WHITE PAPER

IMPROVING SAFETY
IN HELICOPTER EMERGENCY MEDICAL SERVICE (HEMS)
OPERATIONS

Helicopter Association International

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Helicopter Association International (HAI) is the professional trade association for the civil helicopter industry. Its 1,350-plus-member organizations and 1,150 individual members, in more than 73 nations, safely operate more than 4,500 helicopters approximately 2.3 million hours each year. Within the United States, 93 HAI members conduct air medical service operations. HAI is dedicated to the promotion of the helicopter as a safe, effective method of commerce and to the advancement of the civil helicopter industry.

The purpose of this white paper is to delineate positions held by the Helicopter Association International relative to the issue of safety and its enhancement during the conduct of Helicopter Emergency Medical Service (HEMS) operations. The positions stated in this white paper represent what HAI considers is a balanced approach that serves the interests of the entire helicopter air medical industry and recognizes that HEMS operations are conducted in a variety of environments and conditions; that the solution to enhancing safety within HEMS operations must be multi-faceted; and that the goal of enhanced safety is best achieved by actions taken by the industry itself rather than imposed by government regulation. As a not-for-profit trade association representing the entire civil helicopter industry, HAI supports actions or recommendations that are considered best industry practices but does not support the establishment of standards that could be misconstrued as tending to inhibit competition.

Due to an increase in recent years in the number of accidents involving Helicopter Emergency Medical Service (HEMS) helicopters, this industry is once again under scrutiny, by the industry itself, by the Federal Aviation Administration (FAA) and by the public. Every accident involving a HEMS aircraft becomes headline news, particularly if fatalities are involved. In actuality, more accidents in the helicopter community are experienced during personal flights, instructional flights, or a host of other activities, than during air medical flights. However, due to the nature of HEMS operations, air medical aircraft are supposed to save lives, not lose them. We in the rotorcraft industry know that thousands of patients are safely transported and numerous lives are saved every year by HEMS aircraft. We also know that air medical operations are conducted by aviation professionals dedicated to safety. The number of lives that are unfortunately lost as a result of accidents during HEMS operations remains truly low, when the total scale of helicopter operations is considered. However, even one life lost is too many, particularly when post-accident analysis indicates that virtually every accident could have been prevented. Perceptions play an important part in the public’s acceptance of this vitally important segment of the industry.
I. BACKGROUND

In 1991, there were approximately 225 helicopters dedicated to air medical service. Today that number is in excess of 650 helicopters. The number of HEMS flight hours in 1991 was approximately 162,000, and in 2005, the number of HEMS flight hours is expected to exceed 300,000 hours. Since 1991, there have been 127 HEMS accidents, of which 49 were fatal, involving 128 fatalities. Of this total, 109 (85.8%) were precipitated by some failure in human factors, which includes not only pilot error but also improper maintenance or quality assurance, inadequate crew or ground coordination and perhaps, more subtly, inadequate supervision or management. Ninety-six accidents (76%) were a direct result of pilot error. These errors can be broadly categorized as poor pilot technique; lack of situational awareness; loss of control; poor aeronautical decision-making; controlled flight into terrain, water or objects; or perhaps a combination of these. Fifty-nine (46.8%) of these pilot-induced accidents were a result of either controlled flight into terrain, water or obstacles; striking an object with either the main or tail rotor; or a loss-of-control resulting in impact with terrain due to spatial disorientation. Of these, 40 occurred at night, and of these, 23, or over half, involved intentional or inadvertent continued VFR flight into IMC conditions.

II. DISCUSSION

There is, unfortunately, considerable speculation about what segment of the HEMS industry is experiencing accidents. The perception that accidents primarily occur with small operators flying single engine aircraft that are not IFR-certificated is not supported by fact or statistics. Since 1998, of 77 HEMS accidents, essentially half (38) of the accidents were experienced by large operators with fleets in excess of 20 aircraft, and half (39) were experienced by operators with fewer than 20 aircraft. Additionally, since 1998, of these 77 HEMS accidents, 45 occurred in multi-engine aircraft, while 32 occurred in single engine aircraft. Further, of these 77 accidents, 54 accidents occurred in VFR certificated aircraft, but 23, or nearly one-third, of the accidents occurred in IFR certificated aircraft. Thus, it is readily apparent that HEMS accidents occur regardless of the size of operation, number of engines or VFR versus IFR certification.

