



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

CORRECTED COPY

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In reply refer to: A-09-97 through -101

Public Helicopter Emergency
Medical Services Operator
[see attached list]

The National Transportation Safety Board (NTSB) is an independent federal agency charged by Congress with investigating transportation accidents, determining their probable cause, and making recommendations to prevent similar accidents from occurring. We are providing the following information to urge your organization to take action on the safety recommendations in this letter. The NTSB is vitally interested in these recommendations because they are designed to prevent accidents and save lives.

Calendar year 2008 was the deadliest year on record for the helicopter emergency medical services (HEMS) industry, with 12 accidents¹ (8 fatal accidents) and 29 fatalities. As a result of this increase in fatal accidents involving HEMS operations, the NTSB placed the issue of HEMS safety on its *Most Wanted List of Transportation Safety Improvements* on October 28, 2008,² and also conducted a 4-day public hearing to critically examine safety issues concerning this industry.³ Based on testimony given at this hearing, in addition to findings from recent HEMS accidents,⁴ the NTSB believes your organization needs to take action to prevent additional accidents. These actions include improved pilot training; flight data monitoring; and the use of dual pilots, autopilots, and night vision imaging systems (NVIS). Additional recommendations have been addressed to the Federal Aviation Administration (FAA), the Department of Health and Human Services' Centers for Medicare & Medicaid Services (CMS),

¹ The NTSB classifies a HEMS accident as one in which the accident flight involved an aircraft dedicated to or configured for air medical operations and was piloted by an EMS crew.

² See <http://www.nts.gov/Recs/mostwanted/aviation_improvesafety_ems_flights.html> for a discussion of these recommendations: A-06-12, A-06-13, A-06-14, A-06-15.

³ The NTSB's public hearing took place February 3–6, 2009. For details, see the NTSB website at <<http://www.nts.gov/events/Hearing-HEMS/default.htm>>.

⁴ See the NTSB website at <http://www.nts.gov/Publictn/A_Acc1.htm>. The public may view and download docket contents at <http://www.nts.gov/info/foia_fri-dockets.htm>. Details of the recent HEMS accidents that are used to support the recommendations contained in this letter are cited later in the section of this letter titled "Recent EMS Accidents."

the Department of Homeland Security's Federal Interagency Committee on Emergency Medical Services (FICEMS),⁵ and 39 other public HEMS operators.

HEMS operations provide an important service to the public by transporting seriously ill patients and donor organs to emergency care facilities, often from remote areas not served by adequate facilities. These operations, which comprise an estimated 750 helicopters, 70 commercial operators, and 60 hospital-based programs, are unique and complex, mixing highly advanced medical care with the technical challenge of safely operating helicopters 24 hours a day.⁶ Each year, approximately 400,000 patients and transplant organs are safely transported by helicopter. However, the pressure to conduct these operations safely and quickly in various environmental conditions (for example, in inclement weather, at night, or at unfamiliar landing sites for helicopter operations) increases the risk of accidents when compared to other types of commercial flight operations.

Previous NTSB Actions: Safety Study, Special Investigation, and Public Hearing

The NTSB has a long-standing interest in the safety of emergency medical services (EMS) aviation operations. In 1988, the NTSB conducted a safety study of commercial HEMS operations. That study evaluated 59 HEMS accidents and resulted in the NTSB issuing 19 safety recommendations to the FAA and to the air medical transportation industry.⁷ However, the late 1990s and early 2000s saw a rapid growth of HEMS operations and the number of accidents began to rise. Prompted by this rise, the NTSB completed a special investigation in January 2006 that analyzed 41 HEMS accidents and 14 airplane EMS accidents that had occurred during the previous 3 years, claiming 54 lives; of these fatalities, 39 occurred during HEMS operations.⁸ In this *Special Investigation Report on Emergency Medical Services Operations*,⁹ the NTSB identified the following recurring safety issues: less stringent requirements for EMS operations conducted without patients on board; the absence of aviation flight risk evaluation programs for EMS operations; a lack of consistent, comprehensive flight dispatch procedures for EMS operations; and a lack of requirements to use technologies such as terrain awareness and warning systems (TAWS) and NVIS to enhance EMS flight safety. As a result, the NTSB adopted four safety recommendations specifically addressing the need to improve the safety of EMS flights. These recommendations are currently included on the NTSB Most Wanted List.

⁵ FICEMS is an advisory committee whose function is to provide guidance and coordination on EMS. No federal agency is currently responsible for EMS oversight at the national level.

⁶ Estimates provided by the Association of Air Medical Services.

⁷ Most of these recommendations to the FAA were closed as a result of the June 20, 1991, issuance of FAA Advisory Circular (AC) 135-14A, "Emergency Medical Services/Helicopter (EMS/H)," which addressed equipment, training, crew resource management, decision-making, flight-following procedures, weather minimums, and the development of safety programs for HEMS flights operating under 14 *Code of Federal Regulations* (CFR) Part 135. Although the NTSB expressed concern at the time that the FAA chose to issue an AC instead of regulations, the number of EMS accidents was decreasing; thus, the recommendations were closed with a status of acceptable.

⁸ Accident rates would have been a better metric for evaluation, but HEMS operators are not required to report exposure data. Consequently, only raw counts were available.

⁹ *Special Investigation Report on Emergency Medical Services Operations*, NTSB/SIR-06/01 (Washington, DC: National Transportation Safety Board, 2006). The full report can be accessed at the NTSB website at <<http://www.nts.gov/publicctn/2006/SIR0601.pdf>>.

