



# **Peninsula Mounted Search And Rescue**

## **HELICOPTER OPERATIONS - BASIC COURSE**

The State of Washington has always been fortunate to have an abundance of military helicopters to support our search and rescue necessities. Because of military down sizing more agencies are gaining helicopters to meet their own needs.

Helicopters are a unique and valuable SAR resource that can supply an observer platform or a transportation workhorse delivering personnel and supplies.

Although a valuable resource, there is also extreme danger working around helicopters, especially for the untrained.

In order to minimize the danger it is imperative that all who work around helicopters receive training appropriate to their individual SAR responsibilities.

On April 16, 1993 the Washington State Emergency Management Division established the MANDATORY training program for SAR volunteers. This class that you are now attending is a direct result of that program and meets the criteria thereby established for the HELICOPTER OPERATIONS - BASIC COURSE.

This course also complies with the requirements of W.A.C. 118-04. The course is intended for all emergency workers and is a prerequisite for intermediate, advanced, and special skill training. Completion of this course is valid for 24 months from date of completion.

This course has been adapted from the King County Air Support Unit's Helicopter Operations Basic Course. It has been amended to include additional information useful to a horse mounted unit.

### **COURSE OUTLINE**

This one hour program will serve as a basic introduction to helicopters. We are going to cover the following subject matters:

General Aviation Management & Helicopter Safety, Fundamental Helicopter Characteristics,



## Peninsula Mounted Search And Rescue

Use of helicopters in Search And Rescue, Landing zone safety, Passenger Procedures and Safety Requirements, Effects of Helicopters on Horses, Recommended procedures while mounted around helicopters.

### GENERAL AVIATION MANAGEMENT & HELICOPTER SAFETY

**FIXED WING vs HELICOPTERS:** Most individuals working in search and rescue are familiar with the role that fixed wing aircraft play. Fixed wing have been the backbone of the air search and rescue program for missing aircraft since the beginning. SAR volunteers have been provided crosscountry transport to support missions away from their home base.

**FIXED WING SAFETY CONSIDERATIONS:** Even though this is primarily a helicopter orientation course, we briefly discuss fixed wing for a variety of reasons. If you work around helicopters you are most likely at a search operation which is based at an airport and you will also be exposed to fixed wing. We feel it is important for you to be safe around both.

Fixed wing aircraft do offer some benefits over helicopters. They are capable of longer periods of operation without refueling. A typical helicopter has a maximum range of 2 to 3 hours. Fixed wing aircraft have operational periods of double and more than rotary wing aircraft.

