

Helicopters

In Search and Rescue

Intermediate Level



Charley Shimanski
Mountain Rescue Association
www.mra.org

Helicopters in Search and Rescue Intermediate Level

Charley Shimanski



Mountain Rescue Association

www.mra.org

© 2008, Charley Shimanski/Mountain Rescue Association – All rights reserved

COVER PHOTO: Search and rescue professionals train in the “Avalanche Deployment” program near Breckenridge, Colorado. Photo courtesy Flight for Life Colorado

Table of Contents

Objective	1
Introduction.....	1
Part 1 – Helicopter Essentials	2
Helicopter Operations within ICS.....	2
Helicopter Size Classification.....	2
ICS Classification of Helicopters.....	2
Calling for Helicopters.....	2
Specific Helicopters by Type	4
Advanced Helicopter Limitations	5
Helicopter Loading	7
Helicopter Performance Capabilities and Specifications.....	7
Part 2 – Helicopter Landing and Takeoff Areas	9
Landing and Takeoff Areas Definitions	9
Major Elements of a Heliport/Helispot.....	10
Heliport Safety Operations.....	11
Heliport Equipment	12
Helicopter Evacuations	12
In-flight Emergencies.....	14
Part 3 – Helicopter and Heliport Management.....	15
Introduction.....	15
Recommended Procedures.....	15
Managing the Heliport	16
Conclusion	18
Acknowledgements.....	18



Objective

The Mountain Rescue Association (MRA), a volunteer organization dedicated to saving lives through rescue and mountain safety education, has developed this program to assist search and rescue (SAR) organizations in their helicopter operations.

This material is designed for search and rescue professionals that work frequently with helicopters in their search and/or rescue operations.

At the conclusion of this program, the reader should be able to:

- Understand essential elements of helicopter operations within the Incident Command System (ICS)
- Identify several key elements of helicopter landing and takeoff areas; and,
- Understand helicopter and heliport management.

About the Author

Charley Shimanski is President and Education Director for the Mountain Rescue Association, a national organization of rescue mountaineers. A 20-year veteran of Colorado's *Alpine Rescue Team*, Charley has participated as a field member and Incident Commander for hundreds of rescues among Colorado's highest peaks.

The author of the Mountain Rescue Association's *Helicopters in Mountain Rescue Operations* manuals and co-author of the *Avalanche Rescue Operations* manual, Charley has consulted rescue mountaineers, mountain guides, and climbers throughout the world, from Israel to China, from Kilimanjaro to Aconcagua. Charley is a frequent speaker at meetings of the International Technical Rescue Symposium, The National Association of Search and Rescue, the Wilderness Medical Society, and the Mountain Rescue Association.

Dedication

This program is dedicated to Peter Peelgrane, Chief Helicopter Pilot, KUSA-TV, Denver. As a pilot, Peter demonstrated unparalleled concern for mankind, clear focus on safety and uncanny eyes of an eagle. As a friend, he displayed ardent determination to overcome hardship and a questionable sense of humor. For all these things, Peter, we miss you.

Introduction

As a search and reconnaissance platform coupled with rescue and extrication capabilities, the helicopter is unparalleled in its versatility for emergency and disaster response. Yet, its safety is in direct proportion to the knowledge and skill level of those individuals who manage the helicopter operations in a search or rescue situation. Furthermore, since helicopters can be extremely dangerous, the mission's management must assure safety training of ground personnel. With rotors turning at over 150 M.P.H., the hazard to searchers is very real. In addition, the threat of a helicopter crash poses another danger.



Mission management must assure safety training of ground personnel. Photo: Bob Wagner

Still, rescue teams must be prepared for the "mass disaster accident" which results in the need for quick mobilization of large-scale rotary wing operations. Imagine a 747 crash in a remote mountain area that results in numerous survivors. While we may assume the chance of survivors is remote, a similar crash in Japan in the early 1980's resulted in over 100 passengers surviving a DC-10 vs. mountain accident.

In the case of a large scale rescue operation, the rescue team's ability to quickly manage large-scale air operations may be critical to the success of the mission. Certainly other qualified aircraft would be available to assist, however their response time dictates that the initial rescue team members must have a working knowledge of helicopters and the various factors which influence their effective utilization; such as mobilization of air resources and establishment of a heliport. For this reason, large-scale air operations, and the management thereof, are described within this training material.



Large scale rescues with numerous aircraft present many new challenges to rescue operations. Photo: Canadian Special Forces

This Intermediate Level Helicopter Safety program is designed to familiarize the student with helicopter operations in search and rescue (SAR) beyond basic helicopter safety

In particular, this program incorporates elements of the Incident Command System (ICS), and users of this program should be familiar with ICS.

Part 1 – Helicopter Essentials

The safety of a helicopter rescue program depends on the training, qualifications and experience of the search and rescue personnel. Rescuers must have a working knowledge of helicopter safety and operations, augmented with experience in the use of helicopters in rescue settings. Knowledge of and experience in the Incident Command System and its hierarchy is also necessary.

Helicopter Operations within ICS

One of the beauties of the Incident Command System is that it can be scaled up or down in accordance with the size of the search or rescue operation. This is equally true in search and rescue operations that include the use of helicopters.

For large-scale air operations with multiple aircraft, the Heliport Manager manages the Heliport within the Incident Command System. The Heliport Manager reports to the Air Operations Branch Director, who is also responsible for any fixed wing operations. The Air Operations Branch Director reports to the Operations Section Chief who, in turn, reports to the Incident Commander.

