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ATSB TRANSPORT SAFETY INVESTIGATION REPORT
Aviation Occurrence Report – 200505107
Final

VFR into IMC – 76 km north of Brisbane, Qld
11 October 2005
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Abstract

On 11 October 2005 at about 1815 Eastern Standard Time, a Kawasaki Heavy Industries BK 117 B-2 helicopter, registered VH-BKS, became airborne at Brisbane's Princess Alexandra Hospital on a night Visual Flight Rules (VFR) flight to Maroochydore, Qld. On board the helicopter were the pilot, a paramedic and a crewman. The pilot had earlier departed Hervey Bay on a day VFR medical flight, arriving at the hospital at 1748 that afternoon. The incident flight was to reposition the helicopter at the operator's Maroochydore base location.

At about 1823, the pilot was advised by the Brisbane Approach North controller that the weather at Maroochydore included broken cloud, with a cloud base of 1,000 ft above ground level (AGL). In addition, the pilot reported that he observed a solid layer of cloud beneath and in front of the helicopter along the intended route.

The pilot's decision to continue the flight to Maroochydore committed the pilot to a night VFR flight above more than scattered cloud. The pilot could not assure himself of maintaining Visual Meteorological Conditions (VMC) during the remainder of the flight, with the result that the night VFR flight above more than scattered cloud was not possible.

On arrival at Maroochydore, the cloud base was such that the pilot was restricted to a recovery to land via an instrument approach, in conditions in which he was not qualified to operate, and for which the helicopter was not single-pilot instrument flight rules-equipped.

The report also details extensive safety action undertaken by the operator, the Queensland Department of Emergency Services, Airservices Australia and the Civil Aviation Safety Authority.

THE AUSTRALIAN TRANSPORT SAFETY BUREAU

The Australian Transport Safety Bureau (ATSB) is an operationally independent multi-modal Bureau within the Australian Government Department of Transport and Regional Services. ATSB investigations are independent of regulatory, operator or other external bodies.

The ATSB is responsible for investigating accidents and other transport safety matters involving civil aviation, marine and rail operations in Australia that fall within Commonwealth jurisdiction, as well as participating in overseas investigations involving Australian registered aircraft and ships. A primary concern is the safety of commercial transport, with particular regard to fare-paying passenger operations. Accordingly, the ATSB also conducts investigations and studies of the transport system to identify underlying factors and trends that have the potential to adversely affect safety.

The ATSB performs its functions in accordance with the provisions of the *Transport Safety Investigation Act 2003* and, where applicable, relevant international agreements. The object of a safety investigation is to determine the circumstances in order to prevent other similar events. The results of these determinations form the basis for safety action, including recommendations where necessary. As with equivalent overseas organisations, the ATSB has no power to implement its recommendations.

It is not the object of an investigation to determine blame or liability. However, it should be recognised that an investigation report must include factual material of sufficient weight to support the analysis and findings. That material will at times contain information reflecting on the performance of individuals and organisations, and how their actions may have contributed to the outcomes of the matter under investigation. At all times the ATSB endeavours to balance the use of material that could imply adverse comment with the need to properly explain what happened, and why, in a fair and unbiased manner.

Central to the ATSB's investigation of transport safety matters is the early identification of safety issues in the transport environment. While the Bureau issues recommendations to regulatory authorities, industry, or other agencies in order to address safety issues, its preference is for organisations to make safety enhancements during the course of an investigation. The Bureau prefers to report positive safety action in its final reports rather than making formal recommendations. Recommendations may be issued in conjunction with ATSB reports or independently. A safety issue may lead to a number of similar recommendations, each issued to a different agency.

The ATSB does not have the resources to carry out a full cost-benefit analysis of each safety recommendation. The cost of a recommendation must be balanced against its benefits to safety, and transport safety involves the whole community. Such analysis is a matter for the body to which the recommendation is addressed (for example, the relevant regulatory authority in aviation, marine or rail in consultation with the industry).

FACTUAL INFORMATION

History of the flight

On 11 October 2005 at about 1815 Eastern Standard Time[1], a Kawasaki Heavy Industries BK 117 B-2 helicopter, registered VH-BKS, became airborne at Brisbane's Princess Alexandra Hospital (the hospital) on a night Visual Flight Rules (VFR) flight to Maroochydore, Qld. On board the helicopter were the pilot, a paramedic and a crewman. The pilot had earlier departed Hervey Bay on a day VFR medical flight, arriving at the hospital at 1748 that afternoon. The incident flight was to reposition the helicopter at the operator's Maroochydore base location.

The pilot reported that, on departure from the hospital, the weather was suitable for night VFR and that there was 'what looked like 2 oktas[2] of low stratus over the CBD [Brisbane central business district]'. The pilot's intention was to fly 'VFR on top' of cloud direct to Maroochydore, at 4,500 ft above mean sea level (AMSL). The Brisbane Approach North controller issued a clearance to the pilot to climb to 4,000 ft. Shortly after climbing to 4,000 ft, the pilot noted that there was 4 oktas of cloud below the level of the helicopter and along the intended route. The pilot reported that, a short time later, there was a solid overcast beneath the helicopter. A recorded internal communication between the Brisbane Aerodrome Controller (ADC) and Approach North controller stated 'that [the] cloud base out there is 1500 [ft] reference BKS'.

At about 1823, as the helicopter was approaching overhead Pine River Bridge (Figure 1), the pilot was advised by the Brisbane Approach North controller that the weather at Maroochydore included broken cloud, with a cloud base of 1,000 ft above ground level (AGL). The pilot replied 'BKS, thanks for that', and assessed that there was 8 oktas of cloud over the Brisbane area to the rear of the helicopter. The pilot commented later that he had never seen cloud develop so quickly over the Brisbane area.[3]

At 1831, the Brisbane Approach North controller transmitted to the pilot 'BKS, just confirm this leg was VFR.' to which the pilot responded 'BKS, affirmative.'

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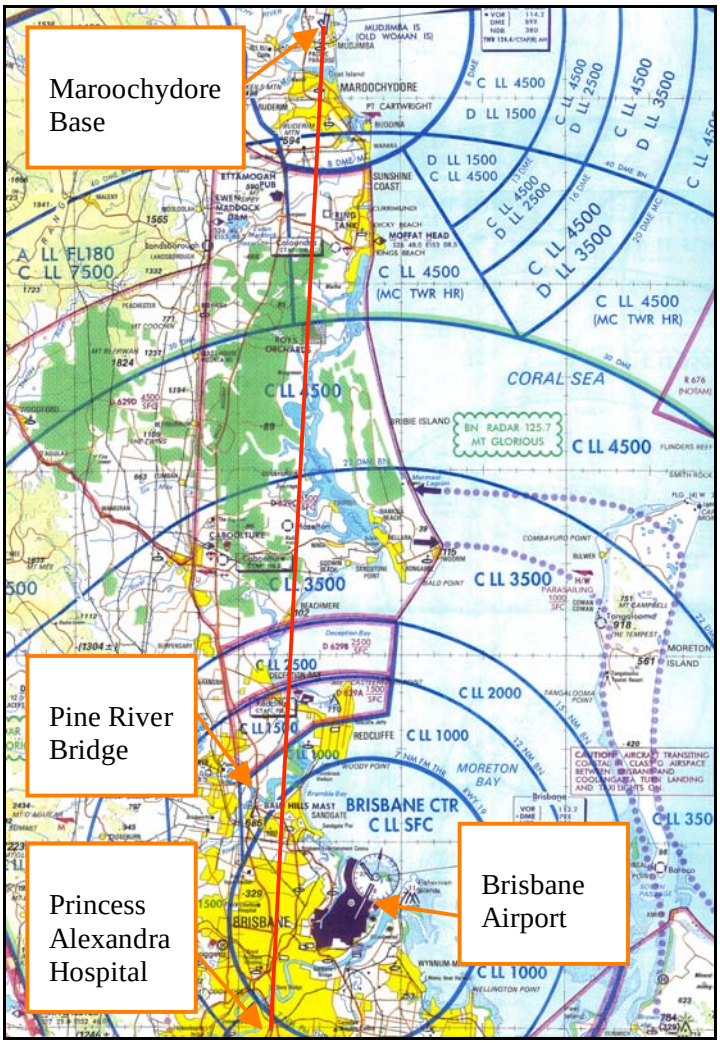
1 The 24-hour clock is used in this report to describe the local time of day, Eastern Standard Time (EST), as particular events occurred. Eastern Standard Time was Coordinated Universal Time (UTC) + 10 hours.

2 An okta is the unit of measurement that is used to report the total sky area that is visible to the celestial horizon. One okta is equal to $1/8^{th}$ of that visible sky area. The term okta is also used to forecast or report the amount of cloud in an area, along a route or at an airfield. The numbers of oktas of cloud are reported or forecast as follows: Few (FEW), meaning 1 to 2 oktas; Scattered (SCT), meaning 3 to 4 oktas; Broken (BKN), meaning 5 to 7 oktas, and Overcast (OVC), meaning 8 oktas.

3 That contrasted with a later observation by the operator's Chief Executive Officer that that was not the first time that the weather conditions had changed dramatically over a 15-minute period overhead Brisbane.

Figure 1: Planned route Princess Alexandra Hospital to Maroochydore



The pilot recalled a radio transmission by the approach controller that 'an Instrument Landing System[4] (ILS) [approach] was mandatory' for all approaches into Brisbane. The pilot's understanding of that transmission was that, had he been required to return to Brisbane, he would not have been able to comply with that instruction, as he did not have the required instrument approach and landing (IAL) procedure approach plates available onboard the helicopter. The pilot also expressed concern that he was unfamiliar with the Brisbane IAL procedures.

An examination of the Brisbane Approach North Controller's communications with the aircraft that were in the Brisbane terminal area at the time of the helicopter's movements indicated that, at no time, did the controller state that ILS approaches were mandatory. In addition, Brisbane Automatic Terminal Information Service (ATIS)[5] 'Oscar', which the pilot reported accessing prior to the departure from the

4 An instrument-presented, pilot-interpreted, precision approach aid that enables an aircraft to be manoeuvred along a precise, predetermined, final approach path.

5 An automatic and continuous broadcast on a discrete frequency, or on the voice channel of one or more radionavigation aids, which includes the normal operational information required by aircraft prior to takeoff or landing.

hospital, and was current for that departure, described Visual Meteorological Conditions (VMC) at Brisbane, and stated '…expect ILS approach runway 01.' Aeronautical Information Publication (AIP) GEN 3.3 Air Traffic Services, paragraph 2.6.3 states that the 'Type of approach expectation; eg, "EXPECT ILS APPROACH", etc' is transmitted on the ATIS. That information does not mandate the conduct by a pilot of the nominated expected approach.