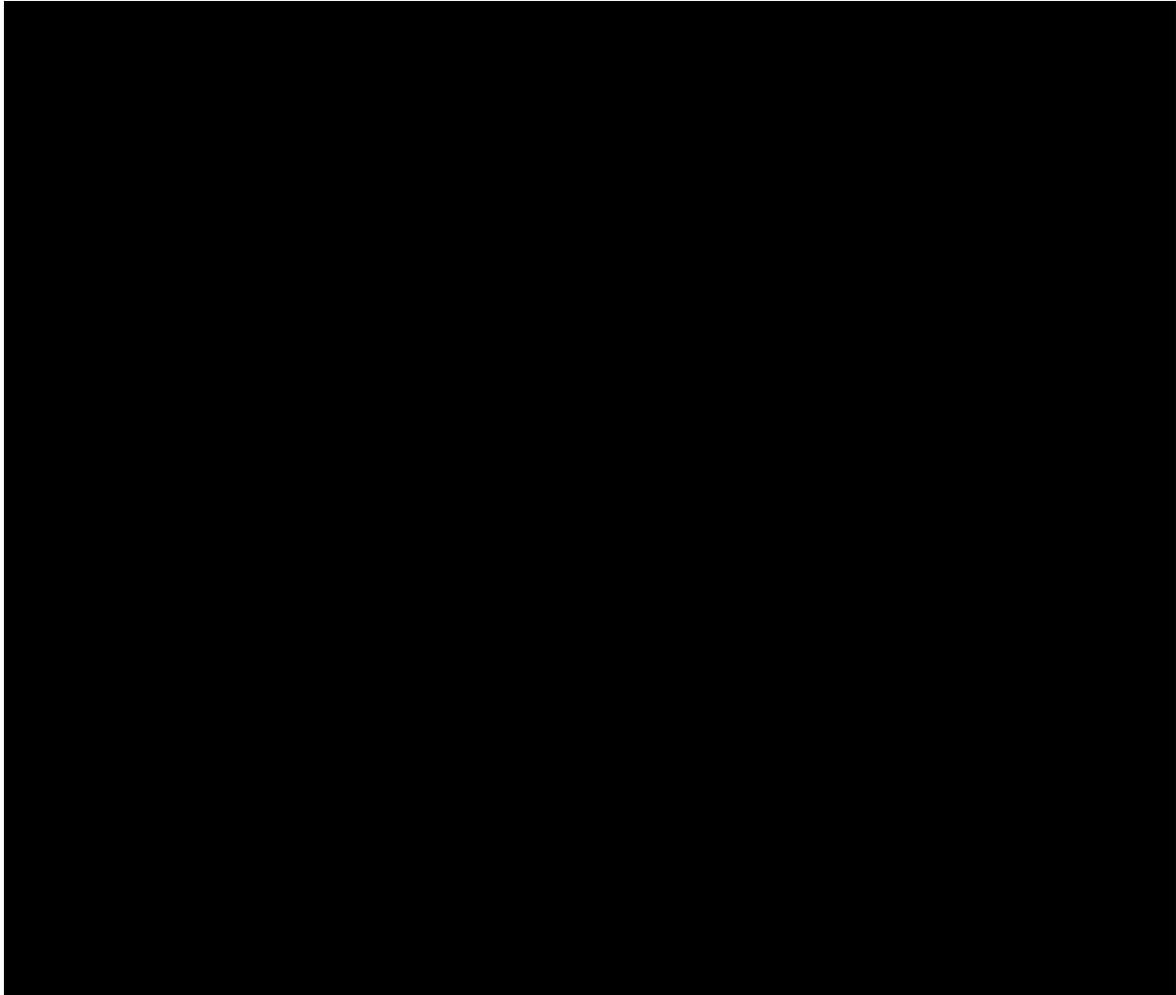
Along with the benefits, of course, there are limitations. They must operate from an airport, and because of speed require better weather down low in the search area than helicopters. They also must maintain forward air speed and, therefore, cannot operate in confined areas such as box canyons and small drainages.

Aircraft propellers are as dangerous as a helicopter's rotor blades. With any helicopter always wait for directions and proceed only when and where directed by the pilot or crew member. Always **CARRY** your packs, do not attempt to approach the helicopter and board while wearing them. The same with equipment. It should be properly packaged and carried in front of you no higher than chest level.

You should be aware the helicopters we are likely to encounter the Bell UH-1 Huey, Bell 206 Jet Ranger, and Augusta 109 (Airlift NW) can dip their rotor tips with in five feet of the ground on **level ground**. The UH-60 Blackhawk can dip to slightly over seven feet.



## Peninsula Mounted Search And Rescue



### **FLYING**

If you are called upon to fly in a helicopter the proper dress and equipment will not only enhance your safety, it will keep you more comfortable. If you are going to be working in the back country, the first item of business is good heavy-soled boots. PMSAR required field dress more than meets these requirements.

For boarding and leaving a helicopter that is running you will also need proper head gear. Climbing, caving, swift water, and rescue helmets are acceptable. 1/2 or 3/4 motorcycle helmets are also acceptable; however, fullcoverage motorcycle helmets are not as they can restrict peripheral vision. Hardhats, such as those used by the U.S. Forest Service (with



## **Peninsula Mounted Search And Rescue**

chin straps), are also acceptable. The riding helmets required by PMSAR also meet this requirement. All headgear must have chin strap capability. It is also recommended that brightly colored reflective tape be placed on the helmet.