Therefore, resolving the issue of enhanced safety within HEMS operations must include feasible and effective solutions that recognize the realities of the helicopter air medical industry. In some countries, air medical operations are contracted by governmental entities funded by taxes. Within the United States, some air medical operations are similarly conducted by State entities funded by taxpayer funds. The majority of air medical operations within the U.S., however, are operated on a commercial basis. Commercial operators must take fiduciary care to ensure that decisions that effect their operations maintain the financial health of their organization. Wide-sweeping and arbitrary mandates of equipage or aircraft capabilities of questionable efficacy, or similar broad-brush interventions, are not appropriate and do not recognize the varied environment, needs and requirements of individual operators in various regions or operating conditions.

Recent history, coupled with the accident data, suggest, however, that there are a number of feasible solutions available to start the process of reducing the HEMS accident rate. However, there is no “silver bullet” that will by itself eliminate accidents. Any enhancement to safety must be through a multi-faceted approach. The solution rests within a system-wide approach that
addresses every element affecting the conduct of air medical flights, including the safety culture within the entire organization, management, supervision, training and equipage.

Concerns about the safety of helicopter air medical operations came to FAA and industry’s attention as early as 2000. An Air Medical Safety Summit was convened in April 2000 to discuss the causes of an alarming increase in air medical accidents. To better understand the causes, HAI chaired the Air Medical Accident Analysis Team, convened following the Safety Summit, to conduct a comprehensive root cause analysis of HEMS accidents. In its final report of September 24, 2001, numerous interventions were provided to the FAA and industry that were deemed by the experienced air medical operators on the team to be highly effective and highly feasible in reducing the number of accidents. HAI strongly recommended then that FAA and industry review this report and implement its recommendations. Further, recognizing the importance of top-level management support to enhancing safety, industry formed the Air Medical Safety Advisory Council (AMSAC) to bring focus and better coordination for reaching a common goal of greater safety within the air medical industry.

It is HAI’s position that adherence to current regulations is far more effective than generating new regulations. Many interventions have been identified that are appropriate, feasible and effective. However, there is no one “true remedy” that applies to all HEMS operators. Within the bounds of prudent standardization, the individual operators should maintain the flexibility to amend their shortcomings without inheriting restrictive regulations that might be the proper solution for someone else’s problems. The FAA recently responded to the increasing number of HEMS accidents by convening an internal Task Force to study these accidents with the purpose of developing interventions that might prevent accidents from occurring in the future. After consultation with HAI and many representatives of the major air medical industry, the FAA, on January 28, 2005, issued Notice 8000.293 “Helicopter Emergency Medical Service (HEMS) Operations,” to provide guidance to Principal Inspectors (PI) regarding HEMS operators for whom they have oversight responsibilities. The Notice also contains information that PIs can provide to HEMS operators for a review of pilot and mechanic decision-making skills, procedural adherence, and crew resource management (CRM). Further, FAA Notice 8000.293 makes numerous recommendations to the air medical community. Most of these focus on training and equipage. To its credit, responding to industry’s concerns, the FAA listed the interventions it thinks will promote safety within the air medical community as recommendations rather than mandates. Within Notice 8000.293, the FAA recommends, and HAI endorses, the following actions be taken by industry:

- Determine if pilot training includes inadvertent IMC and night cross-country for the specific area of operation (i.e., mountainous or flat areas). Operators are encouraged to develop action plans to deal with inadvertent IMC for their local flying areas.
- Review FAA-H-8083-21, Rotorcraft Flying Handbook, Chapter 14, Aeronautical Decision Making, to see if the operator’s policies, procedures, and training programs reflect the principles in the handbook.
- Emphasize a safety culture within the operator’s HEMS organization that applies basic system safety attributes and risk management techniques to your operation. Apply safety attributes or risk management/assessment strategies to each flight.
• Incorporate realistic night flight training such as Line Oriented Flight Training (LOFT), provide operating experience for new crewmembers, and conduct line checks under realistic operating conditions.
• Emphasize the use of radar altimeters for night operations.
• Encourage utilization of enhanced vision systems and a Terrain Awareness Warning System (TAWS) for night operations when conditions and mission dictate.
• Incorporate FAA-approved night vision goggle or enhanced vision systems into the operator’s flight program.
• Review Standard Operating Procedures (SOP) as they pertain to weather minimums, particularly at night for each operational area, focusing on minimums specific to the terrain of the intended operational area. If necessary, increase weather minimums to enhance safety.
• Ensure pilots are aware of the importance of receiving current weather briefings at the time of mission launch.
• Utilize an operations risk assessment tool to include dual decision-making for authorization to accept or continue a flight assignment.
• Ensure that operational control (flight locating) procedures are current and applicable for each base of operation.
• Make the pilot compartment, to the extent possible, free of glare and reflections.
• Review pilot and mechanic shift schedules and fatigue management programs.

