially connected at the main fuselage, however during the recovery process the tail boom separated from the fuselage. The separation resulted in the tail being joined only by the tail-rotor control cables and drive shaft.

- 1.12.2 Significant impact damage was notable on the starboard side of the helicopter. Water impact “wave length signature” was evident on the subframe, causing buckling to the floor (Figure 3). The roof and forward section of the cockpit had separated compromising the rigidity of the cockpit area. The Pilot’s door was not installed during the fire-fighting to allow the Pilot to observe the monsoon bucket. The door was located near the monsoon bucket at the loading site.

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<sup>19</sup> A unit used in expressing the extent of cloud cover, equal to one eighth of the sky.



Figure 2. Helicopter at CAA facility prior to inspection.

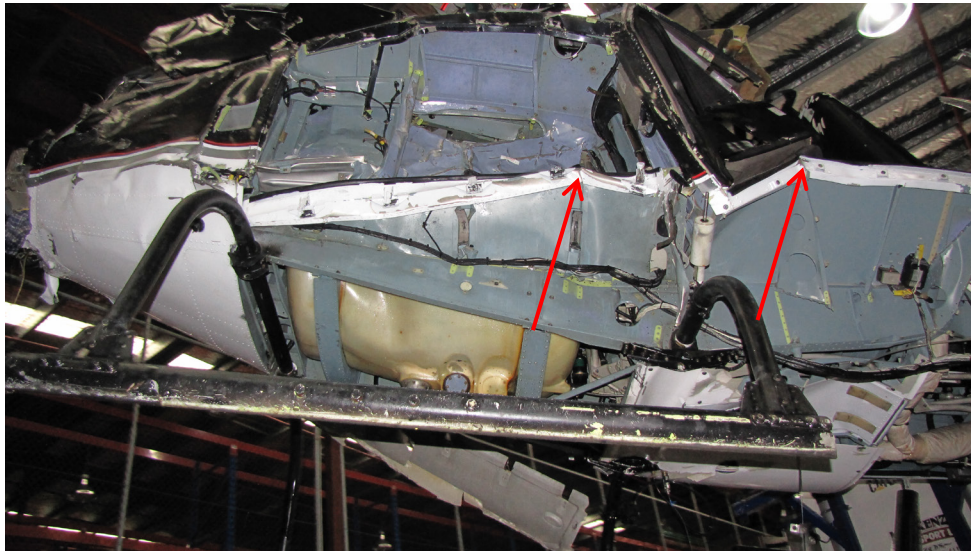


Figure 3. Underneath of fuselage showing wave action and deformation.

1.12.3 A detailed inspection was carried out of the flight controls for continuity and integrity by an Aircraft Maintenance Engineer. No anomalies were found which may have contributed to the accident.

- 1.12.4 The collective lever was found at its upper-most position. Subsequent inspection of the Anticipator Lever and Fuel Control Lever, indicated that a demand for full power was made shortly before the accident.
- 1.12.5 All three main rotor blades were damaged during the accident sequence resulting in the Starflex<sup>20</sup> arms shearing.
- 1.12.6 Detailed inspection of the engine was conducted by a representative of the engine manufacturer and a CAA engineer. No anomalies were found which could have contributed to the accident. It was considered that the engine was operating within normal parameters at the time of the accident.

### **1.13 Medical and pathological information**

- 1.13.1 The post mortem examination revealed no medical condition(s) which could have contributed to the accident.
- 1.13.2 Both the Pilot and Passenger suffered fatal injuries as a result of the accident.