As noted above, 2008 was the deadliest year on record, with 8 fatal accidents and 29 fatalities, up from 2 fatal accidents and 7 fatalities in 2007. During its February 2009 public hearing, the NTSB heard testimony¹⁰ describing the perspectives of nearly every facet of the HEMS industry, including large and small companies, companies that conduct visual flight rules (VFR) and instrument flight rules (IFR) operations, hospital programs, and those who oversee HEMS operators. The hearing called upon 41 expert witnesses representing 8 HEMS operators, 12 associations, 6 manufacturers, and 4 hospitals. The witnesses participated as part of 12 panels¹¹ that addressed particular safety issues.¹²

By taking a comprehensive look at the HEMS industry, the hearing sought to obtain a more complete understanding of why this industry has grown rapidly in recent years and explored its increasingly competitive environment. Topics examined were flight operations procedures including flight planning, weather minimums, and preflight risk assessment, as well as safety-enhancing technology such as TAWS and NVIS. Flight recorders and associated flight operations quality assurance programs were also discussed. Training, including use of flight simulators, was discussed at length, as well as corporate and government oversight of HEMS operations.

Recent HEMS Accidents

Of the 12 HEMS accidents that occurred in 2008, the following 6 (listed chronologically) best illustrate the safety issues addressed in this recommendation letter:

- **South Padre Island, Texas (DFW08FA062).**¹³ On February 5, 2008, a Eurocopter AS350B2 impacted water and was destroyed. The airline transport pilot, flight nurse, and flight paramedic sustained fatal injuries. The flight was en route to pick up a patient at an emergency landing zone in a parking lot. The NTSB determined that the probable cause of this accident was the pilot's failure to maintain aircraft control, resulting in the helicopter impacting the water. Factors contributing to the accident were the pilot's inadvertent flight into instrument meteorological conditions (IMC), the low ceiling, dark night conditions, and the pilot's lack of recent instrument flying experience.
- **La Crosse, Wisconsin (CHI08FA128).** On May 10, 2008, a Eurocopter EC 135 T2+ was destroyed during an in-flight collision with trees. Night visual meteorological

¹⁰ See the NTSB website at <http://www.nts.gov/events/Hearing-HEMS/HEMS_Summary.pdf> for a summary of the public hearing testimony.

¹¹ The 12 sessions included Current EMS Models and Reimbursement Structures; State Oversight and Competition; Patient Transport Request Process; Flight Dispatch Procedures; Safety Equipment and Flight Recorders; Flight Operations Procedures and Training; Corporate Oversight; Safety Management Systems; and FAA Oversight.

¹² Additionally, several organizations designated as parties to the public hearing had an opportunity to question the witnesses directly. The parties, who were designated for their technical expertise in their respective fields, were the FAA; Association of Air Medical Services; Helicopter Association International (HAI); National EMS Pilots Association; Professional Helicopter Pilots Association; Air Methods (representing a relatively large operator); and CareFlite (representing a relatively small operator).

¹³ NTSB accident numbers are included to facilitate use of the NTSB Aviation Accident Database and Synopses site, which can be accessed at <<http://www.nts.gov/nts/query.asp>>.

conditions (VMC) prevailed. The pilot, physician, and flight nurse sustained fatal injuries. The flight departed La Crosse Municipal Airport, La Crosse, Wisconsin, and was destined for the University of Wisconsin Hospital heliport in Madison, Wisconsin. The accident remains under investigation.

- **Huntsville, Texas (DEN08FA101).** On June 8, 2008, a Bell 407 was destroyed when it impacted a heavily forested area during a night VMC flight. The pilot, flight nurse, flight paramedic, and passenger were fatally injured. The NTSB determined that the probable cause of this accident was the pilot's failure to identify and arrest the helicopter's descent, which resulted in its impact with terrain. Contributing to the accident was the limited outside visual reference due to the dark night conditions.
- **Flagstaff, Arizona (DEN08MA116A/B).** On June 29, 2008, two Bell 407 helicopters collided in midair while approaching the Flagstaff Medical Center helipad. Both helicopters were destroyed, and all seven persons aboard the two aircraft were fatally injured. Day VMC prevailed. The NTSB determined that the probable cause of this accident was both helicopter pilots' failure to see and avoid the other helicopter on approach to the helipad. Contributing to the accident were the failure of the pilot of one of the helicopters to follow arrival and noise abatement guidelines and the failure of the pilot of the other helicopter to follow communications guidelines.
- **District Heights, Maryland (MIA08MA203).** On September 27, 2008, an Aerospatiale (Eurocopter) AS365N1, registered to and operated by the Maryland State Police, on a public EMS flight, was substantially damaged when it collided with trees and terrain in a park during an instrument approach. The commercial pilot, one flight paramedic, one field provider, and one of two automobile accident patients being transported were fatally injured. Night VMC conditions prevailed for the departure; however, the flight encountered IMC en route to the hospital and diverted to Andrews Air Force Base. This accident remains under investigation.
- **Aurora, Illinois (CEN09MA019).** On October 15, 2008, a Bell 222 was destroyed when it struck a radio station tower and then impacted the ground. Night VMC prevailed in the area of the accident site. All four occupants, including the pilot, a flight paramedic, a flight nurse, and the 14-month-old patient, were fatally injured. The accident remains under investigation.

These six accidents have been specifically cited, where applicable, in this letter's discussion of each safety issue. More detailed flight histories are provided within each investigation report.

Pilot Flight Training

Testimony taken during the public hearing revealed that pilots who provide and/or receive HEMS flight training believe that scenario-based training could prevent many of the HEMS accidents that occur today. Additionally, FAA witnesses testified that the FAA's analysis of HEMS accidents over the past several years indicates that the causes were predominantly associated with flying at night, inadvertent flight into IMC, and controlled flight into terrain (CFIT). NTSB accident investigations are consistent with the FAA's analysis. As a result of that

analysis, the FAA developed guidance materials for HEMS operators that targeted those three areas; however, the FAA imposed no additional HEMS training requirements. Testimony also indicated that no requirements for instrument proficiency training currently exist for HEMS pilots and that the most common flight training that they receive is preparation to pass an annual VFR checkride, despite the fact that most HEMS accidents involve inadvertent flight into IMC. As a result, most HEMS pilots have not had adequate training to recognize the conditions that indicate when they are encountering IMC, how to effectively avoid IMC encounters, or how to escape safely should they encounter IMC.