The FAA has also gone further to develop several different Threat Matrix Models for the use of Principal Inspectors (PI) relating to HEMS operations. Notice 8000.301 provides additional background and offers alternative threat assessment tools that have been developed by the industry in conjunction with the FAA.

If HEMS operators are serious about taking steps to improve their safety culture, they will adopt these guidelines to the maximum extent possible in line with their specific site or regional requirements.

In other activities, the Aeromedical Working Group of the FAA/Industry’s Aviation Rulemaking Committee (ARC) chartered to revise Part 135 and, to some degree, Part 91 of the Federal Aviation Regulations (FAR) recommended raising the day and night visibility requirements for VFR flight in Class G airspace for all HEMS operations. To determine whether such action would be justified based on statistical evidence, HAI reviewed all helicopter accidents since January 1, 1990. Analysis revealed that only 41, or 1.43%, out of a total of 2,848 accidents, might have been affected by the proposed visibility restrictions. Twenty-nine (29) of these, however, involved poor aeronautical decision-making by pilots intentionally proceeding into worsening conditions. It is likely that such poor decision-making would not be influenced by regulated visibility minimums. HAI, therefore, does not consider the proposal to mandate increased visibility requirements for all general aviation visual flight rule (VFR) operations in Class G airspace as warranted. There is, however, strong support for this within the HEMS industry. HAI maintains, therefore, that if increased visibility requirements for HEMS operations are instituted, it should be accomplished through modification to HEMS Operating Specifications (OPSPECS) rather than through rule change.
II. RECOMMENDATIONS

In many respects, the recommendations contained in the FAA’s Notice 8000.293 and 8000.301 and the Part 135 ARC mirror those that were delineated in the Final Report of the Air Medical Service (AMS) Accident Analysis published in September 2001, following the industry’s Air Medical Safety Summit in Dallas, TX. Much emphasis in both the new HEMS Notice and the earlier AMS accident analysis is placed on training. A comprehensive review of existing training programs should be accomplished to determine if training adequately encompasses the scope of operations! Training must include:

- Risk management training
- Crew resource management training
- Acquisition training for newly hired personnel
- Recurrent training to maintain proficiency in all anticipated flight regimes
- Mission-specific training designed and tailored for each particular area of operations
- Operations in both instrument and marginal weather conditions
- Aircraft systems training
- Night operations
- Mountain operations
- Mission specific training
- Aeronautical decision-making
- Management training that discusses the safety implications of supervisory decisions
- Dispatcher training

Dispatchers provide a critical link in air medical operations. Dispatchers should be provided the resources and training to be able to follow the conduct of flight operations and provide vital information, such as weather and landing zone information, to the pilot. Dispatchers should have the authority to recall aircraft, should conditions warrant, as part of the organizational risk management program.

Training should also extend to those entities, such as police or fire departments, which might be called upon to secure remote landing zones. When properly trained, these individuals can provide critical information on potential hazards in the vicinity of landing sites and can properly prepare the site for an aircraft’s arrival and departure.

There are a multitude of tools available not just for the Safety Manager but for everyone up and down the chain of command to use in building a robust safety program. The FAA has produced a variety of programs to enhance safety, particularly on the subject of HEMS operations and aeronautical decision-making. Further, HAI makes available a significant number of products intended to enhance one’s safety program, including a number of training videos on aeronautical decision making (one specifically tailored to air medical operations), and another video on the subject of landing zone safety. HAI also sponsors a variety of safety courses in its educational series during HELI-EXPO, such as courses on:

- Safety Management
- Safety Leadership
Additionally, HAI conducts a Chief Pilot’s Workshop to enhance the skills, knowledge and awareness of individuals who are assigned as Chief Pilots and also for those evaluating the qualifications of individuals being considered for such assignment.

