

# Some Thoughts on Helicopter Ambulance Safety

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Parents of Kirstin Reann Blockinger, aged 14 months, killed while being evacuated in the crash of an Air Angels helicopter on 15 October 2008



Picking up the shivered pieces of the Air Angels flight.

Near midnight on 15 October 2008, an Air Angels emergency medical service (EMS) helicopter collided with a transmission tower near Aurora, IL, en route at night from Valley West Hospital in Sandwich, IL, to Children's Memorial Hospital in Chicago.



Kirstin Reann Blockinger, who died being evacuated by helicopter for a lifesaving procedure at Children's Memorial Hospital.

At the controls of the Bell 222 was a single pilot, who was killed. Also killed in this senseless tragedy was Kirstin Blockinger, aged 14 months, who was being transported for additional medical treatment in Chicago. The two attending medical attendants were killed, too. Four people dead in an instant, just 10 minutes into the flight, their helicopter having collided with a 734-foot tall radio transmission tower.

We would not know of this tragedy for almost two hours, and then some. Robert was out of town preparing for a deployment to Afghanistan. Brooke drove to Children's Hospital in Chicago while baby Kirstin, suffering seizures, was being transported by helicopter. Arriving at the hospital, Brooke was met by the hospital chaplain,

who informed her of the crash. Disbelief quickly gave way to anguished tears. After all, the name Air Angels denotes protection and succor.

Brooke was finally able to get through on the telephone to Robert at 5 a.m. on the morning of 16 October, repeating the sad news of the helicopter's crash and Kirsten's death. Robert got a plane back to Chicago later that day, and the two of us were just in stunned grief. Our daughter Kirstin was a fine, loving little girl. Her eyes danced with life, she had a smile that melted your heart, and her laughter was contagious and reflected all the discoveries that are so new and innocent to an infant – like her toes!

Her treatment at Chicago's Children's Memorial Hospital could have been a miracle of medical science. In the crash of the helicopter, Kirstin was robbed of her chance for that life-saving miracle.

It is not just we parents that must cope with this loss. Kirstin's two year old brother is struggling with the loss of his sister, as well. A child's bereavement is in many respects superficial, not understanding the precise nature of his sister's loss, knowing only that she is no longer present. But we parents are knowledgeable of the awful reality, and we will bear the grim experience of 15 October 2008 for the remainder of our lives. The sense of loss does not diminish with time. In truth, the expression "time heals all wounds" is a myth. For parents, the loss of a child is permanent, and mental scar tissue really does not grow over the grim memory. Rather, all tears are expended and a dull ache remains.

What we have learned since, to our dismay and rising anger, is that helicopter EMS operations suffer from lapses in operational safety, deficiencies in key safety equipment, lack of essential procedures and lax oversight.

Adding to the shock of loss was the realization that helicopter EMS flights are operated under conditions that would not be tolerated on a commercial airliner. Yet the unsuspecting general public depends on EMS helicopters in moments of extreme stress – when traffic accident injuries occur, when life-threatening medical conditions require speedy and expert treatment, and so forth. Neither victims requiring aerial evacuation nor the families are aware that there is a long history of EMS accidents and that the dismal record spiked to eight such helicopter accidents in 2008. Other families have been traumatized by the losses of relatives killed or injured in EMS helicopter accidents. Nor should we forget the medical attendants and pilots who undertake these flights. All of the deaths are senseless.

What makes no sense is the discovery that in the face of known hazards, there has not been vigorous and effective corrective action. This state of affairs is intolerable.

Based on our discovery over the past few weeks, to include searching the Internet, talking to air safety experts, reviewing the history of past efforts to improve safety, and so forth, the following comments are submitted. What these remarks indicate is that much can be discovered by a family seared by an EMS crash. But families are understandably not aware of the general situation before a crash. We certainly weren't. But federal and state officials definitely are aware of the unsatisfactory state of affairs. It is incumbent on them to take action; there is no more extreme version of "the public trust" than the safety of EMS aerial evacuations.

In this day and age, colliding inadvertently with man-made towers, buildings, bridges, and whatnot, is inexcusable. Why? Because these edifices can be included in a computerized terrain data base, which forms the basis of TAWS, the terrain awareness and warning systems that are found on all commercial airliners. This equipment is largely responsible for virtually eliminating a class of accidents so pervasive that it has its own acronym: CFIT, for controlled flight into terrain. If a pilot of an airliner gets dangerously close to terrain (or man-made objects), the system sounds a warning to "Pull Up!"