The circumstances of some of the accidents discussed above demonstrate that increased training, targeted to the risks identified by the FAA and the NTSB, could likely have prevented these accidents. For example, witness statements and wreckage evidence indicate that the South Padre Island accident flight in February 2008 was consistent with a loss of control after an encounter with IMC resulting in a high-speed, port-side, inverted impact with water. A review of the pilot's experience showed that his most recent actual instrument experience was in 1997 when he completed an instrument competency check in a single-engine airplane. The only helicopter instrument experience entered in the pilot's logbook within the previous 10 years was two entries of simulated instrument time: 0.8 hour in December 2005 and 0.2 hour in September 2007. Had the pilot completed recent training in conducting flight at night and in instrument conditions, or scenario-based training to approach a remote landing site in those conditions, he likely would have been better able to identify and arrest the helicopter's descent.

The District Heights accident in September 2008 is another example of an accident pilot likely not receiving adequate training for the type of circumstances that he encountered. While conducting an instrument landing system approach, the pilot reported that he was not receiving the glideslope and requested a surveillance radar approach, which the controller was unable to provide. Shortly thereafter, the helicopter's rate of descent increased rapidly to more than 2,000 feet per minute, and the helicopter continued to descend until it impacted terrain. Although the pilot met the recent experience requirements to act as pilot-in-command under IFR, the investigation so far has revealed that he was not proficient in performing nonprecision approaches. If the pilot had received more recent and targeted instrument training in night conditions, he might have been better prepared to conduct what effectively became a nonprecision approach during the accident flight.

The NTSB recognizes that requirements for additional training can be costly, especially for small HEMS operators. However, as public hearing testimony indicated, the availability of new helicopter flight training devices (FTD), including simulators, has increased greatly over the past few years.¹⁴ Simulators and FTDs are not only cheaper to operate than training in actual helicopters; they also allow pilots to practice procedures and maneuvers that they would never perform in a helicopter except in an emergency. Hearing witnesses contended that scenario-based training in a simulation environment provides the best opportunity for crewmembers to practice skills that are not demanded on a routine basis.

¹⁴ At one time, a shortage of single-engine FTDs prevented their use in helicopters; however, many more of these devices are now available, as in the Bell 206, Bell 407, and Aerospatiale A-Star helicopters. Simulators and FTDs are now available at various levels: the higher the fidelity (that is, the more realistic it is), the higher its classification. The highest level FTDs, Level 7, allow crewmembers to receive the maximum amount of training credit from an FTD and qualify for nearly all parts of a Part 135 checkride.

Simulators and FTDs are beneficial in several ways. In addition to enabling pilots to train in skills that are too risky to perform in a real helicopter, simulators and FTDs can, unlike real helicopters, be used anytime, day or night, and in any kind of weather. Simulators and FTDs can also allow training for a complete flight, including an emergency. Further, simulated flights can be tailored to a specific type of flight operation, such as interfacility HEMS flights (that is, hospital to hospital) and remote helispot landings and takeoffs. For example, simulator and FTD training can be very useful for scenarios involving avoidance of, or response to, IMC, which has been cited as a factor in numerous HEMS accidents.

The Professional Helicopter Pilots Association/Office of Professional Employees International Union, AFL-CIO (PHPA/OPEIU),¹⁵ in its written submission to the NTSB's HEMS public hearing, identified a deficient training environment for HEMS as its number one safety issue. The PHPA/OPEIU stated the following:

Since there are presently very few two-pilot HEMS operations ... better guidelines for new HEMS pilot training are needed to ensure that solo pilots are properly prepared for the job.... Beyond new employee training, better guidance for routine refresher training in perishable skills is needed. Such training should go beyond simple emergency procedure training and use realistic HEMS scenarios that have specific training objectives. These training flights would ideally be performed several times per year ...¹⁶

Other witnesses also acknowledged the benefits of simulators and FTDs during the public hearing and encouraged their use to improve safety. These witnesses testified that instrument flight training that leads to proficiency in IMC flight enhances a pilot's ability to fly safely at night and in VFR conditions. The NTSB is concerned that the absence of a requirement for additional and specific training for HEMS pilots will allow many operators to continue to accept HEMS flight assignments that may involve flight into conditions for which they are not adequately trained. Therefore, the NTSB recommends that your organization conduct scenario-based training, including the use of simulators and FTDs, for HEMS pilots, to include inadvertent flight into IMC and hazards unique to HEMS operations, and conduct this training frequently enough to ensure proficiency.

Safety Management Systems

The NTSB notes that increasing numbers of operators in the aviation industry are incorporating a formal safety management system (SMS) into their operations. An effective SMS program formalizes a company's standard operating procedures (SOPs) and establishes methods for ensuring that those SOPs are followed. Guidance issued in November 2006 by the International Civil Aviation Organization (ICAO) in Annex 6, "Operation of Aircraft," states that after January 1, 2009, "[Member] States shall require, as part of their safety program, that an

¹⁵ The PHPA/OPEIU is a labor union that represents most HEMS pilots, including those that fly for Air Methods, Inc., and PHI, Inc., two of the largest HEMS operators in the country. The PHPA was designated as a party to the NTSB HEMS public hearing.