For smaller search and rescue operations in which a very informal, scaled-down Incident Command System is used, the Incident Commander may be responsible for most aspects of the decision-making process with regard to air operations. In so doing, the Incident Commander must take responsibility for air safety concerns. He or she must see that all safety issues are addressed.

Helicopter Size Classification

There are three size classifications with regard to helicopters that are used throughout the aviation industry. These classifications are based in accordance with their maximum available standard passenger classification.

The three classes are as follows:

- Light: 0 to 6,000 pounds (typically seats 1 to 7)
- Medium: 6,001 to 12,500 pounds (typically seats 8 to 16)
- Heavy: 12,501 pounds and higher (typically seats 17 or more)

ICS Classification of Helicopters

The Incident Command System, on the other hand, has defined four classifications of helicopters. They are:

- Type I: seats at least 16 people and has a minimum capacity of 5,000 lbs. Both a CH-47 (Chinook) and UH-60 (Blackhawk) are Type I helicopters.
- Type II: seats at least 10 people and has a minimum capacity of 2,500 lbs. Both an UH1-H and a Bell 212 are Type II helicopters.
- Type III: seats at least 5 people and has a minimum capacity of 1,200 lbs. Both a 206 and a Hughes 500 are Type III helicopters.
- Type IV: seats at least 3 people and has a minimum capacity of 600 lbs.

Calling for Helicopters

Since risks are inherent in the utilization of helicopters, SAR teams must consider

several important factors when determining whether or not to call out these resources.

First, the urgency of the mission must be considered. Is the use of a helicopter going to improve the victim's condition? If ground teams could transport the victim without worsening any injury, does the benefit of utilizing a helicopter outweigh the risk? This is an often overlooked primary consideration.

Second, weather, altitude, terrain and daylight conditions must be considered. Since "ideal flying conditions" vary from helicopter to helicopter, rescue team leadership must be aware of the limitations of any helicopter they use when calling for these expensive resources.

Third, we must consider the skills of the pilot. Many search and rescue teams have the good fortune of working with the same pilots, such as local television station pilots or trauma center aero-medical pilots. As such, these SAR teams develop a clearer sense of that pilot's abilities in SAR activities and are able to consider this history when calling for helicopters. Rescue teams that do not know the pilot or his/her history should consider carefully whether particular skills are required to achieve the mission.

Finally, SAR teams must evaluate the nature of the task for which the helicopter is being considered. If, for example, a helicopter is requested to perform spotting during a search operation in fair weather, then the risks may be low. On the other hand, a hoist operation or other external load with a live rescuer suspended from the chopper increases the risk exponentially. In the event of any helicopter performance problems, the pilot will often drop the external load to improve the performance of the chopper and save the lives of the others on board.

As much as search and rescue team members must have the physical skills to perform their field duties, the team's leadership must have the wisdom to know when the risks of helicopter use outweigh the benefits. When conditions are not appropriate for flying, only the best Incident Commander will have the courage to choose **not** to call for the helicopter.

Air Force Rescue Coordination Center (AFRCC)

Civilian SAR teams are fortunate to have at their disposal a multitude of helicopter resources through the United States armed forces. The Air Force Rescue Coordination Center currently located at Tyndall Air Force Base in Florida.

According to the AFRCC web site, *in 1956, the National Search and Rescue Plan was published, establishing a crucial link between military resources and their unique recovery capabilities, and the civilian sector chartered to respond to those in need. This plan established the United States Air Force as the executive agent for inland search and rescue, covering the continental United States, less the major navigable waterways. To provide coordination to meet the growing demand for search and rescue, in 1947 the Air Force established three Rescue Coordination Centers, at Hamilton Air Force Base, California, Lowry Air Force Base, Colorado, and MacDill Air Force Base, Florida.*

In 1974, as a result of improved technology and communications capabilities, these three Rescue Coordination Centers were consolidated into the Air Force Rescue Coordination Center at Scott Air Force Base, Illinois. While at Scott, the Air Force Rescue Coordination Center came under the control of several different commands: Military Airlift Command, Twenty-Third Air Force, Aerospace Rescue and Recovery Service, and Air Rescue Service. As budget

cuts and agency reorganizations continued in the military, the Air Force Rescue Coordination Center was eventually relocated to Langley Air Force Base, Virginia in 1993, and was aligned under the newly organized Air Combat Command.

Despite military restructuring, the peacetime mission has remained unchanged and vital from 1974 to current day. As of August 2001, over 56,450 search and rescue missions have been performed, resulting in over 12,830 lives saved.

The AFRCC mission is “Continuously building a coordinated search and rescue network ensuring timely, effective lifesaving operations whenever and wherever needed.”



Specific Helicopters by Type

There are many types of helicopters, but four types that are useful for rescue operations. For the purpose of this program, we refer to these four types of helicopters:

- Rescue Helicopters
- Transport Helicopters
- Observation Helicopters
- Aero-medical Helicopters

Each of these is further described below.

