Federal Aviation Administration
Aeronautical Information
Manual Official Guide to: Basic Flight Information and ATC Procedures

FAA Chapter 10. Helicopter Operations

Section 2. Special Operations

10-2-2. Helicopter Night VFR Operations

a. Effect of Lighting on Seeing Conditions in Night VFR Helicopter Operations

NOTE-
This guidance was developed to support safe night VFR helicopter emergency medical services (HEMS) operations. The principles of lighting and seeing conditions are useful in any night VFR operation.

While ceiling and visibility significantly affect safety in night VFR operations, lighting conditions also have a profound effect on safety. Even in conditions in which visibility and ceiling are determined to be visual meteorological conditions, the ability to discern unlighted or low contrast objects and terrain at night may be compromised. The ability to discern these objects and terrain is the seeing condition, and is related to the amount of natural and man made lighting available, and the contrast, reflectivity, and texture of surface terrain and obstruction features. In order to conduct operations safely, seeing conditions must be accounted for in the planning and execution of night VFR operations.

Night VFR seeing conditions can be described by identifying "high lighting conditions" and "low lighting conditions."

1. High lighting conditions exist when one of two sets of conditions are present:

(a) The sky cover is less than broken (less than 5/8 cloud cover), the time is between the local Moon rise and Moon set, and the lunar disk is at least 50% illuminated; or

(b) The aircraft is operated over surface lighting which, at least, provides for the lighting of prominent obstacles, the identification of terrain features (shorelines, valleys, hills, mountains, slopes) and a horizontal reference by which the pilot may control the helicopter. For example, this surface lighting may be the result of:

(1) Extensive cultural lighting (man-made, such as a built-up area of a city),

(2) Significant reflected cultural lighting (such as the illumination caused by the reflection of a major metropolitan area's lighting reflecting off a cloud ceiling), or

(3) Limited cultural lighting combined with a high level of natural reflectivity of celestial illumination, such as that provided by a surface covered by snow or a desert surface.

2. Low lighting conditions are those that do not meet the high lighting conditions requirements.

3. Some areas may be considered a high lighting environment only in specific circumstances. For example, some surfaces, such as a forest with limited cultural lighting, normally have little reflectivity, requiring dependence on significant moonlight to achieve a high lighting condition. However, when that same forest is covered with snow, its reflectivity may support a high lighting condition based only on starlight. Similarly, a desolate area, with little cultural lighting, such as a desert, may have such inherent natural reflectivity that it may be considered a high lighting conditions area regardless of season, provided the cloud cover does not prevent starlight from being reflected from the surface. Other surfaces, such as areas of open water, may never have enough reflectivity or cultural lighting to ever be characterized as a high lighting area.

4. Through the accumulation of night flying experience in a particular area, the operator will develop the ability to determine, prior to departure, which areas can be considered supporting high or low lighting conditions. Without that operational experience, low lighting considerations should be applied by operators for both pre-flight planning and operations until high lighting conditions are observed or determined to be regularly available.

b. Astronomical Definitions and Background Information for Night Operations

1. Definitions

(a) Horizon. Wherever one is located on or near the Earth's surface, the Earth is perceived as essentially flat and, therefore, as a plane. If there are no visual obstructions, the apparent intersection of the sky with the Earth's (plane) surface is the horizon, which appears as a circle centered at the observer. For rise/set computations, the observer's eye is considered to be on the surface of the Earth, so that the horizon is geometrically exactly 90 degrees from the local vertical direction.

(b) Rise, Set. During the course of a day the Earth rotates once on its axis causing the phenomena of rising and setting. All celestial bodies, the Sun, Moon, stars and planets, seem to appear in the sky at the horizon to the East of any particular place, then to cross the sky and again disappear at the horizon to the West. Because the Sun and Moon appear as circular disks and not as points of light, a definition of rise or set must be very specific, because not all of either body is seen to rise or set at once.

(c) Sunrise and sunset refer to the times when the upper edge of the disk of the Sun is on the horizon, considered unobstructed relative to the location of interest. Atmospheric conditions are assumed to be average, and the location is in a level region on the Earth's surface.

(d) Moonrise and moonset times are computed for exactly the same circumstances as for sunrise and sunset. However, moonrise and moonset may occur at any time during a 24 hour period and, consequently, it is often possible for the Moon to be seen during daylight, and to have moonless nights. It is also possible that a moonrise or moonset does not occur relative to a specific place on a given date.

