CHAPTER 6: HELICOPTER CAPABILITIES AND LIMITATIONS.

I. Introduction.

It is essential that non-Pilot users of helicopters gain at least a rudimentary knowledge of helicopter capabilities and limitations. The brief summary in this chapter should be supplemented by basic helicopter safety training that provides further specific information concerning helicopter limitations and operating characteristics. Users are encouraged to extend this knowledge further by engaging in conversations with the individual most qualified to answer - the Pilot.

IMPORTANT NOTE: On any flight, the PIC is responsible for the safety of the aircraft and its occupants.

The user needs to become familiar with a number of terms in this section. Refer to the glossary for definitions. These terms include:

- Pressure altitude
- Density altitude
- Weight and balance
- Center of gravity
- Hover Ceiling-In-Ground Effect (HIGE)
- Hover Ceiling-Out-Of-Ground Effect (HOGE)
- Maximum certificated gross weight
- Hover ceiling
- Maximum computed gross weight
- Weight reduction
- Takeoff and landing limitations
- Equipped weight
- Operating weight
- Allowable payload
- Fuel consumption/capacity
- Cruise speed

For a basic explanation of the principles of helicopter flight, capabilities, and limitations, the user may want to refer to FAA Advisory Circular AC 61-13B, Basic Helicopter Handbook.

II. Helicopter Performance and Selection.

In order to safely and successfully complete a mission, the helicopter must be capable of meeting the performance required. Allowable payload, hover ceiling, airspeed, and fuel requirements need to be considered in selecting the proper aircraft.
Chapter 7 and Appendix A address the specifics of the helicopter load calculation form, which is the primary planning tool for determining if the helicopter is capable of lifting a load at a given temperature and elevation.

Chart 6-1 summarizes the minimum specifications for the typing of helicopters by allowable payload, number of passenger seats, and water or retardant carrying capability. When a helicopter is referred to by type, for example, as a Type 2 helicopter, it must have met the minimum specifications outlined in the chart for a Type 2 helicopter.

**Chart 6-1: ICS Type Specifications For Helicopters**

<table>
<thead>
<tr>
<th>TYPE</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Useful Load @ 59° F. @ Sea Level</td>
<td>5000</td>
<td>2500</td>
</tr>
<tr>
<td>Passenger Seats</td>
<td>15 or more</td>
<td>9-14</td>
<td>4-8</td>
</tr>
<tr>
<td>Retardant or Water Carrying Capability (Gallons)</td>
<td>700</td>
<td>300</td>
<td>100</td>
</tr>
<tr>
<td>Maximum Gross Takeoff/Landing Weight (Lbs)</td>
<td>12,501+</td>
<td>6,000-12,500</td>
<td>Up to 6000</td>
</tr>
</tbody>
</table>

**III. Weight and Balance.**

Weight and balance information is kept in each aircraft flight manual or weight and balance book. This information includes:

- Equipped weight of aircraft, as configured.
- Passenger configuration(s).
- Cargo weight and distribution limits.
- Center of gravity (CG) limits, as configured.
- Maximum takeoff and landing limits.
- Charts for computing weights and CG location.
IV. Day/Night Flight Limitations.


Except as noted below, or for reasons of life-or-death emergency, single-engine helicopters shall be limited to flight during daylight hours and only under VFR conditions (minimum ½ mile visibility). Daylight hours are defined as 30 minutes before official sunrise until 30 minutes after official sunset or, in Alaska, during extended twilight hours when the terrain features are readily distinguishable for a distance of at least one mile.

CAUTION: In mountainous or hilly terrain, compounded by the aspect of the terrain in relationship to the sun’s position, one may experience late dawn or early dusk conditions. Flight periods should be adjusted accordingly. Daylight hours may be further limited at the discretion of the Pilot or Helicopter Manager by conditions of visibility caused by smoke, shadows, etc.


Night operations are unique and require agency authorizations.