### **1.15 Survival aspects**

- 1.15.1 The extensive damage to the fuselage indicated that the helicopter had impacted the sea, predominately on the starboard side, with sufficient force to partially separate the forward section of the cockpit from the fuselage.
- 1.15.2 The back of the Pilot's seat had fractured between the back and base, but remained in one piece. The Pilot also remained secured by the shoulder and lap belt. The Pilot was wearing a life vest which was not deployed. The Pilot suffered a number of injuries consistent with blunt force trauma and was likely to have been immediately incapacitated.
- 1.15.3 The Passenger's seat had failed in overload<sup>21</sup> due to impact forces, separating the back of the seat from the base. The Passenger was held in the separated seat secured by the shoulder and lap belts. As a consequence of the seat failure, the Passenger was only partially restrained during the accident sequence and the resultant injuries were

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<sup>20</sup> The Star Flex composite rotor head and modular design provide long service life as well as simplified maintenance procedures. This is a proprietary design unique to Eurocopter.

<sup>21</sup> EASA seat 'g' loading requirement is 2g x 1.33 FAR 27.561 refers.

likely caused by lack of sufficient restraint. The Passenger, whom drowned, received injuries including a blow to the top of the head<sup>22</sup> which probably lead to incapacitation and disorientation.

- 1.15.4 Effective emergency egress by the Pilot and Passenger following the impact and subsequent sinking would have been highly unlikely due to the injuries they received on impact. The Passenger was not wearing a life vest, although one was found with the helicopter at the crash site. Life vests were not required to be worn for the operation. It is conceivable, that due to their injuries neither party would have been able to activate their life vests.

## **1.16 Tests and research**

- 1.16.1 The helicopter was fitted with a Garmin 495 GPS unit, from which data was recovered from the non-volatile memory<sup>23</sup>. Although a number of the copper circuits had been compromised due to salt water corrosion, GPS data recordings detailing the accident flight were recovered.
- 1.16.2 The recovered data was over-laid onto Google Earth™ and was able to be played through a simulation giving a moving picture of the last segments of the flight. This was comparative to the information provided by the Spidertracks.
- 1.16.3 Much has been written in aviation medical publications in regards to the physical and mental phenomena experienced by pilots known as spatial disorientation<sup>24</sup>. Due to the multiple influences involved in causing such a state, it is difficult to find one defining statement that sums up what spatial disorientation is. However, a generally accepted understanding is that it is a situation where the Pilot has conflicting inputs telling the brain information about the aircraft's attitude.
- 1.16.4 Orientation of a pilot's position relative to the Earth is transmitted through the nervous system to the brain by both the vestibular system (balance) and postural system (position and visual reference). This information, coupled with the use of

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<sup>22</sup> Neither occupant was wearing a helmet however the decision to wear one is a personal preference.

<sup>23</sup> Refers to memory chips that hold data content without a power source being applied.

<sup>24</sup> Reference reading: Newman, Dr David G., ATSB 'An overview of spatial disorientation as a factor in aviation accidents and incidents', 2007



instruments, allows the Pilot to understand the attitude of the aircraft. Incorrect information provided by one or a combination of the vestibular and postural systems to the brain can cause spatial disorientation. Simply stated, spatial disorientation for a pilot is the inability to know which way is “up”.

1.16.5 A study into spatial disorientation conducted by the Federal Aviation Administration in 1983 (FAA 60-4A<sup>25</sup>) found, during a test of qualified instrument rated pilots simulating a change from VFR to IFR, that it could take as much as 35 seconds for some pilots to establish full control of the aircraft when visual reference is lost.

1.16.6 A physical sensation identified as ‘flicker vertigo’ can be experienced by helicopter Pilots when operating in an environment where the low-frequency flickering of a rotating beacon is reflected by the rotating main rotor blades (Rash, 2004)<sup>26</sup>. This can increase the effect of spatial disorientation on helicopter Pilots.

## **1.17 Organisational and management information**

1.17.1 A review of the Company Exposition revealed that fire-fighting and SAR operations were not specifically identified as a capability. It should be noted that these types of operation are not required to be identified as part of the certification requirements under CAR Part 119 *Air Operator- Certification*.

## **2. Analysis**

2.1 The factors contributing to this helicopter accident include; the environment in which the helicopter and Pilot were operating, the change from a fire-fighting operation to a SAR operation and the overarching management and supervision of both operations.