(e) Transit. The transit time of a celestial body refers to the instant that its center crosses an imaginary line in the sky - the observer's meridian - running from north to south.

(f) Twilight. Before sunrise and again after sunset there are intervals of time, known as "twilight," during which there is natural light provided by the upper atmosphere, which does receive direct sunlight and reflects part of it toward the Earth's surface.

(g) Civil twilight is defined to begin in the morning, and to end in the evening when the center of the Sun is geometrically 6 degrees below the horizon. This is the limit at which twilight illumination is sufficient, under good weather conditions, for terrestrial objects to be clearly distinguished.

2. Title 14 of the Code of Federal Regulations applies these concepts and definitions in addressing the definition of night (Section 1.1), the requirement for aircraft lighting (Section 91.209) and pilot recency of night experience (Section 61.67).

c. Information on Moon Phases and Changes in the Percentage of the Moon Illuminated

From any location on the Earth, the Moon appears to be a circular disk which, at any specific time, is illuminated to some degree by direct sunlight. During each lunar orbit (a lunar month), we see the Moon's appearance change from not visibly illuminated through partially illuminated to fully illuminated, then back through partially illuminated to not illuminated again. There are eight distinct, traditionally recognized stages, called phases. The phases designate both the degree to which the Moon is illuminated and the geometric appearance of the illuminated part.

10-2-3. Landing Zone Safety

a. This information is provided for use by helicopter emergency medical services (HEMS) pilots, program managers, medical personnel, law enforcement, fire, and rescue personnel to further their understanding of the safety issues concerning Landing Zones (LZs). It is recommended that HEMS operators establish working relationships with the ground responder organizations they may come in contact with in their flight operations and share this information in order to establish a common frame of reference for LZ selection, operations, and safety.

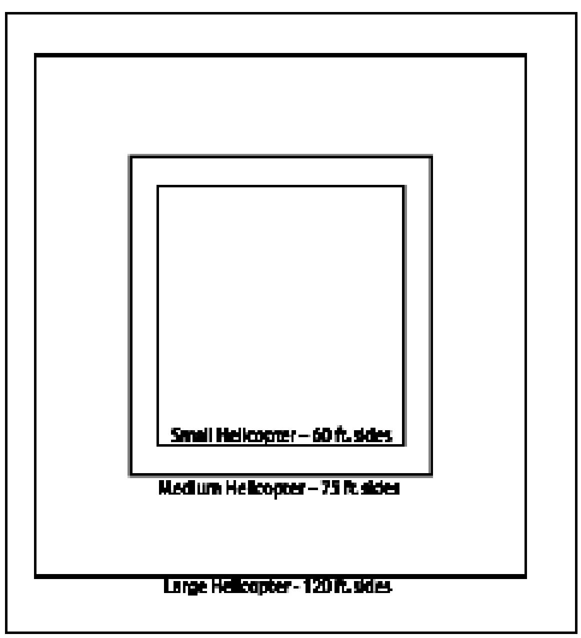
b. The information provided is largely based on the booklet, LZ - Preparing the Landing Zone, issued by National Emergency Medical Services Pilots Association (NEMSPA), and the guidance developed by the University of Tennessee Medical Center's LIFESTAR program, and is used with their permission.

c. Information concerning the estimation of wind velocity is based on the Beaufort Scale.

d. Selecting a Scene LZ

1. If the situation requires the use of a helicopter, first check to see if there is an area large enough to land a helicopter safely.

FIG 10-2-4
Recommended Minimum Landing Zone Dimensions



2. For the purposes of FIG 10-2-4 the following are provided as examples of relative helicopter size:

(a) Small Helicopter: Bell 206/407, Eurocopter AS-350/355, BO-105, BK-117.

(b) Medium Helicopter: Bell UH-1 (Huey) and derivatives (Bell 212/412), Bell 222/230/430 Sikorsky S-76, Eurocopter SA-365.

(c) Large Helicopter: Boeing Chinook, Eurocopter Puma, Sikorsky H-60 series (Blackhawk), SK-92.

3. The LZ should be level, firm and free of loose debris that could possibly blow up into the rotor system.

4. The LZ should be clear of people, vehicles and obstructions such as trees, poles and wires. Remember that wires are difficult to see from the air. The LZ must also be free of stumps, brush, post and large rocks. See FIG 10-2-5.