1. Weather Minimums for Night Operations. The following operational weather minimums are required for normal night operations (FAR 91.155) and recommended for helicopters performing life-or-death emergency night operations.

   a. Night in Class G airspace 1,200 feet or less above the surface:
      - Three (3) statute miles flight visibility;
      - Distance from clouds:
        - 500 feet below
        - 1,000 feet above
        - 2,000 feet horizontal.

   b. Night in Class G airspace more than 1,200 feet above the surface but less than 10,000 feet MSL:
      - Three (3) statute miles flight visibility;
      - Distance from clouds:
        - 500 feet below
        - 1,000 feet above
        - 2,000 feet horizontal.
2. Tactical Operations. Multi-engine helicopters may fly during nighttime hours provided they are equipped with approved night vision goggle (NVG) capability and the Pilots have been approved for NVG operations. NVG helicopter operations must be conducted within NVG operational guidelines.

3. Logistical Operations. Pilots may operate at night under the following conditions:
   a. Agency and Contract Pilots may, with agency specific approval, solo single engine helicopters at night for ferry and maintenance purposes. Transportation of passengers at night in a single engine helicopter is prohibited.
   b. Agency and Contract Pilots may, with agency specific approval, fly twin engine helicopters at night for ferry, transportation of passengers, and maintenance purposes.
   c. Conduct all night helicopter operations, other than NVG operations, in one of the following ways:
      • To and from airports and heliports having FAA approved lighting.
      • To and from airports and helibases approved by the Regional or State Aviation Manager.

4. Emergency Operations. The principles and procedures of risk management and analysis outlined in Chapter 3 shall be applied to any decision regarding conducting a nighttime emergency operation, particularly those conducted in adverse conditions of fog, mountainous terrain, etc.
   • Pilot-in-Command Authority. For single engine and twin engine night operations under emergency life-or-death criteria, final authority for the safety of the flight resides with the Pilot.


IFR operations are authorized when aircraft and Pilot(s) are approved and carded. Flights into IFR conditions shall be conducted only:

• In a multi-engine helicopter certificated for IFR operations, and
• When weather minimums meet or exceed those prescribed in 14 CFR 135 for helicopter IFR operations.

VI. Wind Restrictions.

The capability to fly a helicopter in excessive wind conditions varies considerably with the weight class of the helicopter and the degree of turbulence associated with the wind. If the helicopter flight manual or the helicopter operator’s policy does not set lower limits, the following shall be used. These limits may be further restricted at the discretion of the Pilot or other air operations personnel. See Chart 6-2.
A. Flight Above 500’ AGL.

Flights more than 500 feet above the surface are allowed in winds up to 50 knots for all types of helicopters.

B. Flight Below 500’ AGL.

1. Type 1 (Heavy) and Type 2 (Medium) Helicopters. Steady winds shall not exceed 40 knots or a maximum gust spread of 15 knots.

2. Type 3 (Light) Helicopters. Steady winds shall not exceed 30 knots or a maximum gust spread of 15 knots.

**Chart 6-2: Wind Restrictions For Types 1-3 Helicopters**

<table>
<thead>
<tr>
<th>FLIGHT ABOVE GROUND LEVEL</th>
<th>FLIGHT PERMITTED IN WINDS LESS THAN / MAXIMUM GUST SPREAD (in knots)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TYPE 1</td>
</tr>
<tr>
<td>MORE THAN 500’ AGL</td>
<td>50 / NA</td>
</tr>
<tr>
<td>LESS THAN 500’ AGL</td>
<td>40 / 15</td>
</tr>
</tbody>
</table>

VII. Helicopter Operations in Snow-Covered Areas.

Helicopters may have manufacturer limitations for operating in falling or blowing snow and could require additional equipment to be installed such as engine snow baffles, auto-re-ignition, engine filtration, etc. “Bear paws” or “full length skis” are needed in deep snow. The aircraft flight manual must be reviewed to determine specific requirements and/or limitations. Regardless of snow depth, extra caution is required when operating in areas of freshly fallen snow due to possible whiteout conditions, created by the rotor wash, which could result in the loss of positional awareness.