### **Spatial Disorientation**

2.2 The Pilot was operating the helicopter:

- At night with minimal ambient light, therefore reducing depth perception.
- Over the sea, with limited contrasting features.

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<sup>25</sup> FAA Advisory Circular 60-4A, ‘Pilot’s Spatial Disorientation’, 1983

<sup>26</sup> Reference reading: Rash, Clarence E ‘Awareness of causes and symptoms of flicker vertigo can limit ill effects’, 2004

- With minimal visual references whilst flying through smoke.
- At low level. Although this does not contribute to the effects of spatial disorientation, the availability of increased height above the surface may allowed time for the Pilot to react and recover the helicopter.

2.3 It is possible that due to the wind conditions and the minimal ambient light, that the Pilot unintentionally flew into the smoke, or that the helicopter was enveloped whilst trying to orientate back to shore. The lack of the Pilot's door would have allowed smoke to easily enter the cabin area which may have also had a detrimental effect on the Pilot.

2.4 Inspection of the switch panel showed that the helicopter landing light was on. Examination of the lamp filament showed evidence of hot stretch and blackening to the reflector due to the hot bulb 'blowing' following immersion in the sea. The landing light would have been the only source of lighting.

2.5 It is likely that the use of the rotating beacon and the helicopter landing light contributed to the Pilot's disorientation. The reflection of the lights against the smoke would have been similar to driving through fog creating an adverse effect on the Pilot's night vision along with possible flickering effects.

### **Fire-fighting v SAR Operation**

2.6 The investigation identified that there were two definitive operations, therefore two different roles, being carried out by the helicopter: one role as fire-fighting, the other as SAR.

2.7 The Pilot had extensive experience carrying out fire-fighting operations. The character traits of the Pilot, as described by the CEO, identify a person not likely to make impulsive or unplanned decisions. Similar traits were identified of the Passenger. It is therefore reasonable to conclude that due, to the apparent urgency<sup>27</sup> of the information provided to the Pilot and Passenger, that they did not fully appreciate the changeover from one role to the other. As such they were not in a position to fully assess and mitigate the possible risks associated with the SAR

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<sup>27</sup> Excerpt of radio communication between Northcom and NoRFA staff on site at fire (CD)

operation and without realising the extent of the prevailing and variably environmental conditions; they went to assist the people on the beach.

- 2.8 In April 2012, as a result of this incident, Section 26.11 was added to the Company Exposition entitled 'Rescue Operations'. This section prohibits night rescue operations and identifies certain risks a Pilot should consider such as; overall risk to those involved and aircraft limitations and equipment. It is also identified that the Pilot-in-Command "...makes the ultimate decision..." whether to carry out a rescue operation and should be mindful of "...limitations under high stress situations...". The inclusion of this section reinforces the fact that there were no predetermined processes to account for SAR operations.
- 2.9 The essential part played by the helicopter and decisions made by the Pilot, were in part affected by the multi-agency emergency services command and control. Taking note of the DOC and NaRFA reports, the remote location of the fire coupled with the sparse population, meant that personnel dealing with the fire operation, were subject to multiple roles.
- 2.10 The fire area is the responsibility of NaRFA and it was dealt with by those organisations elements, which included staff from DOC, Far North District Council, New Zealand Fire Service and Forest Owners. The Passenger, an employee of DOC, was also a Rural Fire Officer and effectively was placed in the position of managing both ground and air operations. This was not an ideal situation, as it did not allow for a divorced objective Command and Control (C and C) structure to exist, that was able to manage strategic risks and scenario changes.
- 2.11 NaRFA publications produce in 2009 entitled 'Air Operations' and 'Aircraft Safety' provide concise pocket-sized procedural guides detailing means to carry out fire-fighting operations involving aerial support. These references provide information outlining a multi-level C and C structure and a risk analysis questionnaire specific to managing responsibilities for the aerial support. It appears that due to the limited resources and manning levels, the C and C structure could not be fully established. Although the limited C and C structure may have been sufficient for the fire-fighting operation, when the scenario quickly turned from a fire-fighting to a SAR operation

there were no organisational systems in place to: recognise, adapt and manage the new scenario and identify possible risks.