FIG 10-2-5
Landing Zone Hazards

5. Keep spectators back at least 200 feet. Keep emergency vehicles 100 feet away and have fire equipment standing by. Ground personnel should wear eye protection, if available, during landing and takeoff operations. To avoid loose objects being blown around in the LZ, hats should be removed; if helmets are worn, chin straps must be securely fastened.

6. Fire fighters should wet down the LZ if it is extremely dusty.

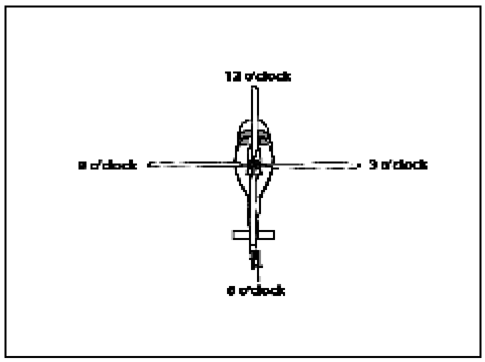
e. Helping the Flight crew Locate the Scene

1. If the LZ coordinator has access to a GPS unit, the exact latitude and longitude of the LZ should be relayed to the HEMS pilot. If unable to contact the pilot directly, relay the information to the HEMS ground communications specialist for relaying to the pilot, so that they may locate your scene more efficiently. Recognize that the aircraft may approach from a direction different than the direct path from the takeoff point to the scene, as the pilot may have to detour around terrain, obstructions or weather in route.

2. Especially in daylight hours, mountainous and densely populated areas can make sighting a scene from the air difficult. Often, the LZ coordinator on the ground will be asked if she or he can see or hear the helicopter.

3. Flight crews use a clock reference method for directing one another's attention to a certain direction from the aircraft. The nose of the aircraft is always 12 o'clock, the right side is 3 o'clock, etc. When the LZ coordinator sees the aircraft, he/she should use this method to assist the flight crew by indicating the scene's clock reference position from the nose of the aircraft. For example, “Accident scene is located at your 2 o'clock position.” See FIG 10-2-6.

FIG 10-2-6
"Clock" System for Identifying Positions
Relative to the Nose of the Aircraft



4. When the helicopter approaches the scene, it will normally orbit at least one time as the flight crew observes the wind direction and obstacles that could interfere with the landing. This is often referred to as the “high reconnaissance” maneuver.

f. Wind Direction and Touchdown Area

1. Determine from which direction the wind is blowing. Helicopters normally land and takeoff into the wind.

2. If contact can be established with the pilot, either directly or indirectly through the HEMS ground communications specialist, describe the wind in terms of the direction the wind is *from* and the speed.

3. Common natural sources of wind direction information are smoke, dust, vegetation movement, water streaks and waves. Flags, pennants, streamers can also be used. When describing the direction, use the compass direction from which the wind is blowing (example: from the North-West).

4. Wind speed can be measured by small hand-held measurement devices, or an observer's estimate can be used to provide velocity information. The wind value should be reported in knots (nautical miles per hour). If unable to numerically measure wind speed, use **TBL 10-2-3** to estimate velocity. Also, report if the wind conditions are gusty, or if the wind direction or velocity is variable or has changed recently.

5. If any obstacle(s) exist, insure their description, position and approximate height are communicated to the pilot on the initial radio call.

TBL 10-2-3
Table of Common References for Estimating Wind Velocity

Wind (Knots)	Wind Classification	Appearance of Wind Effects	
		On the Water	On Land
Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, wind vanes are still
4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
17-21	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
22-27	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires
28-33	Near Gale	Sea heaps up, waves 13-20 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
34-40	Gale	Moderately high (13-20 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Whole trees in motion, resistance felt walking against wind
41-47	Strong Gale	High waves (20 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
48-55	Storm	Very high waves (20-30 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
56-63	Violent Storm	Exceptionally high (30-45 ft.) waves, foam patches cover sea,	

		visibility more reduced	
64+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced	

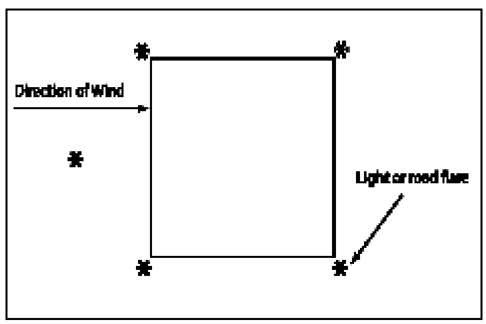
EXAMPLE-
*Wind **from** the South-East, estimated speed 15 knots. Wind shifted from North-East about fifteen minutes ago, and is gusty.*

g. Night LZs

1. There are several ways to light a night LZ:

(a) Mark the touchdown area with five lights or road flares, one in each corner and one indicating the direction of the wind. See FIG 10-2-7.