¹⁶ The PHPA/OPEIU further stated that "These guidelines should be developed considering the amount of single pilot experience, night experience, and experience in aircraft type along with other appropriate factors as to arrive at a template for training based on the individual pilots' needs, as opposed to "cookie cutter" training programs that vary from operator to operator."

operator implements a[n SMS] acceptable to the State of the Operator....”¹⁷ In June 2006, the FAA published AC 120-92, “Introduction to Safety Management Systems for Air Operators,” which states, in part, that “An SMS is essentially a quality management approach to controlling risk. It also provides the organizational framework to support a sound safety culture. For general aviation operators, an SMS can form the core of the company’s safety efforts.”¹⁸

During the HEMS public hearing, witnesses discussed the potential benefits and challenges of applying SMS to HEMS operations.¹⁹ Testimony revealed that a successful SMS program is one that incorporates proactive safety methods to evaluate a company’s flight and maintenance operations to, at a minimum, identify safety hazards, ensure that remedial action necessary to maintain an acceptable level of safety is implemented, provide for continuous monitoring and regular assessment of the safety level achieved, and continuously improve the company’s overall level of safety.

The circumstances of the Aurora accident demonstrate that an SMS program might have reduced the risks leading to that accident. The investigation revealed that the pilot had chosen a nonstandard flight route, at a low altitude, while en route to a hospital to drop off a patient. The helicopter remained on this route until impacting a 734-foot-tall radio tower about 50 feet below the top of the tower. According to the operator’s chief pilot, the en route segment to the hospital was typically performed well clear of the tower and at an altitude at least 1,000 feet above the ground. The accident investigation indicated that continuous monitoring and regular assessments involved in a formal SMS program would have helped to ensure that the pilot adhered in practice to the operator’s established processes and procedures and likely would have prevented the accident aircraft from flying along a route of flight and at an altitude that placed it on a collision course with an obstacle.

During the public hearing, all witnesses on the SMS panel agreed that SMS would greatly benefit HEMS operators, no matter how large or small, and that SMS programs can be scaled to the size and characteristics of a specific operator. This view was supported in written submissions to the NTSB from the Helicopter Association International (HAI), the Commission on Accreditation of Medical Transport Systems (CAMTS),²⁰ and the General Accountability Office (GAO). Additionally, hearing testimony revealed that the International Helicopter Safety Team (IHST) has developed an SMS toolkit for small helicopter operators,²¹ and other guidance, as mentioned above, is also available. The NTSB concludes that SMS programs would provide public HEMS operators a formal system of risk management, safety methods, and internal

¹⁷ In a November 26, 2008, Information for Operators, the FAA stated that it would be filing a difference with ICAO with regard to the January 2009 deadline for SMS programs because the FAA has not yet developed regulations or policy for implementation of SMS by U.S. operators. These regulations and policies are currently under development.

¹⁸ The full text of AC 120-92 is available online at [http://rgl.faa.gov/REGULATORY_AND_GUIDANCE_LIBRARY/RGADVISORYCIRCULAR.NSF/0/6485143d5ec81aae8625719b0055c9e5/\\$FILE/AC%20120-92.pdf](http://rgl.faa.gov/REGULATORY_AND_GUIDANCE_LIBRARY/RGADVISORYCIRCULAR.NSF/0/6485143d5ec81aae8625719b0055c9e5/$FILE/AC%20120-92.pdf).

¹⁹ The SMS panel comprised the safety director of a large HEMS operator, the FAA SMS program manager, and the SMS coordinator for the International Helicopter Safety Team, an organization co-chaired by HAI and the FAA to reduce worldwide helicopter accidents by 80 percent in 10 years.

²⁰ CAMTS is a not-for-profit organization that accredits rotorwing, fixed wing, and ground transport services through a voluntary process. The association was designated a party to the NTSB public hearing.

²¹ This toolkit can be downloaded at <http://ihst.org/Portals/54/SMS-Toolkit.pdf>.

oversight programs that would improve safety and prevent accidents. Therefore, the NTSB recommends that your organization implement an SMS program that includes sound risk management practices.

Flight Operations Monitoring Programs

NTSB public hearing testimony revealed that recent advances in avionics technology have produced a number of low-cost, lightweight flight data recording devices for helicopters. Such affordable, self-contained devices and associated data analysis tools have permitted even small operators to implement effective flight data monitoring (FDM) programs. Such data would be particularly useful in evaluating daily operations according to specific parametric operational standards, such as altitude, bank angle, pitch attitude, and airspeed limitations. Frequent downloading and analysis of these data can aid operators in identifying exceedences from previous flights in order to implement corrective actions for future flights. In addition, periodic review of flight data from HEMS flights would provide information on aircraft proximity to terrain and weather that could assist in evaluating pilot performance to determine if pilots are conducting HEMS flights in accordance with company operating practices.

A flight operations monitoring program may have helped in preventing the Flagstaff midair collision. The Flagstaff investigation revealed that both operators were equipped with a type of flight-following equipment that was able to provide a track history of the flight for flight-following and dispatch purposes; however, no formal monitoring program was developed or used by either operator to identify possible trends in nonstandard operations. The investigation revealed that several operators had complaints about other operators regarding communications and flight profiles while approaching the Flagstaff Medical Center helipad. Neither operator involved in the accident had a way of tracking such complaints reported to them.

After the accident, the management of one of the operators, whose pilot was cited as contributing to the accident because of his failure to follow arrival and noise abatement guidelines, indicated that they were surprised that their pilot had flown to the helipad from Flagstaff Airport in an essentially straight line of flight because they said that their pilots were trained to fly a different profile when approaching the helipad from the south. Additionally, the pilot from the other operator was cited as contributing to the accident due to his failure to follow communications guidelines that were in effect for operations approaching at the helipad. Had either operator had a formal flight operations monitoring program in effect, use of nonstandard procedures by either pilot might have led the operators to take corrective action that could have prevented the two helicopters from arriving at the same helipad on different approach angles that particular day.