The system provides a minute or more advance warning of impending disaster. With their slower cruise speeds, TAWS would provide even more warning for helicopters. Reflect upon the fact that fixed wing cruise altitudes are always considerably higher than en route terrain and obstacles, so the fixed wing airplane's risk exposure is mostly during the latter approach and landing phase. Consequently, the "at risk" terrain collision period for the fixed wing airplane may be as little as 2.5% or less of the cumulative flight time (and at night the risk is much less because a fixed wing airplane will be conducting a published instrument approach).

A completely different scenario pertains for the EMS helicopter (or any helicopter, for that matter). Helicopters are normally cruising in the lower altitudes for performance, icing avoidance, and air traffic control separation reasons. Helicopters are vulnerable to CFIT virtually throughout their sortie length, particularly at night or in foul weather. The workload for a single pilot is also much greater, often to the point of overload. The risk profile for EMS helicopters is in fact maximal.

When considering the risk factors peculiar to night flights, we must first envisage the situation from the helicopter's cockpit. On a dark night, even in good weather with no precipitation (moonless due to cloud cover, for instance), the "look ahead" panorama over built-up areas will include a sea of lights. Some of them will be steady, some blinking in and out due to momentary obscuration, and some will be flashing (neon signs, etc.), while others will be mobile (aircraft, road traffic). Amidst this sea of lights may be a red obstruction light flashing atop an aeronautical hazard, identifying the building, tower, bridge as a danger to the

pilot's operation – assuming that he's even aware of the existence along his track of such fixed obstacles.



Wreckage typical of the ending of too many nighttime EMS helicopter flights.

What if the red blinking light marks the top of a large mast antenna? From some lower vantage point the light will tend to meld into the night sky's stars. If the pilot does see the light for what it is, will he be quick enough to circumnavigate the tower at a sufficient distance to avoid its guy-wires? How, in fact, will a single pilot be navigating? It will usually be via GPS (Global Positioning System) waypoints and/or ADF/VOR (automatic direction finder/VHF omnidirectional radio range) "needle on the nose" (i.e., point at the navigation aid, just head for where you're going).

The sea of lights over a metropolis and its surrounding suburbs is just part of the EMS pilot's all-round background lightscape. Especially at night, the single pilot won't be analyzing the lighting diorama outside his capsule, as it were, particularly if it's only distantly in his visual field of view. He'll usually be without a visual horizon at night and focusing on his instruments. Thus, an intermediate range antenna's red obstruction light will be either unnoticed or lost in the sea of background city/suburban background lights. Lights warning of hazards to navigation can also be obscured by mist or smog.

These are all factors aggravating the CFIT hazard. Given this situation, the fact that the Federal Aviation Administration (FAA) has not yet mandated TAWS for helicopter ambulances is, frankly, unconscionable.

Through Nolan Law Group of Chicago we filed a lawsuit 9 January 2009 against Air Angels Inc. and Reach Medical Holdings Inc., the parent company. We are seeking damages based on the following acts or omissions:

- (a) Failing to equip the subject helicopter with TAWS.
- (b) Failing to implement an effective Operational Risk Assessment Program.

- (c) Failing to provide proper and adequate dispatch, flight planning and flight following procedures, including information and data regarding hazards along the route of the flight.
- (d) Failing to provide two pilots for operation of the flight.
- (e) Failing to maintain safe separation between the helicopter and an existing tower hazard.
- (f) Failing to properly evaluate the environmental risks in utilizing the subject pilot for a single pilot helicopter EMS operation.

Other factors may become evident in the process of discovery. What should be evident from this brief listing of safety shortcomings is that many of these factors will be familiar to the NTSB, which has investigated numerous EMS accidents over the years. The NTSB is presently investigating half a dozen EMS helicopter accidents in 2008, and in fact has reported that the EMS helicopter accident rate in 2008 is the worst on record. There were 12 EMS helicopter accidents in 2008 resulting in 28 deaths and 5 seriously injured people aboard.