- 2.12 The situational change from fire-fighting to a SAR operation does not appear to have been fully appreciated by parties at the scene or at Northcom. The ability to acknowledge the differences in the risks and resource management were left to the Pilot and Passenger.
- 2.13 Possibly believing that Northcom in Auckland was the operational tasking authority as opposed to the strategic authority, it is conceivable that the Pilot and Passenger felt compelled to make an ‘on the spot’ decision to divert from a reconnaissance of the fire front to SAR operations.
- 2.14 Had a comprehensive C and C structure been in place, such as described in the NaRFA publications then the urgent information could have been assessed at a forward fire control with senior staff, allowing for a revised assessment of the change to the operation and to commence planning for SAR. This objective planning may have highlighted a number of issues such as: whether the helicopter was equipped for the task and the appropriate resource to conduct SAR of the trapped people. These are two items identified in the NaRFA publications as part of the: *‘Twelve standard aviation questions’* referencing to fire operation; but could easily be adopted for use in SAR operations.

### **Aerial Fire Operations**

- 2.15 The use of both rotary and fixed wing aircraft to assist with fire suppression within New Zealand has been common practise for many years. Such operations are being conducted on the basis of the Pilot’s rating coupled with the aircraft’s capabilities. For rotary operations this would align with the Pilot’s sling rating under *CAR Part 61 Pilot Licences and Ratings* and for fixed wing pilots an agricultural rating<sup>28</sup>.
- 2.16 There is no fire-fighting rating required under current CARs. NaRFA requires that Pilots attend ground courses as a prerequisite to assisting in NaRFA fire operations.

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<sup>28</sup> Similarly a helicopter pilot could also hold an agricultural rating.

- 2.17 Civil Aviation Safety Authority of Australia is currently reviewing a rule change regarding the creation of an endorsement to pilot licences allowing for fire-fighting activities.
- 2.18 Recently, civil aviation industry driven initiatives i.e. AIRCARE™ in conjunction with the NaRFA have created ‘best practise models’ for fire-fighting operations. This civil aviation industry driven initiative is seen as a positive way forward when coupled with the use of Safety Management Systems and Risk Matrices.
- 2.19 As with external load ratings and agricultural ratings as prescribed in CARs *Part 133 Helicopter External Load Operations* and *Part 137 Agricultural Aircraft Operations*, regulatory oversight of fire-fighting operations could provide for the mandating of specific flight training requirements and continued competency and currency checks. As such CAA Safety Action (CAA14A312) has been raised recommending that the CAA consider the current regulatory oversight of multi-agency fire-fighting operations.

### **3. Conclusions**

- 3.1 The Pilot was appropriately licenced and fit to carry out the flight.
- 3.2 There was no evidence that a technical malfunction of the helicopter contributed to the accident.
- 3.3 The implications of a change in role from fire-fighting operations to recovering people from the fires path (SAR) may not have been fully appreciated by those making the requests, those relaying them and those asked to deal with them.
- 3.4 An inadequate field Command and Control structure contributed to the failure to adequately assess the safety risks when the helicopter changed to a SAR operation.
- 3.5 The helicopter was not fitted with specialist equipment to conduct search and rescue operations.

3.6 The prevailing environmental conditions; minimal ambient light, smoke, high winds<sup>29</sup> and loss of visual reference probably caused the Pilot to experience spatial disorientation.

3.7 It is likely that the Pilot felt compelled to respond to the emergency situation that had developed.

3.8 The accident was not survivable.

#### **4. Safety Actions**

4.1 Safety Action (CAA 14A312) has been raised for the CAA to consider the current regulatory oversight of multi-agency fire-fighting operations.

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<sup>29</sup> Beaufort scale 7 (28-33 kts)