During the HEMS public hearing, several witnesses concurred that the recording and analysis of routine flight data is key to reducing the accident rate. For example, in a joint statement submitted to the HEMS public hearing, HAI, the Association of Air Medical Services (AAMS), and the Air Medical Operators Association (AMOA) recommended the following:

[the] FAA, in coordination with Associations and those conducting air medical services, should establish requirements, procedures and standards for devices, technology, and procedures used to support air medical aircraft for the enhancement of Flight Operations Quality Assurance (FOQA) programs and subsequent accident investigations.

Similar sentiments were expressed in written testimony by PHPA, which stated that “a well designed and managed [FOQA] program can provide pilots with invaluable feedback to improve overall safety performance.”²²

The installation of conventional flight data recorders (FDR) into helicopters has met resistance due to the penalties associated with their cost and weight. However, as previously mentioned, technology currently exists to build image and data recording devices that are relatively inexpensive and lightweight for installation on new and existing helicopters. Although these devices do not meet the current crashworthiness standards required for conventional FDRs by 14 CFR Part 121 for large transport aircraft, they are crash-resistant and can provide significant information for investigators to determine accident causation, as well as for operators in support of flight operations monitoring programs. During the public hearing, the FAA stated that it has not initiated regulatory action to require on-board recording devices for helicopters, despite recommendations by the NTSB. However, during the public hearing, the director of the FAA’s Flight Standards Service indicated a willingness to work with the HEMS industry to streamline approvals that would permit voluntary use of these low-cost recording devices. Several U.S. helicopter manufacturers (Bell and Eurocopter USA, for example) have programs underway to equip their new helicopters with on-board video/voice-data recording devices. The NTSB notes that these devices are consistent with the standards adopted by the European Organization for Civil Aviation Equipment (EUROCAE).²³

Following its investigation of the July 27, 2007, Phoenix, Arizona, accident involving two electronic news gathering helicopters that collided in midair while maneuvering in Phoenix, Arizona,²⁴ neither of which was equipped with an FDR, the NTSB issued Safety Recommendation A-09-11 on February 9, 2009, which asked the FAA to do the following:

²² In addition, the IHST’s highest priority recommendation in its “Safety Equipment” category of recommendations is to incorporate flight data monitoring in all helicopter operations.

²³ Government and industry representatives have been participating since 2007 in a EUROCAE working group to develop a flight recorder specification, “Minimum Operational Performance Specification for Lightweight Flight Recorder Systems” (ED-155). (Both the NTSB and the FAA are members of this working group.) When finalized, ED-155 is expected to address recent improvements in technology by establishing the minimum performance requirements for flight recorder systems that could be used on board smaller aircraft (such as the accident helicopter models). This specification targets a more affordable flight recorder for smaller aircraft than traditional cockpit voice recorders or FDRs and addresses the recording of audio, image, and parametric information.

²⁴ *Midair Collision of Electronic News Gathering Helicopters KTVK-TV, Eurocopter AS350B2, N613TV, and U.S. Helicopters, Inc., Eurocopter AS350B2, N215TV Phoenix, Arizona July 27, 2007*, Aviation Accident Report NTSB/AAR-09-02 (Washington, DC: National Transportation Safety Board, 2009).

Require all existing turbine-powered, nonexperimental, nonrestricted-category aircraft that are not equipped with a flight data recorder and are operating under 14 *Code of Federal Regulations* [CFR] Parts 91, 121, or 135 to be retrofitted with a crash-resistant flight recorder system. The crash-resistant flight recorder system should record cockpit audio (if a cockpit voice recorder is not installed), a view of the cockpit environment to include as much of the outside view as possible, and parametric data per aircraft and system installation, all to be specified in European Organization for Civil Aviation Equipment document ED-155, Minimum Operational Performance Specification for Lightweight Flight Recorder Systems, when the document is finalized and issued.

This recommendation is currently classified “Open—Acceptable Response.”

The NTSB concludes that the systematic monitoring of data from HEMS flights could provide operators with objective information regarding the manner in which their pilots conduct HEMS flights and that a periodic review of such information, along with other available information, such as pilot reports and medical crew feedback, could assist operators in detecting and correcting unsafe deviations from company operating practices. Therefore, the NTSB recommends that your organization install flight data recording devices and establish a structured FDM program that incorporates routine reviews of all available sources of information to identify deviations from established norms and procedures and other potential safety issues.

Night Vision Imaging Systems

In its 2006 special investigation report, the NTSB concluded that, for 13 of the 55 accidents considered, NVIS might have helped the pilots more clearly observe obstacles and take evasive action to avoid them and prevent the accidents. The NTSB concluded that if used properly, NVIS could help EMS pilots identify and avoid hazards during nighttime operations. However, the NTSB stopped short of issuing a recommendation for a requirement because, at that time, NVIS was not feasible in some situations, such as populated areas with ambient light and numerous streetlights. Additionally, the costs, availability, and FAA certification policies and manpower were not mature enough to warrant a reasonable recommendation. However, the NTSB indicated that it would:

monitor the effectiveness of the FAA’s recommendation [as stated in FAA Order 8000.293, “Helicopter Medical Services Operations,” which directs FAA principal inspectors to encourage the use of NVIS] that operators use NVIS to determine whether this recommendation is sufficient to implement NVIS use on a more widespread basis or if a requirement is necessary.