Rescue Helicopters

A "rescue helicopter" is defined as a rotary wing aircraft capable of high altitude, warm weather, and out-of-ground effect (OGE) hovers. The aircraft must be capable of

landings in rugged terrain using small unimproved helispots. A rescue helicopter would be used to perform rescue operations, possibly at high altitude. The following are some examples of rescue helicopters:

- Aerospatiale Alouette III SA-317B
- Aerospatiale Twin Star AS 355 F1
- Lama SA315
- Boeing Vertol Chinook CH47
- Jolly Green Giant
- Bell 212
- Bell 205 (UH-1H, B, M) - Single-engine Huey
- Bell 412 (UH-1N) - Twin engine Huey
- Bell 214 ST
- Bell 414 ST
- BK 117
- BK 105

Transport Helicopters

A "transport helicopter" is defined as one that is capable of transporting up to 6 search and rescue personnel, including their gear. The aircraft must be capable of high altitude, warm weather flying. A "transport helicopter" must also be capable of landings in moderate terrain using medium- to large-sized improved helispots. A transport helicopter, therefore, is used to transport search and rescue teams to the field in situations where ground transport would be impractical or too time-consuming. The following are some examples of transport helicopters:

- Boeing Vertol Chinook CH47
- Huey
- Blackhawk

Not surprisingly, these examples correspond to the three most common helicopters dispatched by the Army when they assist in civilian search and rescue operations.

Observation Helicopters

An "observation helicopter" is defined as one with limited seating with limited tactical capabilities at altitudes on hot days. SAR teams during search operations would use an observation helicopter. Examples of observation helicopters include:

- Aerospatiale Alouette III SA-317B
- Aerospatiale A-Star AS 350
- Aerospatiale Twin Star AS 355
- Bell 47 Soloy
- Bell 206-L2
- Bell 206-L3
- Bell 206 III
- Hiller 12E Soloy
- Hughes 500C, D or E
- McDonald Douglas 500D or E

Aero-medical Helicopters

An "Aero-Medical helicopter" is defined as one that is capable of transporting aero-medical personnel as well as at least one supine patient. This is typically a flying ambulance with a flight nurse or doctor on board and a variety of medical support equipment.



Some aero-medical helicopters can also transport rescuers. Photo: Charley Shimanski

Aero-medical helicopters must be capable of high altitude, warm weather flying as well as

landings in moderate terrain using small- to medium-sized improved helispots. The following are some examples of aero-medical helicopters:

- Aerospatiale Alouette III SA-317B
- Aerospatiale A-Star AS 350
- Aerospatiale Twin Star AS 355
- Bell 205 (UH-1) Huey
- Bell 206 B III
- Bell 206 L-1
- Bell 206 L-3
- Bell 222 UT
- BK-105
- BK-117
- Hughes C, D or E
- McDonald Douglas 500 E
- McDonald Douglas 531 SP

Advanced Helicopter Limitations

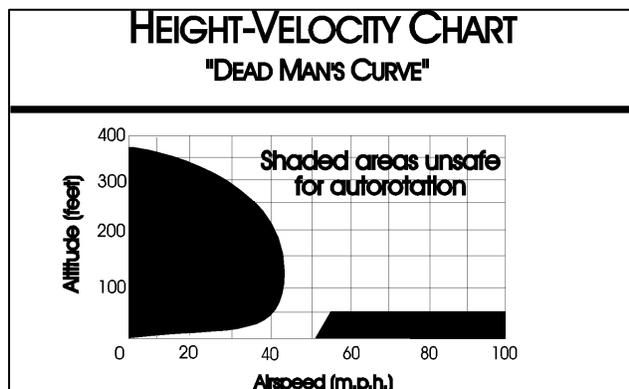
The Mountain Rescue Association's basic level helicopter training program defines several helicopter limitations, such as visibility, weather, fuel capacity, etc. For this intermediate level program, we look more closely at some higher level limitations.

Height-Velocity Chart

Most helicopters can be piloted safely to the ground even in the event of an engine failure. This is only possible, however, if the helicopter is operating at certain speeds and altitudes.

Each helicopter flight manual contains a "Height-Velocity" chart, which indicates speeds and altitudes to be maintained so that a safe autorotation may be made in the event of a mechanical or electrical failure. At speed/altitude combinations below the curve in the "caution" areas of the chart, the helicopter would be difficult to safely autorotate. For this reason, the Height-

Velocity Chart has been given the nickname "Dead-Man's Curve."



Density Altitude

A large number of search and rescue operations requiring helicopters occur at times of high temperature, high humidity, and often at high elevations (subsequently low atmospheric pressure). Unfortunately, each of these three variables negatively affects the performance of a helicopter.

Density altitude, which is the effect on aircraft by these three variables (temperature, humidity and atmospheric pressure), is an important issue that must be considered by the team's leadership. A helicopter cannot work as effectively at higher altitudes as it can at sea level. The effect of increased temperature would be similar to increasing the elevation to which the helicopter must now fly. On a hot day, the density altitude at a particular location may be 2,000 or even 3,000 feet higher than the elevation of that location on a cool day.

Increased humidity has an affect, albeit a minor one, on density altitude as well.

In technical terms, "density altitude" is pressure altitude corrected for temperature and humidity. All three factors (atmospheric pressure, temperature and humidity) affect the density altitude in varying degrees. The higher the density altitude, the weaker the helicopter

performance. High elevation (e.g. reduced atmospheric pressure), high temperature and high humidity all contribute to higher density altitudes. Performance is reduced because the thinner air at high-density altitudes reduces blade efficiency. This, in turn, requires additional pitch and power to maintain the same lift capability. The greater pitch angle results in increased drag that requires additional power. Non-supercharged piston engines and turbines also operate less efficiently in this less dense air.