The pilot did not declare an emergency or otherwise alert the Brisbane Approach North controller that he would be unlikely to be able to complete the transit and approach to Maroochydore in accordance with the requirements for the conduct of the VFR on top flight. Instead, the pilot decided to continue the transit to Maroochydore and to descend into Maroochydore via the runway 36 straight-in VOR/DME[6] IAL procedure, the necessary approach plates for that procedure being onboard the helicopter. The minimum descent altitude[7] (MDA) for that approach was 660 ft. The pilot reported entering cloud at 2,600 ft in the descent and becoming visual[8] during the approach at 760 ft.

The pilot reported being comfortable about having conducted the IAL procedure at Maroochydore and indicated that, if he had not become visual from that procedure, he would have attempted a second IAL procedure. The pilot's plan after a second unsuccessful IAL procedure was to track over the water to the east of Maroochydore, and to carry out a non-published, self-directed let-down through cloud using the helicopter's radio altimeter[9].

The pilot reported that the estimated time interval to Maroochydore was about 25 minutes. On that basis, the estimated landing time at Maroochydore was between 1840 and 1844. The pilot estimated that, after landing, there was about 45 minutes of usable fuel remaining in the helicopter.

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6 Very High Frequency omni-directional radio range (VOR) / Distance Measuring Equipment (DME) navigation aid.

7 A specified altitude (expressed in feet AMSL) during a non-precision circling or runway approach below which descent may not be made without visual reference.

8 Includes a pilot having visual reference with the relevant runway threshold, or approach lights or other markings identifiable with the intended landing runway, and the pilot being able to comply with defined manoeuvring and/or visibility requirements for the particular IAL procedure.

9 An instrument with the capability to provide a readout of an aircraft's height above the earth's surface.

Personnel information

Qualifications, ratings and experience

The pilot's licences, ratings and flying experience included:

Licences held	Air Transport Pilot (Aeroplane) Licence
	Air Transport Pilot (Helicopter) Licence
Medical Certificate	Class 1, valid to 26 August 2006
Ratings and endorsements	Multi-engine Command Instrument Rating (Aeroplane), expired in 2000
	Night VFR rating (Helicopter), issued on 29 August 1986
	Grade 1 Flight Instructor Rating (Helicopter), single-engine aircraft only)
	BK117 B-2, issued 6 May 1999[10]
Total hours flying experience	6,739.9
Total hours helicopter	5,917.2
Hours on type	835.8
Hours flown night	728.1
Hours flown instruments	485.5
Hours flown in last 24 hours	3.0
Hours flown in last 30 days	23.8
Hours flown in last 90 days	55.3

Night VFR and Instrument Flight Rules (IFR) experience and training

The pilot had been flying for 29 years, including service in the Australian Defence Force (ADF). During that time, he received the military equivalent of a civilian Command Instrument Rating (Helicopter), a Grade 1 Flight Instructor Rating and an ADF-specific Instrument Rating Examiner qualification. The pilot did not hold a current Command Instrument Rating.

10 The pilot held endorsements on a number of other helicopter and aeroplane types.

The pilot had been employed by the operator for 6 years, with the majority of that time spent being managed by the previous Chief Pilot.[11] On 22 August 2005, the pilot completed a 1.8 hour night VFR check flight with the Chief Pilot in a Bell Helicopter Company 206L (B206) helicopter. That check included the conduct of IAL procedures at Maroochydore.

Fitness for duty

The operator managed pilots' duty cycles via the operator's fatigue risk management system. The pilot had 21.0 hours free from duty prior to the incident work period, and had been on duty for 5.5 hours, and awake for 11.5 hours prior to the incident.

Helicopter information

The investigation found that the aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures for night VFR operations.

The helicopter did not have an autopilot system and was not certified for single-pilot IFR operations.

Meteorological information

Meteorological forecasts used to plan the series of flights

At about 1400, the pilot obtained an Area 40 forecast[12] and Maroochydore Terminal Aerodrome Forecast[13] (TAF) in order to plan the series of flights to Hervey Bay, the hospital and then return to Maroochydore. The relevant details from those forecasts included:

- **Maroochydore TAF.** The TAF used by the pilot was issued at 1014 and was valid from midday to midnight on the day of the incident. Scattered cloud was forecast with a cloud base of 2,500 ft, and the in-flight visibility was expected to be greater than 10 km.
- **Area 40 forecast.** The area forecast used by the pilot was issued at 1309 and was valid from 1310 to 0300 the next day. The amended overview to that forecast included that areas of fog and low cloud could be expected to develop in the area of the coast to the ranges from midnight on the day of the incident. VMC were forecast for the period of the flight, with an in-flight visibility of 8 km in smoke.

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11 The current Chief Pilot assumed that position on 28 June 2005.

12 A statement of the general synoptic situation and the meteorological conditions expected to prevail in Area 40.

13 A statement of the meteorological conditions expected for a specified period in the airspace within a 5 NM radius of the centre of a runway complex.

Those forecast conditions indicated that the planned series of flights, and the arrival at Maroochydore, could be expected to be able to be carried out in VMC.

Meteorological forecasts issued during the series of flights

A number of additional meteorological forecasts and observations became available during the conduct of the series of flights. Those forecasts and observations included:

- **Amended Area 40 forecast.** An amended Area 40 forecast was issued at 1557, and was valid from 1600 to 0300 the next day. The overview to that forecast included the possibility of areas of fog and low cloud in the coast to ranges area north of Maroochydore after 1800, and in the south after 2200. The expected presence of VMC was indicated for the period of the flight, and the in-flight visibility was forecast to be 8 km in smoke/haze.
- **1626 Maroochydore TAF.** An amended Maroochydore TAF was issued at 1626 and was valid from 1800 to 0600 the next day. That forecast included an expected visibility of greater than 10 km, and the presence of a few clouds with a base of 1,000 ft and of scattered clouds with a base of 2,500 ft. In that case, VMC could still be anticipated for the pilot's planned arrival at Maroochydore. However, a deterioration to non-VMC conditions was forecast after 2100, as a result of the forecast development of broken cloud with a base of 800 ft.

Although not accessed by the pilot during the series of flights, those forecasts also indicated that the planned series of flights, and the arrival at Maroochydore, could be expected to be able to be carried out in VMC.

Other meteorological forecasts and observations

A number of other meteorological forecasts and reports were published, but not accessed by the pilot, or were reported to the pilot during the series of flights, including:

- **1802 Brisbane Trend Type Forecast (TTF)/METAR[14].** The 1802 Brisbane TTF/METAR indicated that the visibility at Brisbane was greater than 10 km, and the presence of a few clouds with a base of 1,600 ft. There was no significant change expected to those conditions over the 3 hours following that report. The pilot did not access this report.
- **Brisbane Automatic Terminal Information Service (ATIS) 'Oscar'.** The pilot reported that, prior to departing the hospital, he accessed Brisbane ATIS 'Oscar'. That information indicated VMC at Brisbane Airport, and included the presence of scattered cloud at Brisbane with a base of 1,500 ft, visibility at Brisbane of greater than 10 km, and a northerly wind at 15 kts.

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14 A routine aerodrome weather report to which a statement of trend is appended. The TTF relates to the expected weather conditions within 5 NM of the centre of the aerodrome runway complex. Supersedes the TAF for the 3 hour period commencing at the time of the observation, and is the current forecast for application by pilots whose arrival time falls within that 3 hour period.

- **1816 Maroochydore Routine Aerodrome Weather Report (METAR[15]).** The 1816 Maroochydore METAR was based on an observation made at the end of the Maroochydore Air Traffic Services (ATS) personnel shift at about that time. That METAR indicated that the visibility at Maroochydore at that time was greater than 10 km, and the presence of a few clouds with a base of 800 ft and of broken cloud with a base of 1,000 ft. The pilot did not access this report.
- **1823 report from the Brisbane Approach North controller.** Recorded data indicated that, at about 1823, the Brisbane Approach North controller informed the pilot by radio that the weather at Maroochydore included broken cloud at 1,000 ft AGL. That report to the pilot reflected the content of the 1816 Maroochydore METAR.
- **1832 Brisbane TTF/METAR.** The 1832 Brisbane TTF/METAR indicated that the visibility at Brisbane was greater than 10 km, and the presence of a few clouds with a base of 1,600 ft and of scattered cloud with a base of 2,200 ft. No significant change to those conditions was expected over the 3 hour period following that report. The pilot did not access this report.

Additional meteorological information

Additional meteorological information that night included:

- **Brisbane ATS Recorded Communication.** A recorded internal communication between the Brisbane ADC and Approach North controllers indicated the understanding that, at about 1816, the cloud base in the vicinity of the helicopter was 1,500 ft.
- **1903 Maroochydore TAF.** At 1903, after the pilot's arrival at Maroochydore, an amended Maroochydore TAF was issued that was valid from 1900 to 0600 the next morning. That forecast indicated an expected visibility at Maroochydore of greater than 10 km, and the presence of broken cloud with a base of 700 ft. The Bureau of Meteorology (BoM) indicated that that amended TAF was developed subsequent to the receipt by the BoM of the 1816 METAR.

Organisational information

The operator

The operator was a Community Helicopter Provider (CHP) with bases at Maroochydore and Bundaberg Aerodromes. The operator provided a day and night VFR helicopter emergency medical service (EMS) to the Queensland Department of Emergency Services (DES) through a Deed of Agreement[16] (Agreement). A Chief Executive Officer (CEO) was responsible for the day-to-day management of the service and reported to the board of the CHP. In addition, the CEO undertook flying duties as a line pilot.

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15 Routine reports of observations by approved observers of the meteorological conditions at aerodromes. Issued at hourly or half hourly intervals, and made available at pre-flight briefing or on request to aircraft in flight.

16 Also known as a Service Agreement.

The terms of the Agreement included that the operator was required to maintain a Safety Management System (SMS) that included a process to manage risks and that the operator was required to appoint a Safety Officer. However, the DES advised that a variation in the terms of the Agreement was agreed with CHPs with the effect that the appointment of Safety Officers, creation of SMSs and development of company risk management processes by the CHPs was not required until a date to be fixed, and subject to the provision of a grant to implement those requirements. At the time of the incident, the variation to the Agreement meant that there was no obligation on a CHP to appoint a Safety Officer or to have an SMS in place.