In addition to training, however, HAI also strongly encourages aircraft equipage that would enhance safety for air medical operations:

- Terrain awareness warning systems (TAWS)
- Radar altimeters
- Night vision enhancement systems

Night vision systems are proven tools that would significantly reduce the risk of controlled flight into terrain (CFIT) accidents. In 2004, of eleven HEMS accidents, six accidents were fatal and involved controlled flight into terrain at night. In five of the six accidents, the aircraft were operating in visual meteorological conditions (VMC) conditions; only one was operating in reported instrument meteorological conditions (IMC) conditions, and that aircraft was operating under VFR rather than instrument flight rules (IFR). These accidents might have been averted had the aircraft been equipped with TAWS and/or night vision systems. The process for obtaining a Special Type Certification (STC) to equip aircraft with night vision enhancement systems is now somewhat more responsive and streamlined than in the past. However, the FAA must do more to simplify and standardize the process to lessen both the cost and the time required for approval and implementation of night vision enhancement systems.

The FAA must also be more proactive in developing airspace infrastructure with existing and emerging technologies that would improve safety of flight in the low altitude environment through the greater implementation of:

- Automated Weather Observing System (AWOS)
- Obstacle Collision Avoidance System (OCAS)

A significant number of accidents are caused by aircraft flying into obstacles in marginal weather conditions. These could largely be eliminated if more weather reporting facilities were available in localized areas where HEMS aircraft operate. Accidents could further be reduced if hazards to low altitude aircraft were more easily identified. Currently, AWOS facilities are located primarily at or near airports. However, HEMS aircraft operate independent of runways. Thus, reporting of weather conditions in the more isolated areas where they do operate is typically not available. Similarly, previously existing technologies for identifying flight hazards, in the form of lights and marker balls, have been essentially non-effective, particularly in conditions of reduced visibility and at night. The Obstacle Collision Avoidance System (OCAS), currently being tested by the Aircraft Certification Service, Rotorcraft Directorate (ASW-100), represents
a promising and cost-effective new technology to warn low flying aircraft of obstacles in their flight path. HAI calls upon the FAA to place greater emphasis on implementing OCAS and to make AWOS more available for low altitude operations.

Perhaps more important than training, equipage or regulation, however, the HEMS industry needs to address the aeronautical decision-making process by which pilots, aircrew and supervisors conduct the evolution of every flight, from standard operating procedures, to preflight planning and on to final landing. After the intense discussions in 1987 on the state of HEMS safety, nearly a dozen manuals and Advisory Circulars were published to assist commercial helicopter pilots in general and HEMS pilots in particular with their decision making:

- Advisory Circular AC No. 60-22, “Aeronautical Decision Making” (12/13/91)
- “Risk Management For Air Ambulance Helicopter Operators” Report No. DOT/FAA/DS-88/7 (June 1989)

This effort resulted in a dramatic, but temporary, reduction in accidents. These materials, which still contain valuable information, must be reviewed and brought up to date with current knowledge of human factors and the way decisions are made. Once updated, they must be given broad dissemination within the industry. Other intervention strategies, such as training, equipage and regulation will go only so far to enhance safety. It is also imperative that the air medical industry address and take steps to improve the actual aeronautical decision-making made by pilots while planning for and conducting air medical operations.

III. CONCLUSION

Ultimately, it is the responsibility to some extent of the FAA, but primarily of industry to take the steps necessary to enhance safety in HEMS operations. The key to enhancing safety within HEMS operations cannot be found in a single source or action. It must be found in a system-wide approach that involves all elements that influence the conduct of flight operations. The air medical accidents that are happening are occurring with large and small operators alike. HAI has been a long time advocate of increased IFR capability across the spectrum of helicopter operations and our position on that point has not changed. However, it is not a single engine versus multi-engine problem, and it is not a VFR versus an IFR operations problem. Safety begins with senior management. Every Chief Executive Officer, General Manager, Director of Operations, Chief Pilot and Safety Manager must be dedicated to his or her organization’s safety culture and must proactively support their organization’s safety and training programs. With
commitment from the top, a strong safety culture will necessarily flow down to everyone else who is involved in the conduct of air medical flight operations.