A high-density altitude can result in loss of engine power, reduced lift and reduced payloads. This would mean that the helicopter would require longer takeoff and landing rolls and would experience a decreased rate of climb. Of the three variables listed above, humidity plays a very minor role in determining density altitude.

Density altitude is one reason why helicopter pilots may prefer to fly in the early morning hours. It also explains why a pilot, whose chopper is full of fuel, may wish to fly with only one passenger at a time.

Most importantly, density altitude is the entire reason why consideration of the need for helicopters during search and rescue missions should be made the night before, or early in the day, since flying conditions may be less than ideal during the afternoon hours.

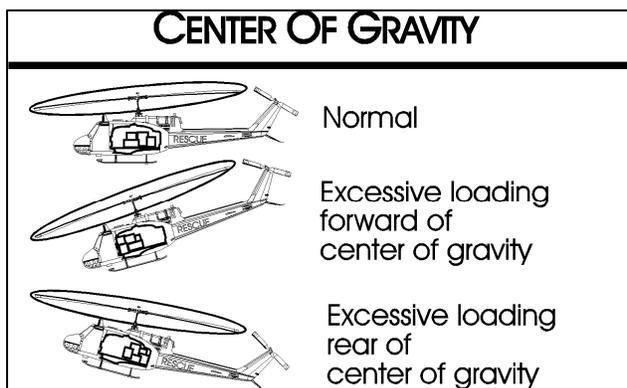
Loss of Tail Rotor Effectiveness

The pilot controls the helicopter's tail rotor with pedals operated by his/her feet. When the anti-torque provided by the tail rotor is insufficient to counteract the torque of the main rotor, the ship experiences the condition called "loss of tail rotor effectiveness." The helicopter will begin a spin, albeit potentially a slow one. This is a dangerous condition. It is more common in situations of high altitude, high temperature and/or heavy loads.

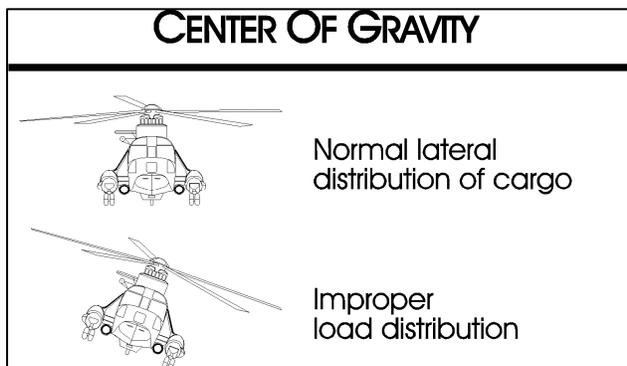
Helicopter Loading

Center-of-Gravity Effects

Consideration of center-of-gravity (CG) limitations is important in the loading of all aircraft, but is particularly important and critical in helicopters. In fixed-wing aircraft, the load is balanced over a horizontal wing area and has a comparatively wide range. In a helicopter, however, it is carried under a single point, like a pendulum. Therefore, even a small amount of "out of CG" loading can greatly affect the controllability of the helicopter.



Center-of-gravity effects are one of the most significant reasons that one-skid offloads should be performed with precision, by rescuers familiar with this procedure, and only when absolutely necessary.



Helicopter Performance Capabilities and Specifications

In order to complete the mission safely and successfully, a helicopter must be capable of the performance required. Weight-lifting capacity, hover ceiling, airspeed and fuel requirements need to be considered by the SAR team leadership while selecting the appropriate aircraft.

Capabilities and Specifications Definitions

The definitions listed below are helpful in understanding the technical specifications of helicopters. Remember that these specifications are generally for a "standard day" (altitude = sea level; temperature = 59 degrees Fahrenheit).

Hover Out of Ground Effect (HOGE)

Hover Out-of-Ground Effect (HOGE) is the absolute limit of the helicopter's ability to hover when in out-of-ground effect.

Hover In Ground Effect (HIGE)

Hover In-Ground Effect (HIGE) is the limit of the helicopter's ability to hover when in in-ground effect (normally effective up to a height above ground equal to the radius of the main rotor). This is measured from the plane of the main rotor blades to the ground.

Gross Weight

"Gross Weight" is the maximum certified weight in pounds. Some models have higher or lower weights for jettisonable external loads. If no number appears in the external weight block, the weight is the same as internal.

Payload

Payload is established by subtracting the equipped weight of the helicopter from the computed gross weight for a calm day at 5,000 feet pressure altitude, 80 degrees Fahrenheit, 7,400 feet density altitude, 2 hours of fuel and a pilot. Pilots and crew use charts or "tabulated data" which provides payload data for a variety of temperatures and pressure altitudes.

Ceilings

These are in and out of ground effect hovering ceilings, computed at maximum gross weight in a standard atmosphere and calm air. This value is "density altitude."

Fuel Consumption and Fuel Capacity

Fuel consumption, given in pounds per hours, is computed for 5,000 feet pressure altitude at 80 degrees Fahrenheit. Fuel capacity is computed using a measured amount of fuel burned in a known amount of time.

