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AERONAUTICAL DECISION MAKING FOR AIR AMBULANCE HELICOPTER PILOTS: SITUATIONAL AWARENESS EXERCISES

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16. Abstract

The following materials are based upon actual helicopter air ambulance accidents. They cover four broad accident types most recently associated with aeromedical accidents: night flying, weather, obstacle strikes, and mechanical failures. Three types of information are included for each accident type. These are: introductory/background material to provide you with the historical importance and frequency of each accident type; training knowledge that should be learned in order to avoid mistakes of the past; and decision making exercises.

This is only one element of a multi-volume set of training materials designed to significantly reduce the helicopter air ambulance accident rate and keep it under control hereafter. The other volumes include:

Aeronautical Decision Making for Helicopter Pilots
Aeronautical Decision Making for Air Ambulance Helicopter Pilots: Learning From Past Mistakes
Risk Management for Air Ambulance Helicopter Operators
Aeronautical Decision Making for Air Ambulance Helicopter Program Administrators

These decision making exercises are based on accident reports with persons and places de-identified. They are meant to enhance the basic manual: "Aeronautical Decision Making for Helicopter Pilots" by providing an insight to the types of decision errors which contributed to accidents in the past. The basic manual contains introductory and tutorial material necessary for improving basic decision making skills. Some material contained in that manual and not included in this one are: rotorcraft risk assessment; the self-awareness inventory; identifying and reducing stress; and headwork. Reading and understanding the concepts of decision making will improve the pilot's ability to analyze the scenarios contained herein.

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1.0 HELICOPTER AIR AMBULANCE DECISION MAKING

1.1 INTRODUCTION

The following situational awareness exercises for air ambulance pilots are supplements to the basic manual on "Aeronautical Decision Making for Helicopter Pilots." The basic manual contains introductory and other material necessary for completion of the "judgment" course and should be read first. Material contained in that manual and not repeated here includes: Rotorcraft Risk Assessment; the Self-Assessment Inventory; Identifying and Reducing Stress; and, Headwork. Please read the basic manual and obtain a thorough understanding of all aspects of the decision making problem before attempting to complete these exercises.

Recent aeromedical helicopter accident statistics show that 67% of all fatal accidents are weather related. The vast majority (71%) of those occur during the hours of darkness, and during the en route segment of flights. Since about 40% of EMS operations are at night, this indicates a very serious problem. That is, pilots either are not being adequately trained, are forgetting their training or are not maintaining their proficiency in those special skills and knowledge demanded by flying in the dark.

Even on the clearest night with VFR conditions, a pilot can come close to IFR operations if there is no moon and/or no ground lights to establish a horizon reference. Or, on the other hand, a profusion of ground lights below and stars above can merge into a continuous sweep of pinpoints that deprive a pilot of any horizon reference. However, the real "killer" lurking in the night sky is the unseen cloud. Clouds disappear easily in the dark and you can fly into one without seeing it coming. Accordingly, the prudent aeromedical pilot must be proficient in keeping the helicopter upright by reference to instruments, even if he's not instrument rated.

1.2 Hazards of Flying "In the Dark"

Night helicopter flight presents many distinct hazards and piloting challenges not encountered during day VMC operations. First , the physiology of "Night Vision" greatly reduces the amount of visual information supplied to the brain. Second, some of the information that is supplied can be erroneous due to the effects of night visual illusions. Third, night helicopter operations require added dimensions of caution and respect to compensate for the eye's lack of daylight visual acuity. Finally, night flight requires diligent prior planning for both the operation and any possible emergencies.

Physiological Hazards

At night, your eyes use different receptors to process images in the subdued light. The impact of this process on flight operations is significant. First, your sharp daylight color vision is lost. You may see some colors, but only from brightly illuminated sources. Consequently, the major visual elements of depth, texture and size determination are lost during night flying. In addition, the ability to distinguish small or distant objects is greatly diminished. Furthermore, because the pupil dilates to gather as much light as possible, the depth of field is reduced.