James Hall, former chairman of the National Transportation Safety Board (NTSB), said recently: “EMS helicopters – often proclaimed ‘angels of mercy’ – are among the most dangerous aircraft in the skies today.”

According to the NTSB, 55 EMS aircraft accidents occurred from 2002-2005, and the accident rate was roughly 4.56 per 100,000 flight hours. This is shockingly high compared to scheduled commercial airlines, where the accident rate – at 0.128 per 100,000 hours in 2007 (the most recent data) – is some 35 times lower.

At least four major studies have been taken of EMS accidents. After an unfortunate spate of EMS accidents in the late 1970s and early 1980s, the NTSB conducted a special study in 1988 of EMS operations. Then, after a similar spike in accidents in the 1990s and early in this decade, the NTSB prepared another “Special Investigation” of EMS operations in 2006. As a result of its latest inquiry, the NTSB issued in 2006 four recommendations to the FAA:

1. Require EMS operators to comply with Part 135 operations specifications, which are more rigorous than Part 91. The Federal Aviation Administration (FAA) told the NTSB that Part 135 flight rules will only be required when medical crew are on board, and EMS flights will be exempt from the requirement for weather reporting at their destination. The NTSB considered this approach an acceptable alternative. The FAA, in our opinion, scores one here for slow-rolling the recommendation.
2. Requires EMS operators to implement a flight risk evaluation program, said form to be completed before the flight to assess whether the risk (e.g., from poor visibility) outweighs the benefit of aerial medical evacuation. The FAA replied that risk assessment would be added to

company Operations Specifications (OpSpecs). Although this has yet to be done, the NTSB has classified the recommendation as “Open” with an acceptable response. Score two here for the FAA again slow-rolling the NTSB.

3. Require EMS operators to use formalized dispatch and flight-following procedures. Response: the FAA is examining the role that a “communication specialist” could play in performing dispatch and flight following activities. This answer studiously avoids the establishment of dispatchers at EMS flight operations centers, as they have for the airlines – where dispatchers and pilots share joint responsibility for safe conduct of a flight. By the way, dispatchers at the airlines follow a flight on radar from takeoff to landing, and are in constant communication with the flight crew regarding weather, traffic delays, and the myriad other problems that can impact the flight schedule. However, it must be said that flight-following an aircraft’s scheduled stops at accredited airports is a wholly different proposition to vague and distant moral support for a helicopter operating into ad hoc traffic accident locations. One could argue that dispatcher flight following is even more important for EMS operations. Score three here for the FAA successfully avoiding imposing anything approaching an airline standard to EMS operations.
4. Require EMS operators to install terrain awareness and warning systems (TAWS) on their aircraft. The FAA has yet to issue a Notice of Proposed Rulemaking (NPRM) imposing such a requirement on EMS operators. Score four here for the FAA’s benign regulatory neglect.

It should be noted that for airliners, the FAA has required two warning systems: TAWS to provide flight crews an alert of threatening terrain or obstacles (e.g., cliffs, power line towers), and TCAS (Traffic Alert Collision Avoidance System) to warn of other aircraft nearby and the need to take avoidance action. TCAS might have alerted one or both helicopter pilots in the Flagstaff, AZ, disaster, when two EMS helicopters, coming from opposite directions, collided in midair, scattering broken bodies and bent, fractured aluminum over a 500-square yard area.

Although this is the first mid-air collision involving EMS helicopters, these flights often occur in the vicinity of local airports, where fixed-wing aircraft operate. I am betting that when the NTSB sorts through the dynamics of the Flagstaff mid-air collision, one or both pilots never saw the other helicopter. It is not unknown for both participants in a midair collision to have been motoring along with each aircraft resident in the other’s blind spot. Only a minimalist TCAS, radar-based air traffic control, satellite based surveillance (ADS-B, explained below) or an actively defensive lookout could avoid that pitfall.

A major study of EMS operations was also completed in November 2002 by the Air Medical Physician Association (AMPA). This effort did not culminate in

recommendations, but rather it collated comprehensive statistics on EMS operations. For instance: “Pilot error was attributed as the direct or indirect cause of EMS accidents nearly three times more often than mechanical failure.”

You then have to discern whether that pilot error relates to negligence, nonchalance, fatigue, lack of third-party support, inexperience, lack of operational currency, or a fatal potpourri of each, which the study goes on to discuss.