FIG 10-2-7
Recommended Lighting for Landing Zone Operations at Night



NOTE-
Road flares are an intense source of ignition and may be unsuitable or dangerous in certain conditions. In any case, they must be closely managed and firefighting equipment should be present when used. Other light sources are preferred, if available.

(b) If chemical light sticks may be used, care should be taken to assure they are adequately secured against being dislodged by the helicopter's rotor wash.

(c) Another method of marking a LZ uses four emergency vehicles with their low beam headlights aimed toward the intended landing area.

(d) A third method for marking a LZ uses two vehicles. Have the vehicles direct their headlight beams into the wind, crossing at the center of the LZ. (If fire/rescue personnel are available, the reflective stripes on their bunker gear will assist the pilot greatly.)

2. At night, spotlights, flood lights and hand lights used to define the LZ are not to be pointed at the helicopter. However, they are helpful when pointed toward utility poles, trees or other hazards to the landing aircraft. White lights such as spotlights, flashbulbs and hi-beam headlights ruin the pilot's night vision and temporarily blind him. Red lights, however, are very helpful in finding accident locations and do not affect the pilot's night vision as significantly.

3. As in Day LZ operations, ensure radio contact is accomplished between ground and air, if possible.

h. Ground Guide

1. When the helicopter is in sight, one person should assist the LZ Coordinator by guiding the helicopter into a safe landing area. In selecting an LZ Coordinator, recognize that medical personnel usually are very busy with the patient at this time. **It is recommended that the LZ Coordinator be someone other than a medical responder, if possible.** Eye protection should be worn. The ground guide should stand with his/her back to the wind and his/her arms raised over his/her head (flashlights in each hand for night operations.)

2. The pilot will confirm the LZ sighting by radio. If possible, once the pilot has identified the LZ, the ground guide should move out of the LZ.

3. As the helicopter turns into the wind and begins a descent, the LZ coordinator should provide assistance by means of **radio contact**, or utilize the “unsafe signal” to wave off the helicopter if the LZ is not safe (see FIG 10-2-8). The LZ Coordinator should be far enough from the touchdown area that he/she can still maintain visual contact with the pilot.

i. Assisting the Crew

1. After the helicopter has landed, do not approach the helicopter. The crew will approach you.

2. Be prepared to assist the crew by providing security for the helicopter. If asked to provide security, allow no one but the crew to approach the aircraft.

3. Once the patient is prepared and ready to load, allow the crew to open the doors to the helicopter and guide the loading of the patient.

4. When approaching or departing the helicopter, always be aware of the tail rotor and always follow the directions of the crew. Working around a running helicopter can be potentially dangerous. The environment is very noisy and, with exhaust gases and rotor wash, often windy. In scene operations, the surface may be uneven, soft, or slippery which can lead to tripping. Be very careful of your footing in this environment.

5. The tail rotor poses a special threat to working around a running helicopter. The tail rotor turns many times faster than the main rotor, and is often invisible even at idle engine power. Avoid walking towards the tail of a helicopter beyond the end of the cabin, unless specifically directed by the crew.

NOTE-
Helicopters typically have doors on the sides of the cabin, but many use aft mounted "clamshell" type doors for loading and unloading patients on litters or stretchers. When using these doors, it is important to avoid moving any further aft than necessary to operate the doors and load/unload the patient. Again, always comply with the crew's instructions.

j. General Rules

1. When working around helicopters, always approach and depart from the front, never from the rear. Approaching from the rear can increase your risk of being struck by the tail rotor, which, when at operating engine speed, is nearly invisible.

2. To prevent injury or damage from the main rotor, never raise anything over your head.

3. If the helicopter landed on a slope, approach and depart from the down slope side only.

4. When the helicopter is loaded and ready for take off, keep the departure path free of vehicles and spectators. In an emergency, this area is needed to execute a landing.

k. Hazardous Chemicals and Gases

1. Responding to accidents involving hazardous materials requires special handling by fire/rescue units on the ground. Equally important are the preparations and considerations for helicopter operations in these areas.