These general night vision limitations are exacerbated by three other consequences of flying in reduced light. First, the transition from an area of bright light (ready rooms) to the dimly lit helicopter cockpit involves a period in which you will see even less than you do under normal night lighting. Your eyes may function below par for up to 30 minutes. For this reason, EMS operations are not conducive to obtaining night vision. Pilots must recognize this hazard and learn how to compensate.

Second, the eye has a central night vision blind spot that extends outward at a 5 to 10 degree arc. During night operations, it is important to scan more frequently and to avoid straight-ahead fixations. That blind spot is large enough to cover a medium size jet at 3000 feet. Finally, some researchers believe that about 75 percent of people with normal vision in daylight become nearsighted in dim light. Have your opthamologist or optometrist check your night distance vision if you suspect any problem.

Visual Illusion Hazards

We all learned about autokinesis and night myopia during our early flight instruction. When is the last time you thought about these potential hazards during an actual night operation? Autokinesis or "self movement caused by fixation" can be a threat when attempting to fix your location by reference to a single light source, particularly during takeoff and landing. Night myopia may be most pronounced in pilots wearing corrective lenses, but it can be avoided in all cases by concentrated scanning and by deliberate focusing on distant objects.

Distance determination can be particularly difficult in the dark. Distance perception is based largely on the relative light intensity and an assumption regarding the light source. Be aware of the fact that you are measuring light intensities at night and weigh those judgments against your familiarity with the sources available. Your distance judgment could be off significantly based upon unfamiliar light sources.

Finally, beware of "False Horizons". When there is little or no ambient light, and a steady, prominent light comes into view there can be an overwhelming sensation that the light source is above the horizon. The effect can be a climbing sensation and a strong impulse to pitch the nose down to compensate. When the light is fairly low and the sensation is strong, the impulse to pitch down can be dangerously strong and persistent.

The solution to all of these visual illusions and the inadequacy of night visual information is the same. Make use of every available source of information. For this reason, night flying is always, at least, partial instrument flying since the outside visual information that is available should be backed up with instrument readings.

Flight Operational Hazards

Night operations in a helicopter are only variations of those same maneuvers used in daylight. However, as illustrated by the accident statistics, there are compelling reasons to make a distinction.

A. Hovering - Higher hovering altitudes should be used because of the difficulties in determining distances and relative motion during the hours of darkness. The higher altitudes help assure ground clearance and provide a better perspective to see additional light sources and improve motion senses.

B. Hover Taxi - There is a tendency to fly too close to the ground and at excessive speeds again due to the decreased sense of relative motion. Be extra vigilant regarding hover taxi speeds and the possibility of overshoots.

C. Takeoffs - Night takeoffs are best accomplished with additional reference to the altimeter and airspeed indicator in order to establish a safe departure vertical profile. Many of the visual images that are available in daylight will be missing at night so instrument scanning is important to establish a positive gradient and to stay out of the avoid areas of the height-velocity diagram.

D. En route - Night cruising flight should be at altitudes that are known to be well clear of all obstacles. Towers, wires and terrain features may not be visible within sufficient time to avoid a collision. Similarly, cruise flight at night makes difficult the visual acquisition of suitable landing sites for autorotation in the event of power or tail-rotor failure.

E. Landings - Night approaches are usually a little steeper and slower than daylight approaches. In the absence of electronic or visual glideslope information the pilot must rely more on airspeed and altimeter information in lieu of the usual visual cues available in daylight to assure a safe profile.

   Night approaches should terminate in a hover, with the landing lights on, to assure zero groundspeed before touchdown. Relative motion can be difficult to perceive in the absence of adequate light, and any drift at touchdown can be uncomfortable or even hazardous.

F. Emergencies - The best preparation for night emergency landings is the realization that they are far more hazardous than daytime emergency landings, and to mentally rehearse the procedures before flight. As a minimum you should be sufficiently familiar with the cockpit to locate every essential control by feel.