Part 2 – Helicopter Landing and Takeoff Areas

One of the most important aspects in planning for helicopter operations is the selection of heliports and helispots for the helicopters. The Air Operations Director and/or Heliport Manager (within the ICS system) may have at their disposal the finest helicopter available, a good crew, and the best helicopter accessories available. Still, he/she may need a network of heliports and helispots to fully utilize the machines.

For large, extended search and rescue operations, the types of activity and the volume of helicopter traffic will affect selection and development of helispots. The site should lend itself to economical development, to a size that will accommodate the type of helicopters used and the volume of traffic expected.

Landing and Takeoff Areas Definitions

Permanent Heliport

A permanent heliport is a permanent facility for helicopter operations, often at or near the incident command post. It is usually the "home base" of assigned helicopters and personnel.

For large scale operation, a heliport should be large enough to accommodate at least two medium-class helicopters, have fueling facilities if possible, a reliable wind indicator, signs, fire extinguishers, paved pads, vehicle parking areas, and reliable telephone and/or radio communications.

A heliport of this size should be located far enough from the command post that the

sounds of aircraft ingress and egress does not disturb operations at the command post. Still, it should be close enough that reliable two-way radio communications is not compromised.



The types of activity will affect the selection and development of heliports and helispots. Photo: Charley Shimanski

Helibase

A helibase is a secondary base to be activated intermittently as the need arises. A helibase should contain most of the facilities required for a permanent heliport.

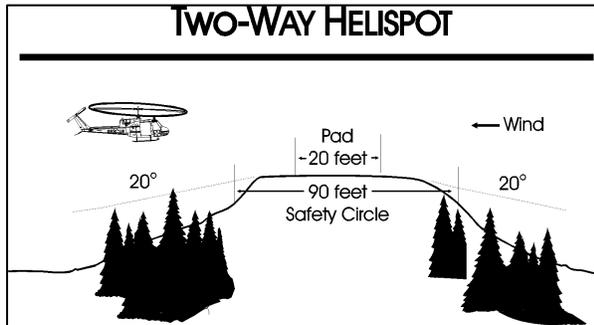
In an extremely large operation, there may be two or more helibases. Facilities should include parking areas for refueling and maintenance trucks, and adequate communications with the command post.

Helispot

A helispot is a natural or improved takeoff and landing area intended for temporary or occasional helicopter use in the field. It may or may not have road access. In many cases, helispots do **not** meet the basic requirements of a heliport and, therefore, should not be declared formally or referred to as heliports.

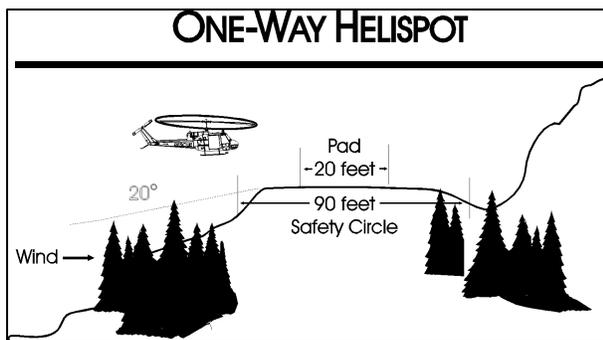
A two-way helispot (pictured below) is ideal because it gives the pilot the option of flying

into the wind during landings and takeoffs. Remember that a helicopter pilot will prefer to land and takeoff into the wind.



It is important to maintain safety precautions around all helispots. A safety circle (described in the diagram) of 90 feet or greater is important, as is a 20-foot landing area (or "touchdown pad"). In addition, trees and other natural or man-made obstructions should be low enough to allow for a 20° angle of approach or departure.

In some cases, one-way helispots may be the only option. In this case, the same safety circle, touchdown pad and approach/departure angle should be maintained.



Off-Site Landing Area/Landing Zones

An off-site landing area is an unimproved area used only one time and at the discretion of the pilot. These are common

in rescue operations where only one victim is to be rescued, and the evacuation is made by helicopter.

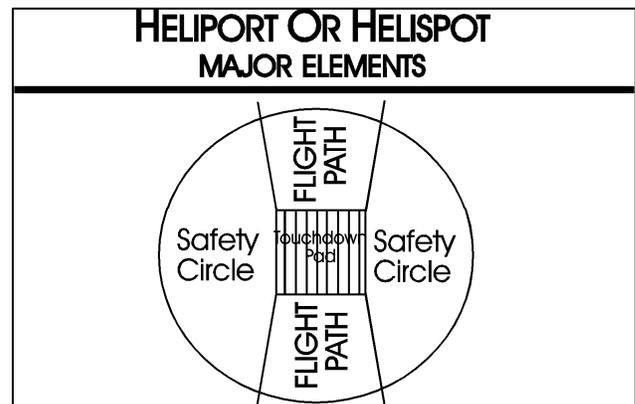
Rescuers often call these off site landing areas "landing zones" or "LZ's."

Major Elements of a Heliprot/Helispot

There are several important aspects that must be considered when developing heliports or helispots. Many of these are detailed below.

Landing and Takeoff Area

The landing and take off area is the specific area in which the helicopter actually lands and takes off, including the touchdown pad and safety circle. A "landing and takeoff area" exists in virtually every landing zone, whether it is at a heliport, helibase or helispot.



Safety Circle

The safety circle is a safety zone that provides an obstruction-free area on all sides of the landing and takeoff area.

Touchdown Pad

A touchdown pad is that part of the landing and takeoff area where it is preferred that the helicopter land. It is essential that there be no large obstacles or debris in this area.