The DES advised further that the variation in the terms of the Agreement was in response to previous CHP concerns that the requirements of the Agreement were in excess of those required by CASA and would incur a significant cost.[17] However, the DES indicated that, irrespective of the deferral of those requirements, it was expected that CHPs would:

- introduce risk management principles into their operations
- have an in-house safety program that would have been expected to be based on those principles.

At the time of the incident, the pilot had recently replaced the Chief Pilot in the role of Safety Officer. The Chief Pilot advised that the risk management process that was stipulated in the Agreement was not available in the operator's SMS.

September 2005 Safety System Evaluation

A Safety System Evaluation (SSE) of the operator's in-place safety and risk management arrangements was carried out by an independent risk management consultant in September 2005. That evaluation sought to benchmark the operator against the standards promulgated by the Aviation Safety Network (ASN)[18], and identified that the operator had not provided any SMS or risk management training for its staff. However, the ATSB investigation established that key personnel in the organisation, such as the CEO, Chief Pilot, and Safety Officer, had received safety-related training, including formal risk management training, during their previous employment in the ADF.

That appeared to contrast with the SSE, which commented that:

> In general there was a low level of understanding on what constitutes a safety management system and risk management…

and that the operator needed to establish:

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17 A more in-depth examination of the variation of the requirements of the Agreement is included at page 16.

18 The Aviation Safety Network (ASN) is an international safety and risk management program that was established by seven Queensland and NSW Community Helicopter Providers (CHP). The ASN includes approximately 20 helicopter EMS companies in Australia, Canada, and the US that work together with a view to adopting an integrated safety and risk management advisory standard, an integrated risk and safety management system (IRSMSTM), and a schedule of annual activities that support the implementation and maturity of safety and risk practices.

> …clearer safety related goals, objectives, comprehensive procedures, identifying clearer responsibility for the safety, risk and error management components of the management system, placing greater emphasis on reporting and trend analysis and allocating greater resources for formal safety management training and a broader range of safety related learning experiences.

The independent risk management consultant later clarified that the observations in the SSE report were made in regard to the content of the ASN integrated safety and risk management advisory standard (IRSMSTM). In addition, the consultant felt that the standards upon which the SSE was based were of a higher standard than required by the Agreement and by the extant CASA regulatory requirements.

The consultant considered that the level of understanding amongst company personnel of the key elements of an SMS and of a risk management approach was consistent with the industry norm.

In the SSE report, the independent risk management consultant made the following conclusions:

- (The operator) is in its initial stages of development and implementation of a tailored SMS
- A structured plan for implementation is required to ensure all tasks are undertaken within a reasonable time frame
- A broader approach to the current safety and risk management focus is required and has been acknowledged through the decision to join the ASN
- There are a number of existing elements of the SMS which provide an excellent platform for further development and implementation. Features recognised as part of the existing SMS include:
    - Management Support
    - Risk Register System
    - Safety Committee
    - Fatigue risk management system (FRMS)
    - Evolving Positive Safety Culture
- Some work is still required in order to have a comprehensive SMS which reflects best practice

> The review's focus was limited to (one base)…where a number of interviews and discussions with key personnel were conducted. In all cases these personnel displayed a very positive and enthusiastic attitude towards safety and risk management. This attitude bodes well for the realisation of the opportunities for improvement to the…..Service's SMS that have been identified in this review and that are selected for implementation.

Improvements to the operator's SMS

The investigation identified that the operator had progressed a number of improvements to its safety system since the appointment of the current Chief Pilot and CEO. That included the separation of the roles of the CEO and Chief Pilot, in order to more clearly define the safety roles and responsibilities of each position.

Despite that improving safety regime, the CEO was reported to consider that the conduct of night VFR operations remained a major compliance risk for the operator.

In regard to that residual risk, the CEO advised that night VFR operations were:

> not an adequate basis on which to guarantee the provision of reliable and sustainable EMS support.

and that:

> Flowing from this assessed organisational and mission risk, a documented intent (that pre-existed the incident) was developed to introduce IFR operations.

Company operational risk management approach

The Chief Pilot advised that a risk management plan was required to be developed by the respective crews for each shift. In addition, even if the risk affecting a mission was 'low', all of the risk management items on the relevant mission dispatch form were required to be completed.

The pilot completed a mission dispatch form prior to the series of flights. An examination of that mission dispatch form revealed that the pilot did not complete the risk assessment and evaluation components of that form.

Pilot training

The Agreement with the Queensland DES included the requirement for the promulgation in the company operations manual of a cyclic training and proficiency program affecting non-instrument rated pilots. However, as was the case with the requirement for the appointment of Safety Officers, creation of SMSs and development of company risk management processes by the CHPs (see discussion at page 8), a variation was in-place to allow CHPs to invoke that training program, including night flight and instrument flight proficiency, at a date to be agreed by the parties, and subject to the provision of the relevant grant. The increase in the relevant grant was not approved until mid-2006.

The Chief Pilot reported that the company night and instrument training was in accordance with the Agreement, and the company had made some adjustments to its existing proficiency program with a view to complying with the initial requirements of the Agreement. In addition, the operator engaged an appropriately qualified external Check and Training organisation to conduct pilot training on the BK117 B-2 helicopter. That organisation also provided instrument training to the operator's BK 117 B-2 pilots, including the conduct of IAL procedures at Maroochydore.

The Chief Pilot, who held a current Grade 1 Flight Instructor Rating, also provided ongoing instrument flying proficiency training in a company B206 helicopter. That training included the conduct of IAL procedures at Maroochydore in VMC. The Chief Pilot had substantial previous instrument flying experience and qualifications that were gained during his time in the ADF. That included the military equivalent of a Command Instrument Rating (Helicopter) and of a Grade 1 Flight Instructor Rating, and an ADF-specific Instrument Rating Examiner qualification. The Chief

Pilot's civilian Grade 1 Flight Instructor Rating included an approval for the provision of instrument training to company pilots.

At the time of the incident, neither the Chief Pilot nor any of the operator's line pilots held a current Command Instrument Rating.

A number of company pilots' night instrument training records were examined during the investigation. That examination determined that those pilots were recording the night instrument training as 'dual'[19], simulated IFR flight in their respective Pilot's Log Books. In addition, the Chief Pilot reported logging command time for those flights, and the understanding that the training was being logged as dual by the pilots. Advice received from the Civil Aviation Safety Authority (CASA) indicated that:

> …if the safety pilot/instructor is giving instruction, then this would seem to fit within the definition of flying training and would require the flight to be conducted under an [appropriately-endorsed] AOC [Air Operators Certificate]. Since the flight time was actually logged as training it would seem that the pilots themselves considered that what they were doing actually was flying training.

The CASA Head Office advice was not consistent with an interpretation that was later provided to the operator by the local Flying Operations Inspector (FOI) in an audit report dated 4 March 2006. In that report, the FOI commented on the operator's simulated night instrument flying as follows:

> During the inspection it was noted that there were a number of log book and pilot training records that recorded "instrument flying training". On reviewing these records I am satisfied that this activity is to satisfy NVFR recency requirements using local navigation aids and procedures with a company check pilot and did not include any initial instrument training.

There was no evidence of a flying school approval on the operator's AOC, or that the operator was approved as a Civil Aviation Regulation (CAR) 217 Check and Training organisation.

The Chief Pilot subsequently supplied the investigation with statements from three company pilots indicating that they had incorrectly logged the simulated instrument flight time as dual, and that they should have been logging the flight time as 'In Command Under Supervision' (ICUS). The CEO, Chief Pilot and company pilots commented that the simulated instrument flying at night did not comprise instrument flying training. Rather, the Chief Pilot was performing the role of safety pilot during night currency sorties.

The Chief Pilot also reported that there was no need to provide instrument training, because all of the company pilots were appropriately qualified and experienced

19 Flying that was conducted in an aircraft fitted with fully-functioning dual controls for the purpose of receiving flying training from a person who is authorised by the Regulations to give training.

night VFR pilots and had previously held instrument ratings. An examination of CASA flight crew records indicated that, at the time of the incident:

- one company pilot had never held an instrument rating
- one had held a Co-pilot Instrument Rating (helicopters)
- two pilots had held Command Instrument Ratings (aeroplanes)
- three company pilots had held the military equivalent of a Command Instrument Rating (helicopters) and/or held Civilian Instrument Ratings (aeroplanes).

In regard to the incident pilot's qualifications and experience, the Chief Pilot commented as follows:

> I also commend the pilot's instrument flying skill, unfortunately this may have been a contributing cause [to the incident].

Night VFR operational requirements

A detailed presentation of the regulatory requirements affecting night VFR operations, including the classification of EMS operations, was presented in Australian Transport Safety Bureau (ATSB) aviation safety investigation report BO/200304282 (available at www.atsb.gov.au).

Included in that presentation were the requirements of Aeronautical Information Publication (AIP) ENROUTE (ENR) section 1.2.8 as they affected the need for a pilot to update the available weather information affecting a flight or series of flights. Those requirements included that:

> When preflight briefing is obtained more than one hour prior to ETD, pilots should obtain an update before departure to ensure that the latest information available can be used for the flight. The update should be obtained by NAIPS pilot access, telephone, or when this is impracticable, by radio.

The pilot reported that he did not update the meteorological information that he used to plan the series of flights at about 1400 that day. The pilot was unaware of the requirement to update the pre-flight briefing, and reported the understanding that there was no requirement for him to update his 1014 Maroochydore TAF, because it was current and valid for the return flight to Maroochydore.

During the investigation, the CEO queried whether the requirements of AIP ENR section 1.2.8 were applicable to a series of flights, such as occurred on the incident flight. The investigation sought a legal interpretation of that section of the AIP from CASA. In its response, CASA stated:

> CASA is of the view that the requirement in the AIP ENR 1.10.1.2.8 applies to each flight in a series of flights, so that a pilot involved in such a series of flights should obtain a forecast update before each of the flights if the last forecast was obtained more than one hour prior to the commencement of the flight. Thus in a series of flights, if a forecast is obtained by the pilot before a flight from A to B would be more than one hour old by the time of the departure of the next flight from B to C (or perhaps D to E, etc) or back to A, then the pilot should obtain a forecast update before that next flight.