   It is sometimes virtually impossible to see specific terrain features in the dark, so preparation for emergency landings becomes much more critical. Special attention should be given to conservative fuel loads and to any maintenance discrepancies that might compromise the powertrain. Also, make sure that your seat belts are secure. When you are forced into an emergency landing at night use the landing lights and make the steepest possible approach if there is any chance of unknown obstacles.

Night Planning & Equipment

Every night flight should begin with a flight plan. That plan can be filed with the FAA if appropriate or it can be left with business

associates, even friends or family. Someone should know where you intend to fly and what schedule you intend to follow.

Charts for night flying should be carefully marked in colors visible under cockpit night lighting prior to the flight and folded for ready reference. Also, pertinent frequencies, altitudes, locations and other flight data should be carefully noted and readily available because it is far more difficult to manipulate pencils and paper in a darkened cockpit.

The FAA requires you to have a flashlight readily available on night flights, which can be extremely important in the event of electrical failure. In fact, because that flashlight is so important you should carry a spare. Personal experience will dictate any other important pieces of equipment that should be carried along, and they should be prepared and stowed in advance.

Night helicopter operations are not so much hazardous as they are unforgiving of human error. Fly with confidence based on knowledge, skill, experience and a healthy respect for the number and types of hazards and decisions you may encounter.

1.3 Review of Aeronautical Decision Making Basics

The term "pilot error" is often used to describe an accident cause and is generally an oversimplification, implying that the pilot intended to have an accident. Pilots always intend to fly safely, but they sometimes make decision errors. Their skill (or luck) is often sufficient to get them out of situations resulting from poor judgment. The objective of these exercises is to teach air ambulance helicopter pilots the techniques to avoid situations that require luck or skill greater than their capabilities. Good judgment means avoiding those situations that require superior skill to overcome.

The following material will not present any new information about flight, decision making, or stress. Rather, this material will reinforce your understanding and appreciation of the material you have studied in the basic Helicopter Pilots ADM text.

The following exercises require you to apply your newly acquired knowledge to aeromedical situations. The examples and scenarios used in these exercises are based on actual NTSB case files of pilots who made errors by failing to exercise good judgment.

In order to proceed with these exercises you must be thoroughly familiar with and clearly remember the following tenets of aeronautical decision making:

	ADM Manual Cross Reference
o Classic Piloting Psychological Pitfalls	p. 4-5
o Decision Making Concepts	p. 5-7
o Four Basic Risk Elements	p. 9-11
o Two Basic Risk Principles	p. 31
o Five Hazardous Attitudes	p. 45
o Antidotes for Hazardous Attitudes	p. 65
o Three Classes of Stressors In Flying	p. 86

If you do not clearly remember these basics, you should go back and review them before continuing. Before you begin the applications exercises, test your recall of the material by filling in the blank spaces with the correct information.

Match the classic piloting psychological pitfall on the left with the correct definition on the right by placing the proper letter in the blank space provided:

PITFALL	DEFINITION	ANSWER
1. Peer Pressure	a. Unjustified reliance on the aircraft's high performance capabilities.	_____
2. Mental Set	b. Inability to recognize deteriorating circumstances and/or misjudgment of the rate of deterioration.	_____
3. Get-There-Itis	c. The only alternative to flying into the ground.	_____
4. Duck-Under Syndrome	d. Unjustified reliance on the pilot's memory, flying skills, repetitive and familiar routes, etc.	_____
5. Scud Running	e. Poor decision making based upon an emotional response to others.	_____
6. Inadvertant IMC	f. Judgement impaired by a fixation on the original goal or destination.	_____
7. Neglect of Flight Planning, Preflight, Checklist	g. Allowing events or the situation to control your actions rather than the other way around.	_____
8. Flying Outside the Envelope	h. Inability to recognize and cope with changes in the situation different from those anticipated.	_____
9. Descent Below MEA	i. Ignoring minimum fuel resource requirements (either IFR or VFR).	_____
10. Operating Without Adequate Fuel Reserves	j. The tendency to "sneak a peek" by descending below minimums during an approach.	_____
11. Loss of Situational Awareness	k. The "duck under syndrome" during the en route portion of an IFR flight.	_____
12. Getting Behind the Aircraft	l. Pushing the capabilities of the pilot and aircraft by trying to maintain visual contact with terrain while trying to avoid physical contact with it.	_____

The six decision making concepts are:

_____
_____
_____
_____
_____
_____

To check your answers see Chapter 1.0, pages 5-7 in the manual.