And,

“Main cabin occupants have nearly 4.5 times the risk of serious injury (especially back injuries and head injuries) or death in survivable crashes when compared to a comparable population of occupants in the cabin of non-EMS air taxi helicopters.”

The Helicopter Association International hosted an EMS safety summit in 2001, and it proposed a number of “interventions” to enhance safety. These included improved training, equipping aircraft with radar altimeters, installing TAWS, and other stratagems. The training needed to be mission oriented. If the pilot is expected to find and land in an LZ (landing zone) in the mountains on a pitch-black foggy night or land in a dusty or snowy LZ, regular and recurrent training should meet that requirement, as opposed to practicing on sterile runways or helipads, the study said.

Many in the helicopter community argue that night vision goggles would enhance safety. The NTSB has not recommended the goggles, going only so far in its 2006 report to say, “If properly used, night vision imaging systems could help EMS pilots identify and avoid hazards during nighttime operations.”

The NTSB prudently noted that night vision goggles are not useful in “populated areas with ambient light and numerous streetlights.”

The lack of safety in EMS operations is not unique to the United States. Here is a 2005 comment on the situation in Australia:

“[The] supervision provided by CASA [Civilian Aviation Safety Authority] varies with the category of operation. HEMS [helicopter emergency medical services] is situated at the lower end of the oversight spectrum ... resulting in a level of scrutiny that, given the complexity and risk involved, is lower than perhaps required ... Given the low level of regulator scrutiny ... the industry has recognized a need to enforce its own standards by commissioning aviation safety experts to conduct independent safety audits. For example, in high-risk areas, such as the off-shore oil industry, oil companies conduct independent safety audits of contracted helicopter operators as frequently as every couple of months. Although HEMS carry greater risk than off-shore oil work, at least one Australian state government is yet to conduct any

independent audits of its contracted HEMS operators, despite this being a requirement of contract.”

Those words could apply to FAA oversight here in the U.S. as well.

Others in the U.S. are getting fed up with the lack of EMS helicopter safety. In the wake of a deadly 28 September 2008 EMS helicopter crash in Maryland, killing three, Maryland State Senators Pipkin and John Astle on 17 October sent a list of 35 questions regarding medical helicopter safety to the State Police (which operates helicopter ambulances in Maryland) and to the state’s Institute of Emergency Medical Services Systems.

Their letter comes on the heels of a Legislative Audit Report in August that found serious shortcomings in maintenance of the helicopters. Those shortcomings included, but are not limited to, poor record keeping of maintenance performed on the helicopters and a shortage of spare parts.

In some respects, the itemized areas of inquiry highlighted by the senators’ letter is more comprehensive than the findings of the NTSB’s 2006 Special Investigation Report, in that the NTSB review was restricted to flight operations, while the senators were questioning the state of maintenance as well. On the other hand, the NTSB urged that all medical flights be conducted under Part 135 of the Federal Aviation Regulations, which would impose higher standards than Part 91 and would apply not only to flights with patients but also to positioning flights. The senators were silent on this matter.

The senators noted that the accident helicopter was not equipped with a “federally recommended” Terrain Awareness and Warning System (TAWS), but they failed to note that the NTSB has urged that this technology be required by the FAA, not merely recommended.

The senators properly question the flight following procedures at the State Police helicopter dispatch center. After all, if the flight was being tracked, it shouldn’t have taken about 40 minutes to call for a search for the overdue helicopter.

Further, a two pilot requirement for EMS flights – which is not now mandated – would alleviate the workload which increases during critical phases of flight, abnormal and emergency flight situations.

Pilots of EMS helicopters have a long list of duties they may have to perform each flight: they must locate a remote landing site (as opposed to an airport with its navigational aids and air traffic controllers for terminal guidance), engage in radio communications with emergency personnel on the ground, communicate with emergency medical staff in the helicopter, fly the helicopter at night and in bad weather, operate at low altitude where a premium is placed on precise navigation, avoid terrain and various obstacles. The fact that these pilots must do

many or all of these tasks each flight raises an obvious question: can a single pilot perform the three essential tasks of aviating, communicating and navigating?

Neither the NTSB nor the state senators have raised the issue of workload and single pilot operations.