Other pertinent regulatory requirements affecting the conduct of the flight to Maroochydore included the conditions listed in AIP ENR section 19.2.1d. for VFR flight on top of more than scattered cloud. Those conditions included that:

> d. VFR flight on top of more than SCT cloud is available provided that
>
> (1) VMC can be maintained during the entire flight, including climb, cruise and descent.
>
> (2) For VFR flight on top of more than SCT cloud, the visual position fixing requirements of sub-para b., or the other navigational requirements of sub-section 19.1 must be met.
>
> (3) Prior to conducting VFR flight on top of more than SCT cloud, the pilot in command must ensure that current forecasts and observations (including those available in-flight observations) indicate that conditions in the area of, and during the period of, the planned descent below the cloud layer will permit the descent to be conducted in VMC.
>
> (4) The position at which descent below cloud is planned to occur must be such as to enable continuation of the flight to the destination and, if required, an alternate aerodrome in VMC (see notes 1 and 3).

Note 3 to AIP ENR 19.2.1d. required that:

> Pilots should not initiate VFR flight on top of more than SCT cloud when weather conditions are marginal. Before committing to operate VFR on top of more than SCT cloud, pilots should be confident that meteorological information used is reliable and current, and clearly indicates that the entire flight will be able to be conducted in VMC.

The weather conditions affecting a flight that required the nomination of an alternate aerodrome were defined in AIP ENR section 72.2. That included the requirement to consider the forecast cumulative amount of cloud below the alternate minimum, the visibility and the wind at the destination aerodrome 'during the currency of, or up to 30 minutes prior to the forecast commencement of' those conditions. There was no requirement to include available meteorological observations, including in-flight observations, when considering the need to nominate an alternate aerodrome.

The alternate requirements affecting the night VFR flight to Maroochydore were promulgated in AIP ENR section 72.2.13, and included a ceiling[20] of 1,500 ft and visibility of 8 km.

In addition to the regulatory requirements affecting the conduct of operations under the night VFR, the company operations manual included a section on night flying operations. Paragraphs 6.5.6 (a) and (c) of that manual stipulated the following company requirements:

> (a) The following provisions apply to all helicopter operations at night, VFR and IFR, unless otherwise specified:

20 Height above the nearest earth's surface of the lowest layer of clouds or obscuring phenomena.

(i) The pilot in command, in conjunction with the aircrew, must be satisfied that all factors have been assessed and that adequate information is available to effectively reduce and manage all associated risk. In all circumstances, the Pilot in Command is to ensure compliance with CAR 224, as applicable to the category of operation.

(ii) All available information should be obtained prior to departure, which could include:

(aa) details of an accurate position, preferably latitude and longitude

(bb) local weather

(cc) obstacles

(dd) power lines

(ee) local terrain and geographical features

(ff) available lighting

(gg) communications on site.

(It is recognised that some information may not be available before departure but updates may be provided during flight).

(c) The following provisions apply to night VFR operations:

(i) The pilot must consult all available sources, including details of moon rise, set and phase, to determine the level of celestial lighting prior to departure.

(ii) The combination of celestial lighting, ground lighting and ambient lighting must be sufficient to enable the helicopter to be flown and navigated by visual reference to the ground or water.

(iii) Actual cloud coverage that may affect the available celestial lighting, ground lighting and ambient lighting must also be assessed prior to departure.

Operator Night VFR into instrument meteorological conditions

Although strongly rejected by the former Chief Pilot/CEO, information was received from a number of sources that indicated that the operator had previously engaged in night VFR operations in weather conditions that were less than VMC. In addition, during interview, a senior company pilot indicated that that practice may have occurred previously. Moreover, a number of interviewees indicated that the former Chief Pilot had condoned such operations. That contrasted with internal company documentation, and third party audit and systems safety reports, which repeatedly highlighted the elevated risks associated with night VFR operations.

The former Chief Pilot stated that, at no time between 1979 and 2005, did he ever have to carry out an instrument approach. He also stated that he was not aware of any of the then company pilots ever carrying out an instrument approach. An examination of the ATSB occurrence database confirmed the notification in 1993 of

one previous inadvertent entry into instrument meteorological conditions (IMC) involving the operator.

Queensland Department of Emergency Services

Management/Operational structure

In 2003, the Aviation Services component of the Counter Disaster and Rescue Services (CDRS) within the DES assumed responsibility for the management of the Service Agreements[21] with all CHPs. Amongst its other responsibilities, Aviation Services provided administrative and policy support to the Queensland Government helicopter service, then known as Queensland Rescue.

In late 2005, responsibility for the management of all Agreements with CHPs was passed to the Helicopter Services Unit (HSU) of the Division of Emergency Management Queensland (EMQ). The Queensland Government helicopter service is now known as the Emergency Management Queensland Helicopter Rescue Service (EMQHR), and works closely with Aviation Services on contract management and general safety and service delivery issues.

The required qualifications for EMQHR pilots included a current Command Instrument Rating (Helicopter). The EMQHR primarily uses twin-engine IFR certificated helicopters and instrument rated crews to conduct most of its night EMS operations. The single-engine VFR helicopter that was operated by the EMQHR was available for night VFR operations; however, pilots engaged in those operations were still required to hold a current Command Instrument Rating (Helicopter). CHPs were not required, nor were they funded at the time, to meet the EMQHR operational standards.

Variation to the DES Deeds of Agreement/Service Agreements

The DES has worked with the Queensland Ambulance Service (QAS), Queensland Health, Queensland Fire and Rescue Service, and Queensland Police Service with a view to amending the current Deeds of Agreement/Service Agreements with CHPs. The aim was to implement the amended Agreements in the period 2004 to 2005.

In response, the CHPs agreed to the introduction of a number of the new provisions, but would not agree to the introduction of requirements which, in their view, exceeded the extant CASA requirements and which might incur additional cost. In order to fully implement the proposed amendments, the CHPs highlighted the need for additional funding. Consequently, the amended Deeds of Agreement/Service

21 Also termed Deeds of Agreement.

Agreements, which were executed on 15 June 2005, included a provision deferring the implementation of a number of amended requirements as follows:

> However, the Provider shall only be required to implement the requirements in clauses 6.2(l), 6.2 (m), 6.2 (n), 6.2 (o), 6.2 (s), 6.2 (ee), 24.4, 24.5 and Schedule 11 from a date to be agreed between the parties provided the parties reach agreement (using their best endeavours to attempt to do so) on if, and the extent to which, the grant will be increased to implement these requirements.

As previously discussed, those deferred requirements included the implementation of an SMS, a cyclic training and proficiency program that included night flight and instrument flight proficiency, and so on.

At the time of the incident, DES and the CHPs had been unable to reach agreement on the level of funding required to implement the deferred requirements.

Oversight of the operator's Agreement

As previously described, the operator was contracted to provide EMS services to the Queensland DES through the Deed of Agreement (Agreement). The 5-year Agreement was signed on 30 January 2002, and specified:

- the agreed services to be provided by the operator
- the methodology for prioritising EMS tasking
- operational issues and strategies for their management
- the requirements for the management of corporate and financial matters
- the oversight of the operation, including the requirement for the conduct of regular third party audits. Two such audits were required during the term of the Agreement, one prior to 30 January 2003, and a second sometime during the period 1 January 2004 to 31 December 2005.

The oversight of the Agreement was the responsibility of the then Aviation Services Unit (ASU).

The strategy adopted by the DES for the general oversight of the operator included:

- the review by DES of third party aviation safety audit reports
- meetings with the operator.

In addition, the operator was subjected to routine CASA regulatory audits and conducted its own internal audits. The operator also requested an independent assessment of its safety systems in September 2005.

Audit and safety evaluation history: December 2002 to September 2005

The investigation examined the results of a number of third party and CASA audits of the EMS operation that were carried out over the period December 2002 to September 2005. The results of the third party audits, together with any action to be taken by the operator, were required to be provided to the DES within 20 business days of their receipt by the operator.

A third party on-site audit of the EMS operation was carried out over the period December 2002 to January 2003. The auditor's report was received by the operator on 9 February 2003. That report identified a number of areas of concern, including that:

- the company operations manual was in need of review and, potentially, amendment
- consideration needed to be given to the operator seeking approval as a CAR 217 Check and Training Organisation
- in respect to the conduct of night VFR operations, the audit report included the comment that:

> There is anecdotal evidence that some night operations have occurred in the past in weather conditions that were less than legal VMC. This is clearly not acceptable.

Concurrently, on 9 January 2003, the QAS advised the then Director, Aviation Services, of a range of safety concerns by QAS paramedics regarding the operation at that time. A QAS investigation into those concerns concluded that there was no evidence to substantiate the paramedics' claims. On 11 March 2003, QAS recommended to Aviation Services that an independent audit should be conducted of the operator's practices.

The on-site audit report was also provided to the then Director of Aviation Services at the Queensland DES and, on 14 March 2003, the operator forwarded a draft action plan to that office in response to the content of the audit. The action plan outlined the operator's strategies in response to the majority of the auditor's areas of concern. It did not address the reported conduct of some night VFR operations by the operator in 'less than legal VMC'.

Aviation Services advised the QAS that they had received an independent on-site audit report on 14 March 2003. QAS requested Aviation Services to review that audit report and to provide QAS with advice regarding the safety of the operation. A Systemic Safety Consultation (SSC) was later conducted, in part, to satisfy the requirement for a report on the safety of the operator in response to the concerns raised by QAS paramedics. The SSC is discussed on page 19.

However, on 17 March 2003, the Director of Aviation Services commissioned a review of the on-site auditor's report by a different third party audit organisation. The scope of that second audit restricted the review to a desktop examination of the on-site auditor's written report, and required that the reviewing auditor should provide the DES with a recommended course of action in response to the on-site auditor's findings. The reviewer's report was provided to DES on 19 March 2003. In his report, the reviewing auditor included the rider that he '[could not] confirm or deny that the issues raised in the [on-site audit] report are fact or not'. In that context, the reviewing auditor commented that '… the [on-site] auditor has found that no urgent safety issues exist'. In addition, the reviewer noted:

> I have confirmed with the [former] Chief Pilot that the [on-site] auditor provided no verbal debrief to the [former] Chief Pilot/Manager or to the Chairman of the Board as to any safety issues of note that needed to be dealt with immediately.

> My consideration of the report is that there are no significant safety issues presented by the auditor nor is there any evidence of concern by the auditor as to implementation of recommendations. This suggests that the auditor found no safety issues of significance.

The reviewing auditor's report recommended the following course of action:

- that DES should accept the on-site report 'as is'
- DES should require the operator to address the issues raised in the on-site report, and to provide DES with a review plan within 7 days
- the operator should be required to provide DES with an additional independent audit report within 90 days in order to allow DES to confirm any follow-up actions in response to the initial on-site audit.