The four basic risk elements are:

_____
_____
_____
_____

To check your answers, turn to Chapter 2.0, page 9 and read through the section again.

What two basic risk principles have been observed in decision making accidents?

1._____
_____
2._____
_____

Review Chapter 3.0 Section E (p. 31) on Balancing Risk While Flying to check you answers. Always be aware of the "Poor Judgment Chain".

The five hazardous thoughts are:

_____	"_____"
_____	"_____"
_____	"_____"
_____	"_____"
_____	"_____"

Check page 45 for the correct answers. Memorize the hazardous attitudes before proceeding.

The antidotes for hazardous attitudes are:

Hazardous Attitude	Antidote
_____	"_____"
_____	"_____"
_____	"_____"
_____	"_____"
_____	"_____"

Check page 65 for the correct answers.

The three classes of stressors in flying are:

_____

_____

_____

Check page 86 for the correct answers.

2.0 DECISION MAKING IN MARGINAL WEATHER

2.1 Night -- En route -- Inadvertent IMC

The following true report is the story of a pilot who made a series of poor decisions which, in the end, were fatal. Read the story and then answer the questions which follow.

Accident Scenario:

(1) I had just successfully completed the transport of a heart patient. (2) Although the flight caused me to miss lunch, I decided to refuel and return to my base hospital as soon as possible, due to low (700') ceilings at my destination. (3) My single engine helicopter was not IFR certified. (4) I'd been flying this model for nearly 1500 hours and nothing's ever happened to me yet that required IFR capability. (5) As I approached the Control Zone of the local airport near my hospital helipad, I estimated the ceiling was about 400 to 500 feet and noticed there were some patches of clouds and fog below that. (6) I called Center and requested an SVFR clearance. (7) I knew I could make it to the helipad by following I-84 to the hospital. (8) I always make it back to my home base! (9) Center asked me to hold while they completed handling some IFR fixed wing approaches.

(10) As time dragged on, I had some difficulty staying clear of clouds and keeping I-84 in sight. (11) The next thing I knew a low fuel warning light came on. (12) I called Center to see what was holding up my clearance. (13) An eternity later, they called back and I was cleared SVFR to the helipad.

(14) Now what? - I've punched into a little bit of that low fog. (15) I'll just hold it level and fly through this baby like I would in my Cessna 182. (16) Who needs a helicopter instrument rating when you are already fixed wing rated? (17) Oh Sh...!!! its getting thicker and I've lost VFR. (18) Mayday!!! Mayday!!! "I'm inadvertent IFR and things look pretty bad."

Tower - "Roger sir are you capable of correction? Are you capable of and qualified for IFR flight?

Pilot - Negative sir.

Tower - Could you give me your position and altitude.

Pilot - Im at, oh, two thousand two hundred and I'm five point one miles from....."

Questions:

1. The first principle of the decision making process states, "One poor judgment increases the probability that another poor judgment will follow." Which sentence best represents what this principle is about?

   a. Number 1
   b. Number 2
   c. Number 3
   d. Number 4

2. What hazardous attitude best describes the pilot's thinking in sentence 4?

   a. Anti-Authority
   b. Impulsivity
   c. Invulnerability
   d. Resignation

3. The risk element mentioned in sentence 5 is?

   a. Pilot
   b. Aircraft
   c. Environment
   d. Operation

4. What classic piloting psychological pitfall does the statement in sentence 8 represent?

   a. Responding to Peer Pressure
   b. Mental Set (or expectancy)
   c. Scud Running
   d. Get-There-Itis

5. What combination of risk elements does sentence 10 suggest?

   a. Pilot/Aircraft
   b. Aircraft/Environment
   c. Environment/Operation
   d. Pilot/Environment

6. What does sentence 15 suggest to you about the pilot?

   a. He is not aware of the graveness of the situation
   b. He is overconfident
   c. He has overestimated his ability
   d. All of the above.