2. Hazardous materials of concern are those which are toxic, poisonous, flammable, explosive, irritating, or radioactive in nature. Helicopter ambulance crews normally don't carry protective suits or breathing apparatuses to protect them from hazardous materials.

3. The helicopter ambulance crew must be told of hazardous materials on the scene in order to avoid the contamination of the crew. Patients/victims contaminated by hazardous materials may require special precautions in packaging before loading on the aircraft for the medical crew's protection, or may be transported by other means.

4. Hazardous chemicals and gases may be fatal to the unprotected person if inhaled or absorbed through the skin.

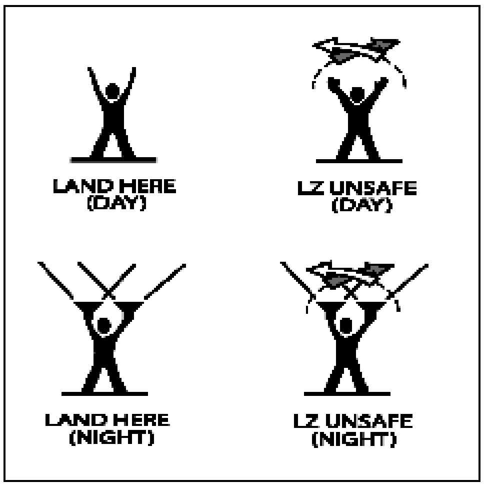
5. Upon initial radio contact, the helicopter crew must be made aware of any hazardous gases in the area. Never assume that the crew has already been informed. If the aircraft were to fly through the hazardous gases, the crew could be poisoned and/or the engines could develop mechanical problems.

6. Poisonous or irritating gases may cling to a victim's clothing and go unnoticed until the patient is loaded and the doors of the helicopter are closed. To avoid possible compromise of the crew, all of these patients must be decontaminated prior to loading.

l. Hand Signals

1. If unable to make radio contact with the HEMS pilot, use the following signals:

FIG 10-2-8
Recommended Landing Zone Ground Signals



m. Emergency Situations

1. In the event of a helicopter accident in the vicinity of the LZ, consider the following:

(a) Emergency Exits:

(1) Doors and emergency exits are typically prominently marked. If possible, operators should familiarize ground responders with the door system on their helicopter in preparation for an emergency event.

(2) In the event of an accident during the LZ operation, be cautious of hazards such as sharp and jagged metal, plastic windows, glass, any rotating components, such as the rotors, and fire sources, such as the fuel tank(s) and the engine.

(b) Fire Suppression:

Helicopters used in HEMS operations are usually powered by turboshaft engines, which use jet fuel. Civil HEMS aircraft typically carry between 50 and 250 gallons of fuel, depending upon the size of the helicopter, and planned flight duration, and the fuel remaining after flying to the scene. Use water to control heat and use foam over fuel to keep vapors from ignition sources.

10-2-4. Emergency Medical Service (EMS) Multiple Helicopter Operations

a. Background. EMS helicopter operators often overlap other EMS operator areas. Standardized procedures can enhance the safety of operating multiple helicopters to landing zones (LZs) and to hospital heliports. Communication is the key to successful operations and in maintaining organization between helicopters, ground units and communication centers. EMS helicopter operators which operate in the same areas should establish joint operating procedures and provide them to related agencies.

b. Recommended Procedures.

1. Landing Zone Operations. The first helicopter to arrive on-scene should establish communications with the ground unit at least 10 NMs from the LZ to receive a LZ briefing and to provide ground control the number of helicopters that can be expected. An attempt should be made to contact other helicopters on 123.025 to pass on to them pertinent LZ information and the ground unit's frequency. Subsequent helicopters arriving on scene should establish communications on 123.025 at least 10 NMs from the LZ. After establishing contact on 123.025, they should contact the ground unit for additional information. All helicopters should monitor 123.025 at all times.

(a) If the landing zone is not established by the ground unit when the first helicopter arrives, then the first helicopter should establish altitude and orbit location requirements for the other arriving helicopters. Recommended altitude separation between helicopters is 500 feet (weather and airspace permitting). Helicopters can orbit on cardinal headings from the scene coordinates. (See FIG 10-2-9.)