Approach/Departure Path (Flight Path)

The approach/departure path is a clear path selected for flight extending upward and outward, in both directions, from the touchdown pad and safety circle. At higher density altitudes, this path must be extended to allow for takeoff in situations where reduced lift is available.

Other Helispots/Heliport Safety Considerations

Whenever possible, landing zones should be located in such a manner that landings and takeoffs may be made into the prevailing winds. Rescuers should avoid, if at all possible, one-way helispots (those which only allow for approach from one direction), especially at higher altitudes. Furthermore, slopes should be avoided at all costs.

Landing Zones Over or Near Water

Water provides a poor ground effect base for hovering. River currents move the ground cushion and can result in pilot disorientation. Furthermore, if a helicopter must take off over water from a helispot on shore, the ship may need at least 300 feet of water over which to gain flying speed.

Canyons

In canyon bottoms rescuers should be aware of dead air holes and consider that canyon bottoms do not have downdrafts from neighboring ridges. If the canyon is deep, the helicopter will need a long forward run to pull out or a wide enough area in which to circle to gain elevation.

Grassy Meadows

Like water, meadows with high grass will tend to dissipate helicopter ground cushion. High grass may also hide rocks, logs and swampy areas. Furthermore, dry grass can be a serious fire hazard.

Landing Zones on Snow or Ice

Ice locations for landing zones should be avoided at all costs. If an icy landing zone must be used, those with a greater than 10% slope should be avoided. Under these conditions, a pilot may not be able to judge the slope angle and iciness of the LZ.

If an icy LZ is chosen, rescuers must stay well clear of the helicopter during landings and takeoffs, since torque may cause the tail rotor to swing around.

If the aircraft is ever parked on a snowy/icy surface for an extended period, the skids may freeze to the surface of the snow/ice. This is a dangerous situation, as it can lead to dynamic rollover of the helicopter during takeoff.

Keeping LZ's Clear

Rescuers must keep landing zones clear of personnel and equipment at all times. In addition, rescuers should keep at least 100 feet away from helicopters except when loading.



Helicopter Safety Operations

The following guidelines must be enforced at the heliport:

First, there should be NO SMOKING within 200 feet of all helicopters. Mission management should strongly consider

having fire equipment (e.g. fully equipped pumpers) at the scene of the heliport during all hours of operation.

The following procedures should be observed when refueling helicopters at landing areas:

- Helicopter engines will be shut off and rotor blades fully stopped (aircraft equipped with closed-circuit fueling systems need not shut down).
- There will be no passengers aboard the choppers while refueling.
- Both helicopters and fuel containers must be grounded.
- Fire extinguishers will be on hand.

Wind direction should be indicated by use of a windsock, flagging or streamers. Heliport landing zones, particularly refueling areas, should be dust-proofed by wetting down or by other means to prevent damage by dust and other foreign objects. LZ's should be kept clear of light, loose objects and unauthorized personnel. Ground vehicles near helicopters should not be moved until the chopper rotors have come to full stop. Helicopters with wheels must be chocked after landing, and parking brakes must be set.

One-wheel or one-skid landings should not be performed in the heliport. When helicopter accessories such as sling loads are being used, unauthorized personnel should never be standing directly beneath any portion of the helicopter or equipment. Finally, takeoff and landing areas must be clear of other aircraft, personnel and vehicles.

Heliport Equipment

The following equipment should be available at the heliport:

- Fire extinguisher (200 pounds at each permanent base heliport - 20 pounds per helicopter.)
- Protective clothing
- Crash rescue equipment for entry and extrication.
- Crash evacuation kit including stokes litter and appropriate first aid equipment.
- Water for refuelers doused in jet fuel - possibly a spare set of overalls



Heliports should have several pieces of essential safety equipment. Photo: Charley Shimanski

Furthermore, the Incident Commander, Operations Chief and/or Heliport Manager must know how to mobilize specialized crash/fire rescue units---their locations, phone numbers and call-out procedures. Specialized medical facilities available including burn and head injury treatment facilities including their locations and phone numbers should be known as well. Medical transportation methods must be available, including trauma center helicopters.

Helicopter Evacuations

In addition to transporting search and rescue workers, helicopters are often used to transport injured subjects. In these cases, helicopters can make pickups in three ways

1. by landing at a LZ
2. by making a hovering or one-skid recovery, or
3. by using an external load operation (hoists, short-hauls)



The last two are hazardous, even under optimal conditions. In conditions of mountainous terrain, evacuations should be by landing if at all possible, even if this means a trail carry of the victim by ground crews to a nearby LZ. In many mountain rescue situations, there is plenty of time to locate or construct a safe landing zone rather than try hovering or one-skid recoveries.

Landing Recoveries

Hazards exist even in relatively safe conditions of a landing recovery whereby the helicopter will normally come to full rotor stop. While rescuers will have likely worked before with the helicopter and its crew, the victim should be briefed regarding helicopter safety. This would include what the subject should expect, and a warning to stay away from the rear of the helicopter (if the patient is ambulatory). Even if the helicopter is fully without power, rescuers should escort any walking victim to the helicopter and assure that they are secured in their seat with their full seat belt, including chest harness.

Particularly if the patient is on his/her back in either or a litter or on the helicopter pram, rescuers should anticipate that the helicopter flight will make the subject nauseous, and should be prepared for the

possibility that the victim may vomit during the transport.