In response to the reviewer's report, the Director of Aviation Services requested the former Chief Pilot/CEO to comment on the results of the on-site audit. The former Chief Pilot/CEO responded in writing on 27 March 2003, including that the on-site auditor had informed him that:

> Overall everything is fine. Just the manual needs to be brought up to date.

In regard to the auditor's concerns about the conduct of night VFR operations by the operator, the former Chief Pilot/CEO stated:

> The auditors need to be more specific as to what is being carried out incorrectly here. All pilots are aware of the requirements. A letter is being sent to the auditors for more details.

There was no evidence that the operator had ever written to, or otherwise contacted the auditor in that regard, or that the Director of Aviation Services had attempted to confirm that that undertaking made by the former Chief Pilot/CEO had been fulfilled.

The possibility of the operator conducting night VFR operations in less than VMC conditions was not raised again in any of the subsequent audit reports, or in any operator/DES correspondence.

The investigation contacted the on-site third party auditor to discuss the conduct and outcomes of that audit. The auditor did not resile from his earlier reported concerns regarding the conduct of night operations by the operator in conditions that were less than VMC. In addition, the auditor reported that he did raise that concern during a verbal debrief with the available senior base pilots at the conclusion of the on-site audit. The former Chief Pilot/CEO was reported by the auditor to not be present at that debrief.

At interview, the on-site third party auditor indicated that he had never been contacted by the reviewing third party auditor.

On 16 May 2003, the operator commissioned an external consultant to conduct an Internal Safety Audit and SSC. The SSC was in response to the desire by the operator for a more in-depth assessment of organisational safety issues than may have been possible through the conduct of an in-isolation audit of the operation. In addition, the operator sought to understand the nature of a number of concerns about the EMS operation that had been raised by QAS paramedics.

The consultant determined that '…uncertainty existed as to the acuity of some of the [paramedics'] stated concerns'. In addition, the consultant noted that it was

unlikely that any of the paramedics' concerns could be effectively and objectively considered as part of his examination. That was primarily as a result of the lack of any documentary evidence in support of the paramedics' concerns.

However, the consultant did identify the 'immature development of an effective systemic safety system' at the company, which should be addressed by the 'prompt application of a comprehensive Systemic Safety Program'. That finding appeared to reflect the finding in the consultant's audit report, which included an alert that there was 'poor operational risk awareness within the company'.

There was no evidence in either the defined scope of the Internal Safety Audit, or in the listed audit references that indicated that the audit was in response to the recommendations made by the previous reviewing auditor's 19 March 2003 report. Specifically, neither the SSC nor the safety audit examined the operator's conduct of night VFR operations, and whether the previously reported incidence of night VFR operations in 'less than legal VMC' was ongoing.

The SSC and audit reports were forwarded to the DES by the former Chief Pilot/CEO on 2 July 2003. In response, the DES directed the operator's attention to the requirement under the terms of the Agreement for the operator to have had an in-house safety program in place within 12 months of signing the Agreement. That was, by 30 January 2003. In addition, the DES requested advice of any proposed enhancements to the operator's current safety program that may have resulted from the operator's consideration of the content of the SSC and audit. The former Chief Pilot/CEO subsequently forwarded a draft Safety Plan to the DES on 24 July 2004.

The company safety plan was finalised sometime later. Amendment 8, dated 22 July 2005 was current at the time of the incident.

The previously discussed September 2005 SSE examined the safety culture existing in the company at that time. The SSE report noted that:

> During the interviews a number of staff indicated they believed that prior to senior management changes in 2005, a negative safety culture existed [at the company].

In addition, the SSE report noted that there had previously been an environment that included 'top level opposition' to a positive safety culture but that 'recent management changes have had a positive impact on safety'. One of the operator's pilots was quoted in the SSE report as expressing concerns that 'night VFR ambiguity in the industry' was a major risk. The SSE report suggested that 'Clear GO/NO GO [meteorological and other] criteria were needed [for application in night VFR operations] as it is currently not definitive' in the company documentation.

The Chief Pilot and CEO indicated that the operator had invested heavily over the period 1 August to 6 October 2005 in an effort to ensure that company pilots understood the AIP night VFR requirements as they affected the operator's night EMS operations. The CEO stated that, as a result of that effort:

> There could have been no doubt in any [company] pilot's mind that, at the time of the incident, compliance, including night VFR compliance, was demanded by the CEO and Chief Pilot.

CASA Audits

The available CASA audit reports for the period February 2003 to September 2005 had not commented on the conduct of operations under the night VFR by the operator. In particular, a CASA audit report dated 30 September 2004 stated that:

> The company was found to be operating in accordance with its procedures manual and the CARs, and no discrepancies were noted.

Additional information

Independent reviews of EMS operations

At least four reviews of the aeromedical retrieval system in Queensland have been undertaken since 1994. ATSB aviation safety investigation report BO/200304282 contains an overview of one of those reviews that was conducted in 2000. The most recent independent review of the aeromedical retrieval system in Queensland was completed in August 2004. That review highlighted that the continued use of VFR aircraft for night aeromedical operations should be subject to a Queensland Emergency Medical System Advisory Committee (QEMSAC) inquiry. In addition, the review recommended that:

> QEMSAC develop a policy which clearly articulates its position on the conduct of night operations by aeromedical helicopters in Queensland for the present and the future.

The benefits of and risks associated with aeromedical operations were also examined in the August 2004 review, with a particular focus on the problematic accident trend emerging in Australia, and particularly in Queensland, amongst EMS helicopter operators. It also summarised the findings from previous reviews, which supported the ongoing use of VFR helicopters for night EMS operations providing that certain criteria relating to personnel, training, experience and equipment were met.

The August 2004 review emphasised the need for restrictions on night flying, including the provision of stricter guidelines, standard operating procedures, standardised pilot training, pilot decision protocols for task acceptance, and better coordination for night VFR aeromedical operations. Moreover, the review stated that:

- VFR aircraft possibly not suitable for 24 hour service or stricter restrictions necessary.
- Need for specified aircraft type and response capabilities (twin engine IFR to minimise risk).
- Need to provide clear definition of aircraft type and suitability for CHP service.
- If government requires full IFR service, need for significant injection of funding to CHPs operating with small population base.

Risks associated with night VFR helicopter EMS operations

A detailed presentation of the risks associated with night VFR EMS helicopter operations in both Australia and abroad has been presented in ATSB aviation safety investigation report BO/200304282. The incident pilot reported being very familiar with that ATSB report and, in his capacity as the operator's Safety Officer, had presented that material to the operator's staff. The ATSB report included research that indicated that the overall accident and fatal accident rates for Queensland CHP EMS helicopter services were significantly higher than the national average.

Since the release of ATSB aviation safety investigation report BO/200304282, additional research has been conducted into the safety of EMS helicopter operations in the US.[22] The research examined US National Transportation Safety Board (NTSB) records of EMS helicopter accidents between 1983 and 2005. Of the 182 EMS helicopter accidents reported, 32% occurred while enroute to pick up patients, 28% had patients on board, and 29% of the flights were returning to base after delivering the patient to the medical facility. Flight time was not related to the accident outcome. The average pilot flight time experience was 6,230 hours for those involved in non-fatal accidents, and 5,968 hours for those involved in fatal accidents. The research indicated that 48% of all EMS helicopter accidents, and 68% of the fatal accidents, occurred at night. In addition, 17% of accidents occurred in IMC, and 77% of those accidents were fatal. All but one accident occurred during single-pilot EMS operations.

Overall, the results indicated that darkness more than tripled the risk of fatalities in EMS helicopter accidents, and that bad weather increased the risk eightfold. The statistics also indicated that one EMS helicopter in four is likely to have an accident during 15 years of service. Previous US research has indicated that an EMS helicopter pilot or crewmember flying 20 hours per week during a 20-year career would have a 37% chance of being involved in a fatal accident.[23]

The EMS research literature has discussed whether, in order to reduce the likelihood of accidents occurring during night operations, helicopters and personnel should be equipped for operations that include the use of night vision goggles (NVGs).[24, 25, 26] The research has reported that, because of the high cost of NVGs, and the associated helicopter modifications, few US companies have invested in that equipment. The cost of the required aircraft modifications, NVGs and initial crew training was in the order of $130,000 to $150,000 US.[27, 28] Those figures did

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22 Baker, S. P., Grabowski, J. G., Dodd, R. S., Shanahan, D. F., Lamb, M. W., Li, G. H. (2006). EMS helicopter crashes: What influences fatal outcome? *Annals of Emergency Medicine, 20,* 1-5.

23 Wright, R. M., Jr. (2004, Winter). Air Medical service, an industry under scrutiny. *Rotor,* 6-8.

24 Baker, S. P., Grabowski, J. G., Dodd, R. S., Shanahan, D. F., Lamb, M. W., Li, G. H. (2006). EMS helicopter crashes: What influences fatal outcome? *Annals of Emergency Medicine, 20,* 1-5.

25 The operator's Board approved the development of an NVG capability in July 2005 but the development was delayed pending the finalisation of CASA's approach to the capability.

26 Australian Transport Safety Bureau. (April, 2005). *Night vision goggles in civil helicopter operations* (Aviation Research Paper B2004/0152). Canberra, ACT: Author.

27 According to Aviation Specialties Unlimited (ASU), estimates for equipping a helicopter like a Bell 206 for NVG operations, including 2 pairs of NVGs, installing an NVG-compatible cockpit,

not take into account the additional maintenance infrastructure required, ongoing crew training, and implications for the management of crew duty times. Furthermore, the research has commented that the effectiveness of NVGs in reducing accidents had not been evaluated, although there had been no EMS helicopter controlled flight into terrain accidents where NVGs were used by the crew.[29] The extent to which NVGs might increase the incidence of hazardous, low visibility flights, with potential negative consequences is unknown.

Finally, the research also noted that reductions in night EMS flights may be appropriate when ground transport is a feasible alternative, as was the case in much of Europe, where night EMS helicopter flights are rare. Given the size and geography of Australia, that may not be appropriate in the Australian context. However, a review of US EMS data indicated that air transport was not warranted in the majority of cases.[30, 31] That appeared to support the European rationale for reducing exposure to the risks associated with unnecessary night VFR EMS flights.

Pilot weather-related decision-making behaviours

Weather-related aviation accidents remain one of the most significant causes for concern in aviation safety. This is despite over half a century of work by aviation professionals and human factors researchers aimed at understanding the reasons behind accidents such as those involving VFR into IMC. In particular, there has been substantive research examining weather-related decision-making amongst pilots.[32, 33, 34, 35, 36, 37] Various training tools, which have been developed by

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and initial training for 4 pilots, is in the order of $58,000 US. See Croft, J. (May, 2006). Bring it on. *Rotor & Wing*, 26-32.