To protect your eyes you will also need some kind of eye protection. This could either be goggles or glasses with side shields. They must be made of impact resistant material.

Helicopters are extremely noisy. You will need some kind of hearing protection. In most cases, if you do not have it, the helicopter crew will have disposable ear plugs.

Standard field utility uniforms are acceptable. As a minimum you will want long sleeve shirts. NOMEX would be nice, but unless you fly on a regular basis, the average SAR volunteer would not want to spend the money. Caution should be exercised about wearing synthetic material. Nylons and such melt onto the skin at fairly low temperatures. A better choice would be a natural fabric such as cotton or wool.

### **HELICOPTER TERMINOLOGY**

**ROTOR, MAIN:** This is the large blade(s) on top of the helicopter. The movement of the blades through the air generate the lift necessary to allow the helicopter to fly.

**ROTOR, TAIL:** The tail rotor serves to compensate for the torque generated by the main rotor. If the helicopter did not have a tail rotor to counteract torque, the helicopter would turn wildly out of control.

**AUTOROTATION:** The term used for the flight condition during which no engine power is supplied and the main rotor is driven only by the action of the relative wind. It is the means of safely landing a helicopter after engine failure or other emergencies.

**DYNAMIC ROLL OVER:** Caused then the maximum lateral ground roll angle of the helicopter is exceeded while landing on sloping ground.

**SETTLING WITH POWER:** Often described as settling in your own downwash. It involves high vertical rates of descent, and the addition of more power produces even greater rate of descent.

**HOVERING IN GROUND EFFECT:** A cushion of air beneath a hovering helicopter furnishing additional lift caused by air that is compressed beneath the helicopter.



## Peninsula Mounted Search And Rescue

Depending on the type of ground usually effective to an altitude equal to the diameter of the main rotor. Thus, the lift needed to sustain hover can be produced with less power.

**HOVERING OUT OF GROUND EFFECT:** Occurs when the helicopter rotor downwash is not affected by the proximity of the surface.

### AERODYNAMICS

Most helicopters operate with a single main rotor and a single tail rotor. If these helicopters had only the main rotor, the fuselage of the ship would spin uncontrollably in the opposite direction of the rotor, due to the torque induced by the main rotor. For this reason a tail rotor is used to counteract the effect of this torque.

The actual "lift" in a helicopter is accomplished by the main rotor blade, which has a cross-section similar to the wing of an airplane. As this "wing" moves through the air, spinning on an engine-driven shaft, lift is generated. The amount of lift generated is dependent on the "pitch" or angle of attack of the rotor blade moving through the air.

If you extend your hand out of the window of a speeding car and move the angle of your hand up from the horizontal position, you can feel the lift produced as the angle is increased. A rotor blade works in the same way.

**TAKEOFF/LANDING REQUIREMENTS:** Most people believe that helicopters take off and land straight up and down. Although this is possible it has extra danger for the aircraft and is normally not done. To avoid deadman's curve the pilot likes to have forward air speed until just before touchdown. On takeoff a run long enough to get the aircraft through **EFFECTIVE TRANSLATION LIFT (ETL)** allows a helicopter to fly out of a landing zone when it would not be possible to climb straight up. Typical landing and takeoff runs run between 200 & 300 feet depending on the helicopter make.

The deadman's curve (formal name height-velocity curve) is the danger area where an autorotation **CANNOT** be made. It is this area that the pilot wants to avoid. When a true vertical ascent/descent is made the aircraft cannot achieve airspeed necessary to force the rotor to turn fast enough to generate lift. What you need to realize is that in selecting LZ or PZ, try to find one with enough length to allow the helicopter to maintain forward speed for landings and takeoffs

**SETTLING WITH POWER:** Is a condition where by the helicopter is settling vertically in



## **Peninsula Mounted Search And Rescue**

his own rotor wash. Typical causes are too much vertical velocity during hovering straight down. Thin air ( high Density Altitude), a downwind steep approach in which forward airspeed is permitted to drop nearly to zero. In sling load operations you never want to be under the helicopter during its decent. Wait till it stabilizes its hover.