(b) Upon landing in the LZ, the first helicopter should update the other helicopters on the LZ conditions, i.e., space, hazards and terrain.

(c) Before initiating any helicopter movement to leave the LZ, all operators should attempt to contact other helicopters on 123.025, and state their position and route of flight intentions for departing the LZ.

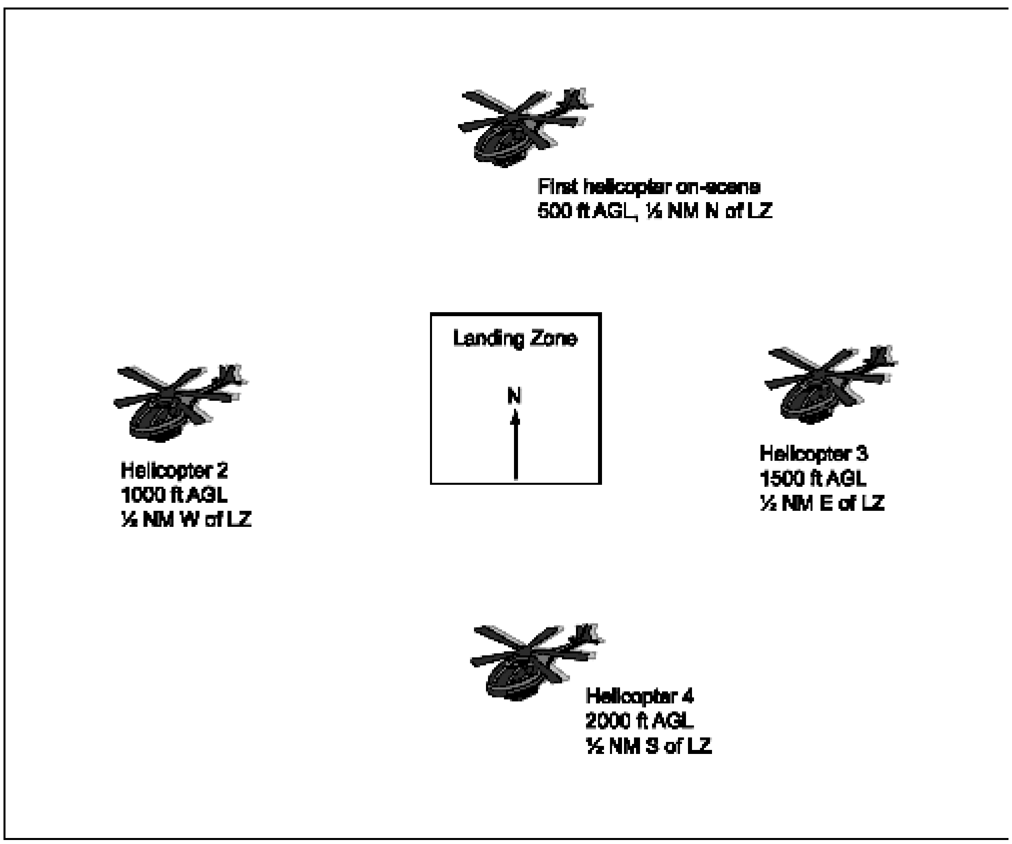
2. Hospital Operations. Because many hospitals require landing permission and have established procedures (frequencies to monitor, primary and secondary routes for approaches and departures, and orbiting areas if the heliport is occupied) pilots should always receive a briefing from the appropriate facility (communication center, flight following, etc.) before proceeding to the hospital.

(a) In the event of multiple helicopters coming into the hospital heliport, the helicopter nearest to the heliport should contact other inbound helicopters on 123.025 and establish intentions. Follow the guidelines established in the LZ operations.

(b) To facilitate approach times, the pilot-in-command of the helicopter occupying the hospital heliport should advise any other operators whether the patient will be off loaded with the rotor blades turning or stopped, and the approximate time to do so.

(c) Before making any helicopter movement to leave the hospital heliport, all operators should attempt to contact other helicopters on 123.025 and state their position and route of flight intentions for departing the heliport.

FIG 10-2-9
EMS Multiple Helicopter LZ/Heliport Operation



NOTE-
If the LZ/hospital heliport weather conditions or airspace altitude restrictions prohibit the recommended vertical separation, 1 NM separations should be kept between helicopter orbit areas.