28 Atwood, M. (2005, July 25-26). Lessons learned in the night-vision goggle world: night vision goggle operations. *Association of Air Medical Services Night-Vision Goggle Conference.* Dallas, TX.

29 Megna, D. (2005). Conquering the night: night-vision goggles in the civil helicopter industry. *Helicopter Monthly Online Magazine*. (Available at http://www.helicoptermonthly.com).

30 Bledsoe, B. E., & Smith, M. G. (2004). Medical helicopter accidents in the United States: a 10-year review. *Journal of Trauma: Injury, Infection and Critical Care, 56,* 1325-1329.

31 Bledsoe, B. E., Wesley, A. K., Eckstein, M., Dunn, T. M., O'Keefe, M. F. (2006). Helicopter scene transport of trauma patients with non-life threatening injuries: A meta-analysis. *Journal of Trauma: Injury, Infection and Critical Care, 60,* 1257-1266.

32 Wiggins, M. W., & O'Hare D. (2003). Weatherwise: Evaluation of a cue-based training approach for the recognition of deteriorating weather conditions during flight. *Human Factors, 45,* 337-345.

33 Wiggins, M. W., & O'Hare, D. (2003). Expert and novice pilot perceptions of static in-flight images of weather. *International Journal of Aviation Psychology, 13,* 173-187.

34 Hunter, D. R, Martinussen, M., & Wiggins, M. (2003). Understanding how pilots make weather-related decisions. *International Journal of Aviation Psychology, 13, 73-87.*

35 Wiggins, M. W. & O'Hare, D. (1995). Expertise in aeronautical weather-related decision-making: A cross-sectional analysis of general aviation pilots. *Journal of Experimental Psychology: Applied, 1, 305-320.*

36 Batt, R., & O'Hare, D. (2005). Pilot behaviors in the face of adverse weather: A new look at an old problem. *Aviation, Space, and Environmental Medicine, 76,* 552-559.

researchers to facilitate better weather-related decision-making, have also been made available to pilots by CASA.[38] Furthermore, CASA has organised and conducted safety seminars on a regular basis for pilots across Australia. Those seminars have included case studies on weather-related accidents.

A recent ATSB aviation research report (B2005/0127) titled 'General Aviation Pilot Behaviours in the Face of Adverse Weather' examined a set of 491 Australian accident and incident reports involving weather-related decision-making behaviours amongst pilots.[39] Weather-related decision-making behaviours can be defined as those behaviours necessary to recognise and avoid meteorological phenomena that present a hazard to a flight.

The study highlighted the following three primary decision-making behaviours amongst the accident and incident reports examined:

- decisions that resulted in VFR flight into IMC (280 cases), comprising 45 accidents and 235 incidents
- the conduct of a weather-related precautionary landing (60 cases), comprising 14 accidents and 46 incidents
- the decision to carry out some other significant avoidance action (151 cases), comprising 5 accidents and 146 incidents.

The three decision-making behaviour groups identified by the study represent a behavioural continuum that reflects different levels of risk to the safe completion of a flight, with VFR into IMC representing the greatest threat to flight safety. Pilots in the weather-related precautionary landing, or 'weather avoidance' group were distinguished by taking timely action before the mid-point of the flight. Seventy six percent of the VFR flight into IMC accidents involved a fatality. The chances of a VFR into IMC encounter increased as the flight progressed until reaching a maximum during the final 20% of the flight distance. This result highlights the danger of pilots 'pressing on' to reach their destination.

One of the difficulties with night VFR operations is that often VMC assurance cannot be guaranteed by a pilot. That is, the pilot cannot always be confident that VMC conditions can be maintained at all times during the planned flight because, depending on the ambient or celestial lighting, there is no means to accurately assess the in-flight visibility and to detect and/or estimate distance from cloud.

In the current incident, the pilot commented that the forecasts used to plan the series of flights earlier in the day, his in-flight observations of the weather, and the content of Brisbane ATIS 'Oscar' provided sufficient information to commit to the night VFR flight on top of scattered cloud. The pilot reported that there were no factors that would have suggested that he needed to seek a weather update for the flight to Maroochydore.

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37 O'Hare, D., & Smitheram, T. (1995). "Pressing on" into deteriorating conditions: an application of behavioural decision theory to pilot decision making. *International Journal of Aviation Psychology, 5*, 351-370.

38 See http://www.casa.gov.au. For example, Weather Wise CD, Weather to Fly DVD, In-Flight Decision Making CD.

39 The cases included fixed-wing general aviation occurrences but excluded night VFR flights, sport aviation, and aerial work such as agricultural flying.

The pilot reported a rapid deterioration in the weather when overhead the Pine River Bridge, with the cloud coverage increasing to 8 oktas. That observation, and the report of the presence of broken cloud with a base of 1,000 ft at Maroochydore that was received from the Brisbane Approach North controller, were available to the pilot before he reached the mid-point of the flight. However, the pilot elected to continue to Maroochydore. The pilot considered that a VMC return to Brisbane was not possible, and reported that he was unfamiliar with the Brisbane IAL procedures and did not have the supporting IAL approach plates available onboard the helicopter. However, the pilot's assessment of the weather in the Brisbane area was not consistent with Brisbane ATIS 'Oscar', or with the 1802 or 1832 METARs. The investigation could not reconcile the apparent disparity between the pilot's assessment of the Brisbane weather and the observations reported by the BoM. The pilot's behaviour was consistent with the VFR into IMC decision-making group identified in the ATSB aviation research report.

Additional research findings on VFR flight into IMC

Wiggins and O'Hare (1993) [40] have defined effective weather-related decision-making as:

> occurring during operations under Visual Flight Rules (VFR) in which a pilot recognizes and avoids conditions which are below that necessary to maintain flight within visual meteorological conditions, ensuring both the safety of the aircraft and its occupants, and achieving as closely as possible, the stated objectives of the flight.

VFR flight into IMC is often characterised by pilots' decisions to continue flights into adverse weather conditions despite having been given information or presented with cues indicating that they should do otherwise.[41] This continuation of one's original plan, even with the availability of new evidence suggesting that the plan should be abandoned, has been termed a plan continuation error.[42] Such behaviour is also typical of the effects of confirmation bias.

Confirmation bias involves a person seeking information to confirm an expectation or assumption and rejecting that information which conflicts with that expectation. An example of confirmation bias can be drawn from the situation where an operator has a strong motivation for a particular activity or diagnosis.[43] Under those circumstances, the operator is more likely to seek out that information that confirms a decision, and reject, ignore or explain away that information which conflicts with the decision. In the aviation environment, confirmation bias is most evident in accidents involving inadvertent visual flight into IMC where pilots are known to

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40 Wiggins, M., & O'Hare, D. (1993). A skill-based approach to aeronautical decision making. In R. Telfer, (Ed.), *Aviation instruction and training* (pp. 431). Aldershot: Gower.

41 National Transportation Safety Board. (1989). *Safety report: General aviation accidents involving visual flight rules flight into instrument meteorological conditions* (NTSB/SR-89/01). Washington, DC: Author.

42 Orasanu, J., Martin, L., & Davison, J. (2001). Cognitive and contextual factors in aviation accidents. In E. Salas & G. Klein (Eds.), *Linking expertise and naturalistic decision making* (pp. 209-226). Mahwah, NJ: Erlbaum.

43 Plous, S. (1993). *The psychology of judgement and decision-making*. New York, NY: McGraw Hill.

continue a flight irrespective of the apparent difficulty of the situation.[44] The continuation of VFR flight into adverse weather reflects a growing commitment by the pilot to a chosen course of action, or a tendency to adhere to an original plan, despite evidence or cues indicating that an alternative course of action may be safer. Furthermore, confirmation bias can interfere with a pilot's critical analysis and ability to evaluate the feasibility of the chosen plan over time.

O'Hare and Smitheram (1995)[45] found that, during a simulated VFR cross-country flight, pilots who were presented with adverse weather information that focused on the gains of diverting (eg. personal safety) were less likely to continue the flight than pilots who were presented with the same weather information that focussed on the losses associated with diverting (eg. loss of time, money and effort). The researchers suggested that decision frames may be induced by the proximity of the pilot's goal, such as the destination airport. As goal achievement gets closer, there may be a shift from the gains to the loss frame, resulting in what is known in prospect theory as the sunk-cost effect. If more has been invested in a certain course of action, it is less likely that this course of action will be abandoned than if less were invested.[46]

Goh & Wiegmann (2001b)[47] have suggested that VFR flight into IMC might be better explained in terms of errors in situation assessment. Pilots risk pressing on into deteriorating weather because they do not fully realise they are doing so. That is, pilots continue VFR flight into IMC when they misdiagnose the changes in or severity of the weather. However, this tends to occur with inexperienced pilots. Klein's (1993)[48] recognition-primed decision making model proposes that experience or expertise allows an individual to diagnose a situation quickly, enabling a pilot to immediately identify a feasible course of action. Pilots with more experience should be better able to diagnose adverse weather and decide to divert sooner compared to pilots with less experience. However, older and more experienced pilots are not necessarily under-represented in accident statistics. For example, Wiggins and O'Hare (1993)[49] quote US data that indicated that pilots aged 40 to 55 comprised 32% of the active US pilot population between 1975 and 1986, but were involved in approximately 43% of the VFR flight into IMC accidents during that period.

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44 Wiggins, M., & O'Hare, D. (1993). A skill-based approach to aeronautical decision making. In R. Telfer, (Ed.), *Aviation instruction and training* (pp. 430-475). Aldershot: Gower.

45 O'Hare, D., & Smitheram, T. (1995). "Pressing on" into deteriorating conditions: An application of behavioural decision theory to pilot decision making. *The International Journal of Aviation Psychology, 5,* 351-370.

46 Kahneman, D., & Tversky, A. (1982). Choices, values, and frames. *American Psychologist, 39,* 341-350.

47 Goh, J., & Wiegmann, D. A. (2001b). Visual flight rules (VFR) flight into instrument meteorological conditions (IMC): An empirical investigation of the possible causes. *The International Journal of Aviation Psychology, 11,* 359-379.

48 Klein, G. A. (1993). A recognition-primed decision (RPD) model of rapid decision making. In G. A. Klein, J. Orasanu, R. Calderwood, & C. E. Tzambok (Eds.), *Decision making in action: Models and methods* (pp. 138-147). Norwood, NJ: Ablex.