Information gathered during the HEMS public hearing revealed that NVIS technology has advanced over the past few years. Witnesses indicated that today’s NVIS is effective in urban areas that emit manmade lighting and that law enforcement helicopter pilots in major cities have used NVIS successfully. Witnesses also contended that NVIS can be a critical part of a helicopter’s safety equipment and that with proper training in its use, crews can use NVIS to

significantly enhance situational awareness. NVIS includes night vision goggles (NVG), types of which are now available that meet the FAA's new NVG technical standard order.²⁵

The use of NVIS might have helped the pilots involved in the Aurora and La Crosse accidents. Each of these accidents occurred at night and in VMC. Had the Aurora accident pilot been using NVIS, he likely would have seen the radio tower ahead of him and been able to avoid the impact. In the La Crosse accident, the helicopter impacted trees along a ridgeline in a sparsely populated area approximately 4.5 miles southeast of the departure airport. Had this pilot been using NVIS, he would likely have been able to identify the ridgeline, negotiate the terrain, and avoid the accident.

The NTSB notes that, of all the initiatives discussed at the hearing to improve HEMS safety, requiring the use of NVIS has gained the strongest consensus. For example, in their joint statement to the HEMS public hearing, AAMS, HAI, and AMOA recommended "that all air medical operations at night be conducted using either NVGs or enhanced vision systems..., or be conducted under IFR in a timeline established by the FAA in coordination with the industry." The GAO's April 2009 testimony to the congressional Subcommittee on Aviation, Committee on Transportation and Infrastructure, also indicated that "the most frequently cited helicopter-appropriate technology was night vision goggles." This conclusion was also reached by the PHPA at the same hearing; the PHPA recommended a requirement for NVIS to be "onboard and functioning in each aircraft in the current HEMS fleet as quickly as equipment can be purchased, aircraft modified, and crews trained."

As previously stated, even the FAA's own analysis of HEMS accidents over the past several years indicates that predominantly, the causes were associated with flying at night, inadvertent flight into IMC, and CFIT. The NTSB believes that a significant number of HEMS nighttime accidents can be prevented by operators' installing and requiring pilots to use NVIS. Therefore, the NTSB recommends that your organization install NVIS in helicopters used for emergency medical services and require HEMS pilots be trained in their use during night operations.

Dual-Pilot/Autopilot Use

A review of the NTSB Aviation Accident Database revealed that during the 8-year period from 2000–2008, 123 HEMS accidents occurred, killing 104 people and seriously injuring 42 more. All but nine of these accidents involved operations with only one pilot.²⁶ Pilot actions or omissions, of some sort, were attributed as the probable cause in 60 of the 123 accidents. Many of these 60 accidents might have been prevented had a second pilot and/or an autopilot been present.

Witnesses at the NTSB hearing described the risks for helicopter pilots working in the HEMS environment, which are greater than those in other types of flight operations. The airline industry, which has an accident rate much lower than that of the HEMS industry, conducts flights

²⁵ FAA Technical Standard Order-C164, "Night Vision Goggles," describes the minimum performance standards that NVGs must meet for design approval. The FAA also issued Flight Standards Handbook Bulletin for Air Transportation 04-02, "Night Vision Imaging Systems," which guides principal operations inspectors in the evaluation of operations, training, currency, and equipment after an operator's request to use NVIS.

²⁶ The remaining accidents were all training accidents, which involved two pilots each.

with two pilots who attend training regularly and are required to be evaluated during that training. Conducting flights with two pilots allows one pilot to fly the airplane while the other communicates on the radio, programs aircraft avionics, and runs checklists. The NTSB notes that some HEMS operators currently operate with two pilots. According to hearing testimony, the Canadian HEMS industry operates its helicopters with two pilots and has flown over 230,000 hours since 1977 with no fatal accidents. In addition, the New Jersey State Police, which flies its helicopters with two pilots, has had no accidents for the last 10 years.

The circumstances of several of the accidents discussed above suggest that the presence of two pilots might have prevented these accidents. In the District Heights accident, for example, a second pilot could have handled radio communications with air traffic control, reducing the pilot's workload and allowing him to concentrate on flying the helicopter. Additionally, after the controller denied the pilot's request for a surveillance radar approach, a second pilot may have suggested they declare an emergency or execute a missed approach and request a different approach rather than continue to descend. A second pilot could have also monitored the helicopter's altitude while on the approach to ensure terrain clearance.

In the South Padre Island accident, two pilots might have been able to entirely avoid their inadvertent entry into IMC. Even after inadvertently entering IMC, two pilots might have been better able to maintain control of the helicopter during the course reversal to return to home base. In the Huntsville accident, which occurred at night, impact signatures were consistent with a controlled descent into forested terrain. A second pilot or the use of an autopilot could have prevented this CFIT accident.

In the absence of a second pilot, use of an autopilot might enhance a pilot's ability to cope with high workload, such as in inadvertent flight into IMC. The NTSB notes that the FAA currently requires all 14 CFR Part 135 passenger-carrying operations conducted under IFR to have a "second-in-command" pilot and that the FAA sometimes allows an exception to the second-in-command requirement if an autopilot is used.²⁷ Clearly, the FAA recognizes the advantages of using an autopilot or a second-in-command pilot in that type of operation. The NTSB believes that requiring a second pilot in HEMS operations, or the use of an autopilot, may prevent a significant number of HEMS accidents. Therefore, the NTSB recommends that your organization equip helicopters that are used in EMS transportation with autopilots, and train pilots to use the autopilot if a second pilot is not available.