Congress has stepped in and taken action to upgrade standards by which emergency medical service (EMS) helicopters are operated. The Congressional legislation goes a long way toward ending the FAA shilly-shallying over NTSB recommendations.

The Senate Commerce Committee reported out a bill in May 2008, called "S.1300, Aviation Investment & Modernization Act of 2007," that funds the FAA for the 2008-2011 time frame. The legislation imposes new requirements on commercial air carriers and on operators of EMS helicopters; the requirements equate closely to the NTSB recommendations. For example, the NTSB recommended that EMS operations comply fully with Part 135 operations specifications, and the legislation does require this whenever a helicopter has medical personnel aboard. However, the legislation accords with the FAA position, exempting EMS flights from the requirement for weather reporting at their destination. Thus, helipads that do not have weather-reporting equipment or personnel required for a Part 135 flight's approach will not be required to have this capability for, say, positioning flights. The FAA said in a 2007 letter to the NTSB that requiring full Part 135 compliance "would impose a significant burden on the owners/operators of these helipads to acquire this capability."

The NTSB wanted a flight risk evaluation prepared for each EMS flight, to basically structure the determination as to whether the conditions were prohibitive or not for aerial evacuation. A checklist has been developed for such an assessment, but its use is not presently mandatory. The FAA originally was committed to requiring a flight risk assessment as part of a medical evacuation company's operations specifications (OpSpecs) by 2006. Now, almost three years later, Congress is directing the FAA to get this done within 18 months. This deadline is generous, to say the least, and it means that the flight risk evaluation will not be fully implemented until 2010. Giving the FAA six months would have been more appropriate given the unnecessary delay thus far.

The new law requires EMS operators to adopt dispatchers and the roles they play in airline operations. In a 2007 letter to the NTSB the FAA said it is embarking on a one-year study of this issue. The law seems to supersede the FAA's stately approach.

Congress is requiring terrain avoidance systems, but only for helicopters acquired after the law enters into force. This seems an enormous loophole, as the hundreds of EMS helicopters now in service will not have to be retrofitted with

this life-saving technology. While this technology will warn the pilot of potential impact with terrain of man-made objects, it will not alert aircrews to threatened collisions with other flying machines, as happened at Flagstaff.

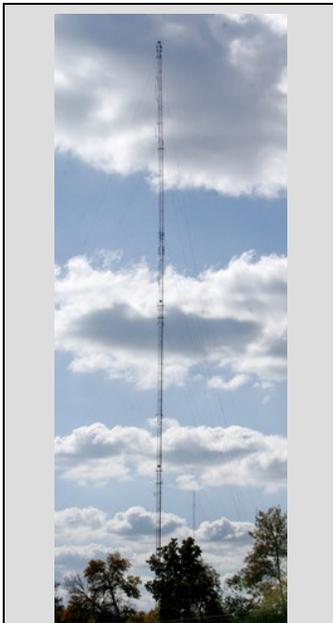
The new law requires the FAA to conduct a feasibility study of equipping new and existing EMS helicopters with cockpit voice and flight data recorders (CVR/FDR). Not said is what is to be done if such equipage were not feasible; rather, the law requires CVR/FDR's to be installed within two years, which seems to make the feasibility study superfluous. Thus, all EMS machines will be required to have CVR/FDRs, but only new helicopters will be required to have terrain avoidance technology. In other words, only new aircraft will be required to have a system that will prevent accidents, but all EMS helicopters will have recorders for analysis of factors following accidents. The irony, of course, is that the CVR/FDR recordings might well indicate that collision with terrain could have been avoided with an appropriate warning system.

From the litany of shortcomings, it is possible to put together a list of suggested corrective actions far more comprehensive than anything yet proposed by the NTSB or legislated by a frustrated Congress:

- ▶ How about hospitals served by EMS operators retain aviation safety experts to conduct the independent safety audits bi-monthly of the type performed by the off-shore oil industry in Australia?
- ▶ Perhaps the wisdom of contracting medical evacuation flights to private companies merits assessment. In the state of Maryland, the function is performed by the aviation department of the state police. Maryland is the only state to opt for government-provided service, thus assuring coverage of small towns and remote areas throughout the state (unless coverage of these areas is mandated in the contract, the private EMS aviation firms are going to concentrate on the areas of greatest population density).
- ▶ To what extent does competition for business among private EMS providers result in pressure to evacuate patients by air? One account indicates that many patients without life-threatening and/or time-sensitive injuries could be evacuated by ground ambulance. Bad weather and darkness should be determining arbiters of need. Both factors loom large in the accident statistics' scenarios.
- ▶ Should EMS companies maintain a full-time dispatcher capability along the lines of airline operations centers? Having a 911 operator perform this function borders on the irresponsible, as those operators are not familiar with aviation, do not have access to real-time weather reports, etc. The risk assessment for each flight should be jointly conducted by the pilot and the dispatcher, with either one empowered to say "no" to the justification (or qualifications/specifications required) for a flight.

‣ Is one pilot in the helicopter sufficient, given the workload and nature of the mission, where the pick-up point is not a hospital helipad but a parking lot, highway or remote clearing? The helicopters were designed for two-pilot operation, with duties divided between the pilot flying (PF) and the pilot not flying (PNF). For example, the PNF assumes navigation, radio, fuel management and systems and safety monitoring duties (including basic visual lookout) while the PF focuses primarily on the aviating, attitude instrument flying and airmanship aspects of the flight. Two pilots are required for airline and most air taxi operations, but not for EMS helicopters (the Maryland state police operate with two pilots per helicopter, we should note).

‣ More needs to be done to prevent collisions with towers, power lines, tall buildings, etc. While these man-made structures can be included in the TAWS terrain database, all such structures may not be incorporated. As a last ditch guard, consideration should be given to mounting transponders on towers, buildings, and so forth – the pilot of an approaching helicopter would receive a warning in his earpieces. It is clear that blinking red lights on these structures are not enough, especially given the panoply of lights in an urban area and the visibility problems attendant to fog, snow and other inclement weather.



Note that the guy-wires on the antenna tower struck by the Air Angels flight are practically invisible *in daylight*.

‣ Pilots and controllers should be able to anonymously report safety hazards through an Aviation Safety Action Program (ASAP). The absence of such programs among EMS operators means that insights into latent hazards, time pressures, and other factors, is lost.

‣ The minimum equipment list (MEL) at all EMS operators should be evaluated for effectiveness and relevance. For example, while many operators have equipped their helicopters with radar altimeters, the altimeters do not always work, and flying with an inoperative radar altimeter is permitted. In a 2005 crash into the Potomac River in Washington DC, the radar altimeter, which was functioning the night before, was inoperative the night of the crash, when the same pilot from the night before lost spatial awareness.

‣ Dispatchers for EMS operations need the capability to follow the flight throughout. This is not possible with ground-based radar, as the helicopters often fly at low altitude and hence below radar coverage. However, a satellite-based system, automatic dependent surveillance – broadcast, or

ADS-B, could provide full-time flight-following capability and awareness of other air traffic (and a timely alerting of mid-air potentials).

The impression one gets of the EMS industry is of a general apathy towards development of a voluntary safety culture, and a reluctance to invest in those programs and technologies that support safety. Night vision goggles have been adopted by some operators, but they are only for limited application. ASAP programs, equipping with TAWS and TCAS, and staffing for two-pilot operations would go considerably further in improving safety.

The lawsuit filed on our behalf in the aftermath of the Aurora, IL, EMS helicopter collision with an antenna tower lists a bill of particulars that is not unique. Indeed, it is a listing of deficiencies that, to a greater or lesser extent, has been identified in various studies, symposia and commentaries of recent years. The same factors contributing to a mishap or fatal accident keep cropping up. For how much longer will this situation be tolerated?

The earliest acid test of medicine – “first, do no harm” – can be applied to EMS operations. This timeless medical precept is violated too often in aeromedical evacuation, as evidenced by the grim and extensive mishap history. The EMS industry is often perceived to be more like the fourth horseman of the Apocalypse than an angel of mercy.

The loss of our infant daughter will have meaning only if it catalyzes action to improve the safety standards of EMS flights. Instead of delivering Kirstin to a hospital of scientific miracles, we have discovered that she was the innocent victim of poor to nonexistent aerial standards and procedures. Instead of hope, we have been cast into grief. Now, lamentations give way to a sense that action is too long overdue.

*Robert & Brooke Blockinger*

13 January 2009

File: EMS filing A