**WIND & TURBULENCE:** The helicopter in flight is subject to the effects of wind. Variable winds or turbulence may make it impossible for the helicopter to maintain a hover for rappelling or hoist operations. Light turbulence causes some minor control problems and certainly can cause some discomfort for the passengers.

**DENSITY ALTITUDE:** There are 4 factors which affect density altitude: altitude, atmospheric pressure, temperature, and moisture in the air.

The higher up the mountains the LZ is located, the higher the pressure, warmer the temperature, the dryer the air, the higher the density altitude will be. The higher the density altitude less performance will be available from the helicopter.

### **USE OF HELICOPTERS IN SAR**

While fixed wing aircraft are generally used for searching large open areas, helicopters can be used to search areas more difficult to spot from fixed wing aircraft, such as cliffs, gullies, cliff bottoms, etc.

In search operations, helicopters can also be used as an attraction device. The noise from a chopper may attract the victim of a search, who in turn may attempt to attract the attention of those on board the helicopter. In addition, helicopters can be used to transport searchers and/or equipment to remote search and rescue assignments.

Helicopters are often used in rescue situations, whereby a victim can be extricated by a number of methods including hoists and slings. Finally and perhaps most importantly, helicopters can be used to evacuate and transport injured victims to a local hospital.

The helicopter makes a great platform for observers to have a slow moving thorough view of the search area. If weather permits helicopters can be flown with doors open or even removed. This greatly enhances field of view.

The helicopter's maneuverability allows it to get down to tree top level and search in areas that have limited space such as canyons and under ledges.



## Peninsula Mounted Search And Rescue

The helicopter also makes a great transportation vehicle. Ground search personnel can be transported close to the search area. This saves time and also allows the searchers to commence the search well rested.

Finally helicopters can be used to transport supplies and material to almost any area. If landing zones are not available the material can be transported attached to the cargo hook and released in the target area.

### LANDING ZONE SAFETY

As was mentioned earlier helicopters do not normally land on a dime, but rather require or desire a sizeable landing zone, particularly at high elevations. The ideal LZ would be a flat strip of land 100 feet wide by 300 feet long . HELISPOT is the term assigned to a locations where a helicopter can land or take off. Helispot, Landing Zone or Pick up Zone. Regardless of the name applied the safety issues are the same.

The landing area should be defined in such a way that the helicopter can land and take off into the wind, especially at higher elevations. Only as a last resort should a "hover hole" helispot be chosen. You should be aware the pilot may elect to land downwind or cross wind depending on other factors. Just be aware the helicopter has great leway of maneuver, and may not always do what you expect.

Since the typical helicopter will kick up rotor wash in excess of 100 mph on takeoffs and landings, the LZ should be free of lightweight objects that will blow away. Tall dry grass and shrubs should be avoided to prevent possible damage to the tail rotor. Tree stumps should be less than 1 foot high. A snow field can make a good LZ but markers such as backpacks must be placed near the LZ to give the pilot some sense of depth perception.

Horses should be kept as far away from the LZ as possible and up wind away from blowing debris. If you can predict the flight path of the helicopter try to keep the horses out from under it.

If possible horses should not be left unattended (tied, hobbled or loose) in the vicinity of helicopter operations. One team member should remain in control of horses at all times.

If the landing is to be made at night, use two vehicles with headlights on, located 40 yards downwind at opposing 45 degree angles to the proposed LZ. Turn off strobes, emergency



## Peninsula Mounted Search And Rescue

lights, and flashers. These only serve to blind the pilot.

The LZ will be under the control of the LZ Coordinator (Ground Guide) who should be the only person signaling or attempting to signal the helicopter. All other personnel should stay clear of the LZ.