7. Which antidote would you suggest for what the pilot is saying in sentence 16?

   a. Follow the rules. They are usually right.
   b. Not so fast. Think first.
   c. I'm not helpless. I can make a difference.
   d. It could happen to me.

2.2 Day -- En route -- Inadvertent IMC

The following exercise is based upon an NTSB case file of an accident which could happen to pilots of any experience level. An unexpected, lethal rolling fog bank surprised the pilot. He was unable to hold altitude and struck a mountain peak less than 60 seconds after entering IMC. Read the story and then answer the questions which follow.

Accident Scenario:

(1) I had just completed a well earned 3 day rest period at the beach cottage I share with 3 other pilots. (2) After a leisurely drive to the hospital I felt rested and ready for action as I arrived at 7:00 a.m. (3) Unfortunately, flight service quickly dampened my enthusiasm with a report of widespread IMC and "VFR not recommended" at 7:40 a.m. (4) By noon I was restless and anxious for something to happen -- anything. (5) I don't care if the weather is bad this morning, the 11:45 a.m. tower observation was 1500 scattered and 3 miles visibility. (6) Even if it goes SVFR, I can handle it.

(7) Finally, a nice easy 60 minute round trip to my favorite hospital. (8) I'd better get this thing cranked up and gone before somebody changes their mind.

(9) Tower, this is NT344 Papa how do you read?
(10) 44 Papa, I've been receiving you loud and clear, do you hear me now?
(11) Our radios have been messing up on us I'm reading you. We have departed to the Northwest - 44 Papa.
(12) What's that they're mumbling on the dispatch frequency - forty seven year old with intercranial bleeding? (13) My God, that must be painful. (14) I wonder what they have done for him? (15) I'd better pull out the stops on this one.

(16) Oh-oh it looks like the ceiling's dropping. (17) As long as I can see the ridge line I'll keep going. (18) I know there is a pass straight ahead. (19) I'll just put the autopilot on heading hold, I can make it. (20) I wonder how that poor patient is doing. (21) I hope we make it in time. (22) Those Feds and their stupid IFR requirements-this is a piece of.....

Questions:

1. Although rested and displaying professional attitude toward the weather and the aircraft, which hazardous attitude begins to surface in sentence 4?

   a. Anti-Authority
   b. Impulsivity
   c. Invulnerability
   d. Resignation

2. A second hazardous attitude is displayed in sentence 6. What is the antidote to this attitude?

   a. I'm not helpless, I can make a difference.
   b. Follow the rules they are usually right.
   c. Taking chances is foolish.
   d. Not so fast, think first.

3. What classic piloting psychological pitfall does the statement in sentence 8 represent?

   a. Operating without adequate fuel reserves.
   b. Inadvertant IMC.
   c. Responding to peer pressure.
   d. Neglect of flight planning, preflight inspection, check lists, etc.

4. Which of the basic decision making concepts is not adhered to in sentences 12-15?

   a. Headwork
   b. Cockpit resource management
   c. Skills and procedures
   d. Stress management

5. What piloting psychological pitfall does the statement in sentence 17 represent?

   a. Scud running
   b. Mental set (or expectancy)
   c. Loss of positional/situational awareness
   d. Getting behind the aircraft

6. What hazardous attitude is exhibited in sentence 19?

   a. Resignation
   b. Invulnerability
   c. Macho
   d. Impulsivity

7. The risk element acting on the pilot in sentence 20 is?

   a. Pilot
   b. Aircraft
   c. Environment
   d. Operation

8. What hazardous attitude best describes the pilot's final thought in sentence 22?

   a. Macho
   b. Anti-Authority
   c. Invulnerability
   d. Impulsivity