49 Wiggins, M., & O'Hare, D. (1993). A skill-based approach to aeronautical decision making. In R. Telfer, (Ed.), *Aviation instruction and training* (pp. 430-475). Aldershot: Gower.

Wiegmann, Goh, & O'Hare (2002)[50] found that the location at which adverse weather is encountered during a flight affects pilots' decisions to continue with the flight. Results indicated that pilots who encountered the deteriorating weather earlier in the flight flew longer into the weather prior to diverting, or had more optimistic estimates of the weather conditions, than did pilots who encountered the deteriorating weather later in the flight. This finding was not consistent with the sunk-cost hypothesis that pilots were more likely to continue VFR flight into IMC because more time and effort had been invested in the flight (sometimes known as 'get-there-itis'). The results were more consistent with the situation assessment hypothesis, which suggested that pilots who encountered adverse weather early in a flight tended to 'have a look', or to fly longer into the adverse weather in an attempt to reconcile the disparity between the encountered weather and the weather information obtained before departure.

Wiegmann & Goh (2000)[51] found that the accuracy of visibility estimates, one's appraisal of one's own skill levels and judgement, and the frequency of an individual's risk-taking behaviour were most important in predicting whether a pilot would continue VFR flight into IMC, or would divert. During training, pilots are taught to feel confident in their ability to control the aircraft in all flight regimes. However, an unfortunate by-product of that training may be a degree of overconfidence in one's skill level, and an unrealistic optimism about the chances of avoiding harm through personal control.

Erosion of instrument flying skills

The pilot had significant previous instrument flying experience in the ADF. However, the pilot did not hold a current instrument rating of any kind and the helicopter was not equipped for single-pilot IFR operations. Instrument flying is a highly perishable skill that requires regular practice and assessment by appropriately qualified and proficient instructors to maintain a safe level of competency. The pilot, despite his experience, was still at risk of disorientation and loss of control in IMC because he was neither recent nor current to the standard of a Multi-Engine Command Instrument Rating (Helicopter) required by the CASA regulations. There have been instances in Australia of night VFR EMS/SAR helicopter accidents which involved former military pilots with substantial, but not current, instrument flying experience misjudging their position and/or losing control of the aircraft.[52]

An analysis of 1,494 US helicopter accidents, including an examination of 58 EMS helicopter (HEMS) accidents, between 1990 and 2000 was conducted by the

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50 Wiegmann, D. A., Goh, J., & O'Hare, D. (2002). The role of situation assessment and flight experience in pilots' decisions to continue visual flight rules flight into adverse weather. *Human Factors, 44,* 189-197.

51 Wiegmann, D. A., & Goh, J. (2000). *Visual flight rules (VFR) flight into adverse weather: An empirical investigation of factors affecting pilot decision making* (Technical Report ARL-00-15/FAA-00-8). Washington, DC: FAA.

52 Australian Transport Safety Bureau (ATSB) aviation safety investigation reports BO/200003130 and BO/200102083 (available at www.atsb.gov.au).

National Aeronautics and Space Administration (NASA) Ames Research Centre.[53] Approximately 53% of the HEMS accidents occurred between dusk and dawn and nearly five times as many HEMS accidents occurred in IMC compared to other helicopter accidents. Some of the pilot-related risk factors associated with the accidents included: inability to evaluate the weather; inadvertent flight into IMC; spatial disorientation; and inadequate pre-flight planning.

With reference to pilot instrument flying experience: [54]

> The Ames researchers found a significant difference in regards to instrument ratings. EMS pilots were far more likely to have an instrument rating than all helicopter pilots involved in accidents. They may not have been current and they may not have been flying helicopters that were IFR equipped, but their training and experience was noted…..while this additional training and experience should be considered an advantage to the EMS helicopter pilots, it may have worked as a disadvantage if the pilots training and experience would allow them to "push the envelope a little bit more."

The risk of a pilot becoming disoriented and losing control of an aircraft in IMC is reduced if the pilot has significant previous instrument flying experience. However, that risk is not nullified, even if the pilot holds a current Command Instrument Rating. In a report into the safety aspects of helicopter EMS operations, the US NTSB summarised the risks of spatial disorientation after loss of visual reference and noted that: [55]

> If the pilot is not trained (and current) to fly the aircraft by reference to instruments, there is a great risk of losing control of the aircraft. Even if the pilot is instrument rated, current, and proficient in helicopters, success in coping with inadvertent instrument flight is not guaranteed. The FAA has reported that in tests with qualified instrument pilots, it took as long as 35 seconds for some of the pilots to establish full control of the aircraft by instruments after loss of visual contact with the surface (and these tests were conducted with fixed-wing aircraft, which are inherently more stable than helicopters).

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53 Hart, S. G. (2000). EMS accident and incident trends (NASA-Ames Research Center, Moffett Field, CA). Presented at the AMTC Conference, Salt Lake City, UT.

54 Blumen, I. J. et al. (2002). A safety review and risk assessment in air medical transport. *Supplement to the Air Medical Physician Handbook* .Salt Lake City, UT: AMPA.

55 US National Transportation Safety Board. (1988). *Safety study – Commercial emergency medical service helicopter operations* (NTSB/SS-80/01). Washington, DC: Author.

ANALYSIS

Operational aspects

The meteorological information that was accessed by the pilot at about 1400 in order to plan for the series of flights was appropriate for the conduct of the planned night Visual Flight Rules (VFR) flight to Maroochydore.

However, had the pilot complied with the requirements of the Aeronautical Information Publication (AIP) ENROUTE (ENR) section 1.2.8 prior to his departure from the Princess Alexandra Hospital (the hospital), he would have been aware of the content of the amended 1557 Area 40 forecast, and of the amended 1626 Maroochydore Terminal Aerodrome Forecast (TAF). Those forecasts indicated that the pilot's planned night VFR flight on top of cloud remained possible. However, by examining those forecasts, the pilot may have identified the apparent risk of developing low cloud and fog affecting the Maroochydore area earlier than indicated in the meteorological information that was used to plan the flight.

Given the pilot's high level of experience, an awareness of the risk of the progressively earlier development of low cloud in the Maroochydore area would most likely have resulted in the development by the pilot of an alternate recovery strategy should the low cloud have developed sufficiently to have adversely affected the planned night VFR arrival at Maroochydore. Despite the absence of a clear decision-making matrix that was proposed in the September 2005 Safety System Evaluation, and still under development at the time of the incident, any alternative strategy could have been expected to have relied on the pilot remaining in Visual Meteorological Conditions (VMC). In that case, there would have been no need for the approach to Maroochydore in instrument meteorological conditions (IMC).

Since the pilot did not access any updated meteorological information since planning the series of flights earlier that afternoon, the 1823 in-flight report of the presence of broken low cloud at Maroochydore was the first indication to the pilot that his plan for the conduct of the flight under night VFR was problematic. The observation by the pilot of a solid layer of cloud beneath and in front of the helicopter along the intended route meant that, by continuing the flight to Maroochydore, the pilot was committing to night VFR flight above more than scattered cloud. On the basis that the pilot could not assure himself of maintaining VMC during the remainder of the flight, including during the descent at Maroochydore, the requirements of AIP ENR 19.2.1d meant that night VFR flight above more than scattered cloud was not possible.

The pilot's assessment in the vicinity of the Pine River Bridge that there was 8 oktas of cloud over the Brisbane area to the rear of the helicopter was made 8 minutes after becoming airborne at the hospital, and contrasted with the pilot's observation that there had been minimal low cloud overhead the Brisbane central business district when he departed the hospital. Similarly, the pilot's assessment was not consistent with: the scattered cloud that was indicated in Brisbane Automatic Terminal Information Service (ATIS) 'Oscar'; or the amount of cloud that was indicated in either of the 1802 or 1832 Brisbane Trend Type Forecast/Routine Aerodrome Weather Reports (TTF/METARs).

The investigation could not reconcile the apparent disparity in the amount of cloud overhead Brisbane. However, there may have been an earlier than forecast development of the layered cloud that was subsequently reported in the 1832 TTF/METAR in the area behind and to the rear of the helicopter. Had that been the case, it was not inconceivable that, from his altitude of 4,000 ft, and given his probable slant view of any clouds to the rear of the helicopter, the pilot may have perceived the forecast few clouds, base 1,600 ft and scattered cloud, base 2,200 ft as representing approaching 8 oktas.

Nonetheless, after receiving and acknowledging advice from the Brisbane Approach North controller of the observed broken low cloud at Maroochydore, and subsequently responding to the controller's query regarding the VFR-nature of the flight, the pilot did not attempt to obtain the latest available observations and/or forecasts for Maroochydore, Brisbane or any other potential alternative destination aerodromes. That and the pilot's decision to not avail himself of any potential assistance from the Brisbane Approach North controller in the consideration and resolution of alternative options, restricted the pilot to the recovery at Maroochydore in conditions in which he was not qualified to operate, and for which the helicopter was not single-pilot instrument flight rules (IFR)-equipped.

Had the pilot made the decision to discontinue the flight and to return to Brisbane, he would have had the benefit of an approach and landing in controlled airspace with all of its associated Air Traffic Services (ATS). Those services included the (if required/requested) provision of radar guidance in order to avoid terrain, other traffic, and weather. The ATS could also have provided heading and altitude instructions that minimised the potential for flight into IMC, provided for a safe and timely cloud break, or provided assistance to establish the aircraft for a visual approach. Nonetheless, the Brisbane weather forecasts and observations and ATIS 'Oscar' indicated that the weather was suitable for a visual approach at the time the pilot elected to continue to Maroochydore. The risks for a return to Brisbane were arguably far lower than continuing to Maroochydore, where the conditions were reported to the pilot as being unsuitable for a descent in VMC.

The pilot's behaviour was consistent with a plan continuation error, or with confirmation bias having influenced his decision-making. The continuation of the night VFR flight into adverse weather reflected a growing commitment by the pilot to a chosen course of action, despite the reported meteorological conditions that, together with his lack of a current Command Instrument Rating (Helicopter), and the helicopter's lack of necessary equipment for single-pilot IFR operations, indicated that an alternative course of action may have been a safer option.

The pilot's decision to continue VFR flight into IMC was also consistent with the situation assessment hypothesis, which suggested that pilots who encountered adverse weather early in a flight tended to 'have a look', or to fly longer into the adverse weather in an attempt to reconcile the disparity between the encountered weather and the weather information obtained before departure. The pilot's decision after being advised of the low cloud at Maroochydore to not access any available updated weather for that destination appears to reinforce the applicability of that hypothesis in this case.