### PASSENGER PROCEDURES AND SAFETY REQUIREMENTS

Although it is unlikely PMSAR members will be called to ride in a helicopter it is important you understand the protocols involved with helicopter flight. Everything you will need to know for the upcoming flight will be presented in the Safety Briefing prior to boarding the helicopter.. The helicopter manager, LZ Coordinator, or ground guide should make sure that all personnel scheduled to board the helicopter have been properly briefed and reviewed for:

PROPER CLOTHING

PROTECTIVE EQUIPMENT

ENTRY AND EXIT PROCEDURES FOR THE HELICOPTER USE OF DOWN SLOPE

REMAINING IN THE PILOT'S FIELD OF VISION WHERE THEY WILL SIT IN THE AIRCRAFT

HOW THEIR EQUIPMENT IS GOING TO BE LOADED

The most important thing to remember is "IF YOU DO NOT UNDERSTAND SOMETHING, ASK" .....

### HORSE SAFETY

Helicopters are extremely noisy, fast moving and will most likely scare your horse. Your horse will probably likely hear the helicopter first. If possible face him in the direction the helicopter's approach. Try to calm the horse, let him know this is no big deal, its not a horse eater, everything is ok. **However be prepared to deal with a runaway.**



## Peninsula Mounted Search And Rescue

Wind and rotor wash should be avoided. Blowing debris can spook the horse or cause injury to the eyes. Attempt to stay far away as practicle from any LZ.

The horse should not be tied in the vacinity of helicopter activities, they should attended if at all possible.

### HELICOPTER SAFETY RULES

1. All personnel must stay at least 50 feet from small helicopters (2-3 place Models) and 100 feet from larger models, unless directly part of the authorized crew working with the aircraft.
2. Always approach or leave an operational helicopter from the front so the pilot can see you at all times. Never approach a helicopter without being signaled to do so by a crew member.
3. Keep your head down at all times. Remember that the slower the rotor is moving, the lower it can dip. Depending on the ground contour, wind, gusts, load etc, main or tail rotor(s) may be extremely close to the ground, even when hovering.
4. Always be aware of the slope of the ground. Never approach the helicopter from or leave to the **up slope side**, You will walk into the rotor system.
5. Never touch sling/external load, hook or any part of a helicopter until it has made contact with the ground. Severe injury or possible death may result from the discharge of static electricity.
6. To hook up a load, do not attempt to grab a hook and move the helicopter to the sling. Hold the sling eye above you and let the helicopter come to you. Then simply slap the sling into the hook.
7. Positively no smoking within 100 feet of helicopters.
8. Remember that under most circumstances depending on visibility, viewpoint and angle, a helicopter tail rotor cannot be seen or heard due to its high speed (tail rotor blade tip speed is right at the sound barrier). Maintain a wide clearance from the tail area and



## **Peninsula Mounted Search And Rescue**

never stoop or walk under the tail boom.

9. Personnel working around operational helicopters should wear hardhats with chin straps securely fastened, goggles and bright jackets or vests.
10. Passengers should wear protective headgear with chin straps fastened at all times and seat belts secured until a pilot or crew chief directs removal.
11. Keep long handled tools, ice axes, skis, litters, radio antenna and similar items low and parallel to the ground when approaching or leaving a helicopter.
12. Ropes should be coiled and secured. Loose, light items such as sleeping bags, parkas and small pieces of gear should be secured in packs or bags.
13. Do not load gear without pilot's or other authorized crew member's supervision, as only they can best judge weight distribution and proper tie-down methods.
14. Passengers should never enter a helicopter until the pilot gives an OK. Enter carefully so as not to interfere with controls, cables and pilot. Do not exit until the pilot gives an OK. Ground personnel should not approach any helicopter until the engine is off and rotors stopped or the pilot signals ok. Even after touchdown the pilot may, without warning, shift the aircrafts position.
15. Never stand directly beneath a helicopter or its takeoff or landing pattern unless directed and authorized to hook sling loads.
16. At takeoffs and landings all personnel should be well away from the helicopter. Main rotors may dip to one side as the craft moves and the tail rotor may swing around.



# **Peninsula Mounted Search And Rescue**

## **SAFE APPROACH ZONES**