Recommendations

The National Transportation Safety Board therefore recommends that your organization:

Conduct scenario-based training, including the use of simulators and flight training devices, for helicopter emergency medical services (HEMS) pilots, to include inadvertent flight into instrument meteorological conditions and hazards

²⁷ Title 14 CFR 135.101 and 135.105 currently require a "second in command" for all Part 135 IFR passenger operations. This includes both airplanes and helicopters. Section 135.105 allows the substitution of an autopilot instead of a second-in-command pilot.

unique to HEMS operations, and conduct this training frequently enough to ensure proficiency. (A-09-97)

Implement a safety management system program that includes sound risk management practices. (A-09-98)

Install flight data recording devices and establish a structured flight data monitoring program that incorporates routine reviews of all available sources of information to identify deviations from established norms and procedures and other potential safety issues. (A-09-99)

Install night vision imaging systems in helicopters used for emergency medical services and require helicopter emergency medical services pilots be trained in their use during night operations. (A-09-100)

Equip helicopters that are used in emergency medical services transportation with autopilots, and train pilots to use the autopilot if a second pilot is not available. (A-09-101)

In response to the recommendations in this letter, please refer to Safety Recommendations A-09-97 through -101. If you would like to submit your response electronically rather than in hard copy, you may send it to the following e-mail address: correspondence@ntsb.gov. If your response includes attachments that exceed 5 megabytes, please e-mail us asking for instructions on how to use our secure mailbox. To avoid confusion, please use only one method of submission (that is, do not submit both an electronic copy and a hard copy of the same response letter).

Chairman HERSMAN, Vice Chairman HART, and Member SUMWALT concurred in these recommendations.

[Original Signed]

By: Deborah A.P. Hersman
Chairman

HEMS Public Operators By State

Alaska

Mr. Hugo Patkotak, Director
P.O. Box 69
North Slope Borough
Barrow, Alaska 99723
907-852-2822 - Office
907-852-2826 - Fax
hugh.patkotak@north-slope.org

Arizona

Mr. Rich Thacher, Aviation Commander
Arizona Department of Public Safety
Highway Patrol, Aviation Division
2615 E. Airlane
Phoenix, Arizona 85034
(602) 223-2535 – Office
(602) 223-2539 – Fax
Sgt. Marty Fink
mfink@azdps.gov

Lieutenant Timothy Palmer
Maricopa County Sheriff's Office
Aviation Services Division
23636 N. 7th Street
Phoenix, Arizona 85024
(602) 876-1040 – Office
(623) 516-2903 – Fax
T_palmer@mcs.maricopa.gov

California

Commander Keith Dittimus
California Highway Patrol
Office of Air Operations
860 Stillwater Road
West Sacramento, California 95605
(916) 375-6900 – Office
(916) 375-6940 – Fax
kdittimus@chp.ca.gov

Sergeant Morrie Zager
Los Angeles County Sheriff's Department, Aero Bureau
3235 North Lakewood Boulevard
Long Beach, California 90808
(562) 421-2701 – Office
(562) 469-4785 - Fax
mczager@lasd.org

Battalion Chief Anthony Whittle
Los Angeles County Fire Department – EMS
5801 South Eastern Avenue Suite 100
Commerce, California 90040
(323) 838-2212 – Office
(323) 881-2329 – Fax
awhittle@fire.lacounty.gov

Mr. Joseph Foley, Battalion Chief, Air Operations
Los Angeles City Fire Department
Air Operations
16617 Arminta Street
Van Nuys, California 91406
(818) 756-8635 – Office
(818) 756-4094 – Fax
Thomas.jeffers@lacity.org (Safety Officer)
Glenn.smith@lacity.org (Chief Pilot)

Captain Mario Quesada
San Bernardino County Sheriff's Department
Sheriff's Air Medic Program
1776 Miro Way
Rialto, California 92376
(909) 356-3800 – Office
(909) 356-3867 – Fax
mquesada@sbcasd.org

Ms. Tracy Jarman, Fire Chief
San Diego Fire Department
San Diego Medical Services Enterprise
San Diego Fire-Rescue Department
1010 2nd Avenue, Suite 400
San Diego, California 92101
(619) 533-4300 – Office
(619) 544-9351 – Fax
jcarle@sandiego.gov

Sergeant Dave Thompson
Sonoma County Sheriff's Office
2265 Becker Boulevard
Santa Rosa, California 95403
(707) 565-7195 – Office
(707) 565-7194 – Fax
dthompson@sonoma-county.org

Sergeant Andrew White, Supervisor, Air Support Unit
East Bay Regional Park District Police
20876 #C Corsair Boulevard
Hayward, California 94545
(510) 544-3011 – Office
(510) 738-7654 – Fax
awhite@ebparks.org

Sergeant Han O
Orange County Sheriff's Department
Air Support Division
361 Paularino Hangar 26
Costa Mesa, California 92808
(949) 252-5257 – Office
(714) 546-2362 – Fax
ohs@ocsd.org

Mr. Alex Tipolt
Santa Barbara Sheriff's Department, Aviation Division
900 Airport Road
Hangar G7
Santa Ynez, California 93460
(805) 686-9723 – Office
(805) 693-0436 – Fax
ajt2253@sbsheriff.org

Mr. Gordon O'Neill
Santa Barbara County Fire Department
Air Unit
901 Airport Road
Hangar G7
Santa Ynez, California 93460
(805) 693-8481 – Office
(805) 693-8409 – Fax
Gordon.oniell@sbcfire.com

Sergeant Frank Underlin
Ventura County Sheriff's Department
Aviation Division
375 Suite A Durley Ave
Camarillo, California 93012
(805) 388-4212 – Office
(805) 388-4380 – Fax
frank.underlin@ventura.org

Captain Barry Parker
Ventura County Fire Department
165 Durley Avenue
Camarillo, California 93010
(805) 389-9710 – Office
(805) 383-4787 – Fax
bob.roper@ventura.org

Delaware

Captain Jeff Evans
Delaware State Police
Aviation Unit
4 Troopers Way
Middletown, Delaware 19709
(302) 378-5788 - Office
(302) 378-5787 - Fax
dejeffevans@us.state

Florida

Mr. Joseph Ferrara, Acting Fire Chief
Martin County Fire-Rescue LifeStar
Fire Rescue Department
800 SE Monterey Road
Stuart, Florida 34994
Phone: (772) 288-5710
Fax: (772) 221-1457
Email: mmills@martin.fl.us