The simulated instrument training that was recorded by company pilots, in part, enabled the pilot to successfully carry out the runway 36 instrument approach and landing (IAL) procedure at Maroochydore. Nonetheless, as indicated by the Chief Pilot, that training, the pilot's previous instrument flying experience in the

Australian Defence Force, and the pilot's reported general comfort with the conduct of the Maroochydore IAL procedure may also have influenced his decision to continue the planned night VFR flight into IMC. This finding was consistent with the available research into the conduct of VFR flights into IMC, in that the pilot's previous and current instrument flying training may have provided a degree of overconfidence in his skill level, and an unrealistic optimism about the chances of avoiding harm through his personal control of the instrument approach at Maroochydore.

The pilot was the operator's Safety Officer, and had presented accident case studies to staff, including on the most recent Australian fatal emergency medical service (EMS) helicopter accident at Cape Hillsborough, Qld (see aviation safety investigation report BO/200304282, available at www.atsb.gov.au). The company Safety Officer was, in part, responsible for instilling the operator's approach to safety in the operator's staff. The operator's documentation suite also appeared to emphasise safety as an integral part of its operations.

However, the action by the pilot in this incident to continue the night VFR flight into IMC indicated an inconsistency between the operator's documented philosophy, policies and procedures, and the practices of some of its flight crews. In particular, it would appear that the efforts and focus by the Chief Executive Officer and Chief Pilot on night VFR compliance risks, and their management, had no bearing on the pilot's behaviour, which would appear consistent with the reported previous company culture. The pilot's behaviour was not consistent with the admonitions and procedures contained in the company documentation, or with the Chief Pilot's attempts to implement a more robust safety regime. It was consistent with previously reported instances in which the operator was reported to have conducted night VFR flight in IMC conditions.

Organisational aspects

The Department of Emergency Services (DES) response to the report by the on-site auditor of night VFR operations by the operator in less than VMC, and to the operator's draft action plan in response to that audit, appeared to have been the conduct of the desktop review of the findings of that auditor's report. Despite the known limitations affecting the conduct of that desktop review, the DES appeared to have placed greater reliance on the conclusions that were made by the desktop reviewer, than on the content of the original on-site audit report.

In its draft action plan, the operator omitted to address the conduct of night VFR operations in less than VMC that was reported by the on-site auditor. There was the potential that that omission, together with the desktop reviewer's conclusion that there were no significant safety issues affecting the EMS operation, may have combined to have marginalised the importance of the on-site auditor's initial observation.

Any perceived diminished importance placed on the on-site auditor's observation by the DES would have been reinforced by the omission by the former Chief Pilot/Chief Executive Officer to correspond with the on-site auditor regarding the conduct of night VFR operations in less than VMC, before advising the DES of any company management response. That may have explained why, after the initial concern shown by the DES regarding the reported conduct by the operator of night VFR operations in less than VMC, the issue was effectively never resolved. That

included the DES not confirming the operator's actions in response to the initial on-site audit report within 90 days of that audit, as recommended by the desktop reviewer.

In contrast, the DES response to the receipt of the 16 May 2003 Internal Safety Audit and Systemic Safety Consultation identified a lack of compliance with the Deed of Agreement, and sought action by the operator to address that deficiency. The lack of a similar positive action by the DES in regard to the operator's reported previous night VFR operations in less than VMC may have contributed to the operator's inaction in response to the on-site auditor's observation. As a result, the DES could not assure itself that instances of night VFR operations by the operator in less than VMC were not being conducted during the period prior to this incident.

In that context, the reported previous company culture of condoning such operations may have subtly contributed to the pilot's decision to continue VFR flight into IMC, and to complete the Maroochydore IAL procedure.

FINDINGS

Contributing safety factors

- The pilot committed to a night Visual Flight Rules (VFR) flight on top of more than scattered cloud, despite being unable to assure himself that Visual Meteorological Conditions (VMC) existed for the remainder of the flight.
- The pilot conducted an instrument approach and landing (IAL) procedure in meteorological conditions in which he was not qualified to operate, and for which the helicopter was not single-pilot instrument flight rules (IFR)-equipped.

Other safety factors

- The pilot committed to a night VFR flight on top of more than scattered cloud when he could not be confident that the meteorological information used to plan the flight was reliable and current.
- On receipt of a meteorological observation that indicated that VMC did not exist at Maroochydore, the pilot did not attempt to obtain the latest weather for Maroochydore, or any other potential alternative destination airfields.

Other key findings

- The pilot was appropriately qualified for the planned night VFR flight.
- The helicopter was certified and suitably equipped for the planned night VFR flight.
- The available weather forecasts indicated that:
  - the planned night VFR flight was possible
  - an alternate destination was not required for the planned night VFR flight.
- The pilot was unaware of the effect on the conduct of the series of flights of the requirements of Aeronautical Information Publication (AIP) ENROUTE (ENR) section 1.2.8.
- The operator's Air Operator's Certificate (AOC) did not support the provision of instrument flying training.
- There was substantial evidence that the operator had previously engaged in night VFR operations in weather conditions that were less than VMC.
- The reported conduct by the operator of night VFR operations in less than VMC was effectively never resolved by the Queensland Department of Emergency Services.
- Since the appointment of the current Chief Pilot and Chief Executive Officer, a number of improvements to the company safety system were being progressed by the operator.

SAFETY ACTION

As a result of this incident, a number of organisations and agencies have carried out numerous safety actions as highlighted in the following discussion.

Operator

The operator has undertaken the following safety actions:

- in February 2006, all company pilots received Multi-Engine Command Instrument Rating (Helicopter) training
- in July 2006, the operator commenced two-pilot instrument flight rules (IFR) operations in the BK-117 helicopter
- the Operations Manual was rewritten to include:
  - a check and training manual, which encompasses a cyclical pilot and aircrew training system
  - a comprehensive re-work of the company's night flying requirements which are, as a result, more restrictive than required by the Aeronautical Information Publication (AIP)
  - a night operations 'GO/NO GO' flow chart
  - the requirement for a risk management analysis in support of all proposed night operations
  - additional restrictions being placed on night visual flight rules (VFR) operations, in response to company concerns about the accuracy of meteorological forecasts and the compliance risk associated with marginal weather conditions
- issued Operations Memo 06/137 to all pilots and aircrew on the company's night VFR weather planning requirements
- counselled the pilot concerned
- developed and implemented procedures to ensure that pilots are supported with relevant information while on task and the base is manned
- provided additional safety-related training to company personnel
- improved the induction training that is provided to staff to include risk management training
- developed a monthly safety and risk management newsletter, which presents and explains safety and risk-related case studies.

In addition, as part of its normal surveillance program, the Civil Aviation Safety Authority (CASA) conducted two audits of the operator in the 15-month period since the incident. The first audit was carried out on 4 March 2006 and the second on 5 January 2007.

The results of the March 2006 audit included a number of Requests for Corrective Action (RCA) and/or observations that were associated with identified deficiencies.

The January 2007 audit, although including some recommendations or suggestions for improvement, commented positively on the progress made by the company since the 2006 audit and resulted in no RCAs. In addition, the CASA 2007 audit stated that:

> A strong safety culture has been developed with an emphasis on hazard and error reporting, comprehensive crew competency training and checking, and the introduction of IFR capability. An ethos of "safety first" has been inculcated, and reinforced by continued commitment from management.

Department of Emergency Services

This incident has, in part, served to reinforce the relevance and impetus for the Department of Emergency Services (DES) to continue to progress its safety action in response to the recommendations made by the Coronial Inquiry into the fatal accident at Cape Hillsborough, Qld on 17 October 2003 (see aviation safety investigation report BO/200304282, available at www.atsb.gov.au).

In addition, the DES undertook safety action that was specifically related to this incident.

Cape Hillsborough Coronial Inquiry

The DES safety action that was commenced as a result of the Cape Hillsborough Coronial inquiry, and that has relevance to this incident, included the negotiation of new Service Agreements with the Community Helicopter Providers (CHPs). The new Service Agreements will require:

- an IFR–capable, twin-engine aircraft as the primary aircraft
- all pilots to hold a current Command Instrument Rating
- that single-engine VFR aircraft, which may be used as a back-up aircraft when the primary aircraft is unavailable, are to be used for daylight operations only.

In addition, the Queensland Government provided additional funding in order for CHPs to upgrade their services to an IFR capability. The revised DES requirements, and allocation of additional funds, were to be included in new Service Contracts with the CHPs. The timeframe for the implementation of the revised Service Contracts was dependent on the CHPs' agreement to the terms and conditions of those revised contracts. In that regard, a number of outstanding issues have yet to be finalised with the CHPs, including:

- the requirement for CHPs to obtain an Air Operator's Certificate (AOC), and the specified time-frame in which to acquire that AOC
- aircraft down-time
- the term of the Agreement.

Finally, the DES has introduced a centralised auditing system, to ensure consistency of safety standards and to enable systems audit findings to be shared across the network. The audit reports will also be presented to a newly-established Emergency Helicopter Network Advisory Group (EHNAG), which includes representation from:

- the Helicopter Services Unit
- EMQ Helicopter Rescue
- all Tasking Agencies (Queensland Health, Queensland Ambulance Service, Queensland Fire and Rescue Service, and Queensland Police Service)
- the Queensland Emergency Medical System Coordination Centre (QCC) – the body responsible for tasking the aircraft for aeromedical tasks
- the CHPs
- the commercial service provider in the Torres Strait.

The DES aim is that these arrangements will ensure that the key stakeholders in the emergency helicopter network are informed of any safety issues identified in the systems audits, and of the actions taken by helicopter providers to address those issues.

Safety action specific to this incident

The DES safety actions that are specifically related to this incident include:

- the establishment of an incident reporting system to enable the sharing of accident and incident information across the network
- strengthening the role of the Chief Pilot, EMQ Helicopter Rescue, in providing technical safety advice to the Helicopter Services Unit, and in liaising directly with the CHPs on safety matters.

Airservices Australia

Airservices Australia, in consultation with CASA, will amend AIP ENROUTE section 1.2.8 to explain the effect of that section of the AIP on each flight in a series of flights.

Civil Aviation Safety Authority

CASA had previously identified VFR flight into instrument meteorological conditions (IMC) as a critical factor in many incidents. In response, CASA has published a number of articles on the topic in its *Flight Safety Australia* magazine. More recently, CASA's *Crash Scene Investigator* workshops examined the risks associated with VFR flight into IMC.