Hovering and One-Skid Recoveries

In certain situation, pilots and rescuers may choose to perform a hovering or one-skid recovery of a rescue victim. In this case, serious medical complications are likely present, which warrants the more hazardous recovery.

Medical problems of a victim can be compromised during hovering or one-skid recoveries, due to fear, uncertainty and anxiety. Rescuers should advise the victim what will happen prior to the actual helicopter pickup. They must be certain that the victim is capable of withstanding the strain of the recovery procedures, which will include a very loud noise combined with high rotor wash and dangerous conditions.

If rescuers do not have communications with the pilot and the rescuer will not accompany the victim on board the chopper, a tag should be attached to the victim stating the medical condition and treatment given as well as where s/he is to be taken.

The factors to be taken into account in selecting a site for a hovering recovery are generally the same as those for selecting a helispot. In these conditions, a smaller ground area, rougher terrain and steeper slope are permissible. On the other hand, it is extremely important that there be plenty of room for both the main rotor and the tail rotor boom, since the pilot may have to turn the helicopter in the event changes in wind direction. An experienced hand signaler, one that the pilot knows is competent, should be at the site and all ground personnel should be within the pilot's view, if at all possible. In the case of one-skid recoveries on rock outcrops, this may be impractical.

External Loads (Suspended/Retractable Recoveries)

A detailed explanation of external load operations is found in the Helicopters in Search and Rescue Operations – Advanced Level” program of the Mountain Rescue Association.

In-flight Emergencies

There may be cases in which an in-flight emergency can occur. These may be due to mechanical issues with the aircraft, or visibility and/or weather conditions outside the aircraft.

In the event of an in-flight emergency, the following procedures must be observed:

- all the way and tighten all straps.
 - Exiting: Wait until all motion stops unless there is a fire or unless instructed to do otherwise by the pilot.
- Notify base of emergency and location, regardless of how minor the emergency may appear. This is normally accomplished by the pilot
 - Assure that seat belts are snug.
 - Secure protective equipment, including helmet and clothing.
 - Keep hands and feet clear of controls.
 - Secure any loose gear.
 - Check emergency exits and operation.
 - Observe the following crash landing seating positions
 - For passengers facing forward or sideways with seat belt only: lean forward, tuck head between knees and place arms around knees.
 - For passengers facing forward with seat belt and shoulder harness: lean back all the way and tighten all straps.
 - For passengers facing to rear with seat belt and/or shoulder harness: lean back

Part 3 – Helicopter and Heliport Management

Introduction

Management of helicopters in any search or rescue operation is a challenging job. The speed (or short round-trip times) in which helicopter missions are accomplished represents the primary challenge. To take advantage of this speed, the Heliport Manager must anticipate expected needs.

The success of efficient helicopter management depends on trained and qualified managers and key mission overhead that have working knowledge of helicopter use.

Recommended Procedures

A Manager should be assigned whenever a heliport or helispot is used. An individual trained in basic helicopter use, the Heliport Manager should be stationed at each heliport or helispot during operations to load, unload and enforce safety procedures. An adequate ground crew should be provided to perform work in support of the manager and aircraft.

It is the responsibility of the Incident Commander or Air Operations Director to place trained and qualified people in helicopter management.

Considerations When Utilizing Media Helicopters

Since search and rescue teams often request the assistance of media helicopters, there exists the possibility that the helicopter operations team will be faced with requests

for information and/or interviews by the media. The Heliport Manager should recognize that press releases and/or media interviews are the responsibility of the Sheriff, Incident Commander, and Operations Chief or assigned Public Information Officer. Furthermore, interviews with search team members and/or subjects or family should be discouraged until the Sheriff, Incident Commander and/or Public Information Officer has been notified.



Special consideration must be given when working with media helicopters.
Photo: Charley Shimanski

Considerations When Utilizing Aero-Medical Helicopters

If aero-medical helicopters arrive at a heliport or at the command post en route to a rescue scene, the Heliport Manager or Incident Commander must assure that the flight nurse is able to quickly contact field medical personnel for a briefing on the rescue and/or patient's status. The pilot should be given a briefing by those familiar with the designated field LZ.

Locating the Base Heliport

Normal guidelines should be observed for helicopter landing and takeoff areas. The best heliports are located on exposed knobs, including a spot where a drop-off is possible for takeoffs. The higher the elevation, the more important the drop-off becomes. With

a drop-off, the helicopter may use less power, carry a larger payload and have a greater safety margin.

Location of the heliport should always be a prime consideration. Consider the location relative to the command post. If possible, the heliport should be within walking distance of the command post, but not located so close that dust and dirt would affect base operations and create noise.

The heliport should be large enough to accommodate all helicopters presently working on the mission. In extended search operations, the Air Operations Chief should also plan for growth potential.

The heliport must be accessible by road, preferably one other than the main road to the command post. The heliport should have access to water, if possible.

Activating the Base of Operations

When activating the Heliport, several important issues must be considered. First, personnel should restrict travel on the heliport using barriers, cones, flagging, etc. Access control for official vehicles and personnel should be provided. Warning and directional signals must be provided as necessary. These include "NO SMOKING" signs at fuel storage areas around heliport as well as directional signs pointing the way to the heliport and the command post.