Mr. Raymond Barreto, Division Chief
Miami-Dade Fire Rescue
Special Operations Division
9300 N.W. 41st Street
Miami, Florida 33178-2414
(786) 331-5000 – Office
(305) 466-0005 - Fax
mdfrd@miamidade.gov

Sergeant Dale Owens
Broward County Sheriff's Office
Air Rescue 85
Ft. Lauderdale Executive Airport Station 85
5253 NW 20th Terrace
Ft. Lauderdale, Florida 33309
Phone: (954) 938-0650
Fax: (954) 938-0609
dale_owens@sheriff.org

Captain John Bonnevier
Volusia County Sheriff's Office
951 Singleton Drive
DeLand, Florida 32724
Phone: (386) 736-5333
Fax: (386) 736-5336
JBonnevier@vcsso.us

Mr. Steven Adams,
Director of Operations Collier County MEDFLIGHT
2375 Tower Drive, Naples FL 34104
Cell: 239-253-8843
Office: 239-643-5506
Fax: 239-261-5176
Email: stevenadams@colliergov.net

Mr. Gerald Pegano, Director of Operations
Health Care District of Palm Beach
4255 Southern Boulevard
West Palm Beach, Florida 33406
Phone: 561-689-7140
Fax:(561) 659-1628
gpagano@hcdpbc.org

Mr. Rick O’Neal, Manager, Aircraft Operations
Lee County EMS, MEDSTAR
One Private Sky Way
Fort Myers, Florida 33913
Phone: 239-533-3911
Fax: 239-485-2626
ROneal@leegov.com

Georgia

Major M. Yarbrough, Commander
DeKalb County Police Department
Special Operations
1960 West Exchange Place
Tucker, Georgia 30084
404-294-2119 - Phone
404-294-2593 – Fax
tdbolton@co.dekalb.ga.us

Maryland

Major A. J. McAndrew
Maryland State Police Aviation Command
3023 Strawberry Point Road
Baltimore, Maryland 21220-5577
Phone: (410) 238-5860 - Flight Ops
Fax: (410) 238-05809
Email: aviation@mdsp.gov

Nevada

Lieutenant Joe Ojeda, Section Commander
Las Vegas Metro Police Department
Air Support, Search & Rescue
2990 N. Ranch Drive
Las Vegas, Nevada 89130
(702) 828-3552 – Office
(702) 828-1515 – Fax
J.24330@lvmpd.com

New Jersey

Major Edward Cetnar
Commander, Special Operations Section
New Jersey State Police
P.O. Box 7068
West Trenton, New Jersey 08628
609-882-2000 - phone
(609) 633-7954 - fax
crnjoem@gw.njsp.org

New York

Major Robert Kreppin
New York State Police, Aviation Unit
739 Albany Shaker Road
Latham, New York 12110
Phone: (518) 242-4500
Fax: (518) 242-4526
nyspmail@troopers.state.ny.us

John Durkin, Deputy Inspector
New York City Police, Aviation Unit
Floyd Bennett Field
Brooklyn, New York 11234
Phone: (718) 692-1220/1230
Fax: (718) 692-2390
pcoffice@nypd.org

Steven Salz, Deputy Inspector
Nassau County Police, Aviation
101 Grumman Road, West
Bethpage, New York 11714
Phone: (516) 573-4000
Fax: (516) 573-4005
Email: ssalz@pdcn.org

Captain Michael Pellizzari
Onodaga County Sheriff's Department
Aviation Unit
407 South State Street
Syracuse, New York 13202
Phone: (315) 435-3095
Fax: (315) 484-1502
ocso@nysnet.net

Sergeant Brian Barrett
Suffolk County Police Department
Aviation Section
30 Yaphank Avenue
Yaphank, New York 11980
Phone: (631) 854-5704/5705
Fax: (631) 467-5056
sepdinfo@suffolkcountyny.gov

Sheriff Joseph A. Gerace
Chautauqua County Sheriff's Office
15 E. Chautauqua Street
P.O. Box 128
Mayville, New York 14757
Phone: 716-753-2131
Fax: 716-661-8451
webmaster@sheriff.us

North Carolina

William Sawyer, Director
Dare County, Emergency Medical Severices
P.O. Box 1000
Manteo, North Carolina 27954
Phone:(252) 475-5710
Fax: (252) 441-1847
wsawyer@darenc.com

Pennsylvania

Captain Todd B. Johnson, Director
Pennsylvania State Police
Aviation Section
171 E. Hershey Park Drive
Hershey, Pennsylvania 17033
Phone: (717) 508-0033
Fax: (717) 508-0040
todjohnson@state.pa.us

Texas

Mr. Casey Ping, Director
Austin-Travis County, EMS STAR Flight
7800 Old Manor Road
Austin, Texas 78724
Phone: 512-854-6464
EMSPublicInfo@ci.austin.tx.us

Virginia

Mr. Paul Schaaf, Chief Pilot,
Fairfax County Police Department
Helicopter Division
4604 West Ox Road
Fairfax, Virginia 22030
Phone: (703) 830-3105
Fax: (703) 815-9632
Email: paul.schaaf@fairfaxcounty.gov

Lieutenant R.N. Possumato, Unit Commandar,
Virigina State Police, EMS Unit
Locations- Richmond, Abington, Lynchburg
7411 Airfield Drive
Richmond, Virginia 23237
Fax: 804-743-2235
Phone: 804-743-2228
E-mail: Aviation@vsp.virginia.gov

Washington D.C

Lieutenant Kathleen Harasek
United States Park Police
1100 Ohio Drive SW
Washington, D. C. 20242
(202) 619-7350 - Phone
(202) 433-7210 - Fax
Kathleen_Harasek@nps.gov