A windsock or flagging (if windsock is not available) must be installed as well. Wind indicators must not be in any takeoff or landing path. Wind indicators should be posted where pilots can clearly see them. Wherever possible, use a smooth surface pole so that wind indicators will not "hang-up" while wind or rotor wash is blowing.

Fuel and Oil considerations must be made as well. The Heliport Manager must maintain adequate supplies of jet fuel and

oil. All drums should be stored 100 feet from the landing area. Shade and air circulation must be provided. Finally, fuel trucks should be on the landing and takeoff area only during refueling, and then moved away.

It is essential that communications issues be addressed. First, telephone communications with the command post may be useful. Radio communications between aircraft, managers and the command post are essential for efficient use. Pilots should be briefed on the appropriate frequencies for all communications. Finally, all helicopters must be equipped with radios/frequencies essential to the mission.

Trash cans for paper, oily rags, and oil cans etc. may be useful. If the mission is anticipated to be a long one, a portable generator or other source of electricity is necessary to provide lights. Water or dust abatement liquids should be used to maintain a dust-proof environment for the heliport. Finally, a vehicle to take rescuers, pilots and key overhead to and from the command post would be advisable.

Managing the Heliport

Duties of the Heliport Manager

The following duties are the responsibility of the Heliport Manager:

First, s/he requests ground operations crew through the Operations Chief. S/he also supervises construction of the heliport and helispots. The Heliport Manager must also order necessary facilities and equipment from the Operations Chief for safe efficient heliport operation. Supervises installation and placement of facilities

The Heliport Manager must obtain data on each aircraft operating on the heliport, including:

- Type
- Owner and pilot(s)
- Estimated time of travel
- Limitations on normal use
- Hours flown

S/he must also secure a priority list of air missions and schedule flights, as directed by the Operations Chief and/or Incident Commander. In addition, the Heliport Manager supervises and clears all missions approved by the project manager (Assignments should be made the previous night, during the evening planning session). Maps showing mission area, hazard areas, heliports, etc. must be furnished to helicopter support crews and pilots.

The Heliport Manager must brief pilots, helicopter support crews and other personnel on the following:

- Type of mission to be flown
- Landing and takeoff areas (helispots) to be used and their numbers
- Weather conditions
- Hazards, such as power lines
- Safety and emergency procedures
- Other aircraft activities
- Established flight patterns at all landing areas
- Communications protocol and frequencies

Aided by the ground crew, s/he must instruct all personnel in helicopter safety. Emphasis is placed on safety training in approaching, entering, riding and exiting the helicopter. The Heliport Manager must also assure that personnel and freight are loaded at the heliport and unloaded at the field helispot safely

Flight operations must be ceased during periods of high wind and poor visibility.

Operational concerns must also be addressed. The Heliport Manager must receive overhead, crews and supplies arriving at the heliport and verify arrangements for transportation to assigned destinations. S/he must also record ETA's on all assigned helicopters. Remember that the Heliport Manager works closely with the dispatcher and timekeeper. By recording ETA's, better helicopter management is realized and immediate search can be initiated for overdue or lost helicopters (A missed radio check-in during a 1988 Alpine Rescue Team search was the primary reason for a quick spotting of the downed aircraft with one survivor on board).

Arrangements to protect helicopters at night must be made.

Duties of the Heliport Crew

The Heliport Crew must construct and equip the heliport as directed by the Heliport Manager. They must maintain the heliport including dust abatement. They must also assist in supervising loading and unloading of personnel. It is best to escort personnel to and from the helicopters. Ground crewmen also carry tools and equipment for passengers and check belts before takeoff.

Conclusion

The key to effective utilization of any resource in search and rescue operations lies in the following factors:

- Early identification of the requirements
- Effective mobilization of the required resources
- Efficient management of the resources at the scene
- Accountability for resource utilization

With helicopter resource management, additional concerns are vital to the success of the operation. These are:

- Assurance that safety considerations are not only met, but exceeded
- A complete risk-benefit analysis is performed prior to the utilization of any aircraft

With proper management of airborne resources, search and rescue teams can accomplish more than is possible with simply ground-based resources.

Once again, "helicopter management" is "the direction, scheduling, coordination and control of helicopter use in accordance with agency policies to ensure maximum efficiency as well as safety in all aspects of the search or rescue operation."

Acknowledgements

Our thanks to the following individuals and organizations that assisted in the development of this program:

"Flight for Life" staff and pilots - St. Anthony's Hospital, Denver CO

"Air Life" pilots - Centennial Hospital, Denver CO
Richard Arnold - Past President, Mountain Rescue Association
Keith Cubbege – former Dispatcher, Air Life, Denver CO
Drew Davis - Past President, Mountain Rescue Association and Colorado Search and Rescue Board
Jim Frank - Santa Barbara County Sheriff's SAR
Mike Fyola - Pilot, Jefferson County (CO) Aviation Wing
Steve Kelleher - Alpine Rescue Team
Tim Kovacs – Past President, Mountain Rescue Association
Peter Peelgrane - Chief Helicopter Pilot, KUSA-TV Denver CO
Mark Reese - Office of Aircraft, U.S. Department of the Interior
Mike Silva - Helicopter Pilot, KCNC-TV Denver CO
Rich Westra - Helicopter Pilot, KMGH-TV Denver CO



M O U N T A I N
RESCUE
A S S O C I A T I O N

The Mountain Rescue Association is an organization dedicated to saving lives through rescue and mountain safety education

www.mra.org