Special pilot techniques are required for safe operations when landing in 36 inches or more of undisturbed or crusted snow (not hard packed) in most light and medium helicopters that are equipped with high skid gear. Snow depths that are substantially less than 36 inches may require special pilot techniques when operations are conducted in models equipped with standard (low) height skid gear. Failure to use special operating techniques can be catastrophic if the tail rotor contacts the snow surface. Dynamic rollover is also possible. In addition, special passenger entry and exit procedures are required when operating in these conditions.

Pilots are required to have a “deep snow” endorsement on their Helicopter Pilot Qualification Card when operating over snow-covered areas where the depth and condition of the snow could pose a threat to safe operation during the takeoff and landing phases of flight. If the
snow depth is unknown, but suspected to be in excess of 18 inches deep, the pilot should be approved for deep snow operations.

It is difficult to specify a specific snow depth that defines the need for a deep snow endorsement on a pilot’s qualification card. If defined as the snow depth at which the entire weight of the helicopter is supported by snow only and no portion of the skids or wheels contacts the ground, the depth of the snow that may create that landing hazard to a Robinson R-44 may be different for a Sikorsky S-64. In addition, snow consistency may impact the need of a deep snow endorsement. For example, although a pilot may land on 5,000 feet of undisturbed snow on Antarctica’s polar cap, he or she would have difficulty having skids penetrate the surface more than a few inches due to hard packed snow, thus not requiring a deep snow endorsement.

To ensure safety, please contact a helicopter inspector pilot if you have questions or concerns.

VIII. Helicopter Flight Over Congested and Densely Populated Areas.

Whether a helicopter may operate over congested and/or densely populated areas pursuant to the Federal Aviation Regulations (FARs) depends on the type of operation being performed. With respect to external load operations, the FAA has determined that such operations are in the public interest and do not pose an undue risk to the public, as long as risk management principles are implemented.

Specifically, the FARs permit an operator to conduct external load operations over congested and densely populated areas provided the following conditions are met. Each flight must be conducted at an altitude, and on a route, that will allow a jettisonable external load to be released, and the rotorcraft landed, in an emergency without hazard to persons or property on the surface. However, in the event of an emergency involving the safety of persons or property, a certificate holder may deviate from the rules of this part to the extent required to meet that emergency.

Densely populated areas are those areas of a city, town or settlement that contain a large number of structures or a large gathering of persons, such as on a beach, air show, sporting event or roadway. Helicopters may conduct external load operations over roadways as long as the pilot is able to remain clear of non-participating personnel. Mitigations may include:

- See and avoid
- Traffic control using road guards (coordinate with appropriate authorities)
- Closure of road

Ensure that areas for load jettisoning, emergency landings, ingress and egress routes and a means to reduce the threat to the nonparticipating public are communicated. The last item is most important since the presence of a helicopter conducting an external load operation is likely to draw spectators and other unnecessary personnel to the scene.
IX. High Elevation Operations.

Supplemental oxygen may be required when operating above 10,000 feet for more than 30 minutes. Consult the procurement document and technical specialists for specific requirements (reference FAR Part 91.211 or Part 135.89).

X. Lockdown of Controls.

Specific direction may be provided by the procurement document regarding the lockdown of controls. In general, when trained ground or aircrew personnel are available to assist in loading and unloading, the Pilot should remain at the controls when the rotors are turning.

When these personnel are not available to assist, whenever practical, the aircraft should be shut down and rotors stopped prior to departure of passengers and Pilot.

It is recognized that there are certain situations when personnel are not available and which may require the Pilot to lockdown the controls (flight idle with controls locked). An example is the Pilot needing to check that the doors are secure. In these cases, if allowed in the approved flight manual, the Pilot may lock down the controls, but should not leave the area of the rotor arc.

XI. Military Helicopter Limitations.

The use of military aircraft shall comply with the requirements established in the *Military Use Handbook*. Military helicopters and flight crews, including National Guard and Coast Guard, must be agency approved by letter or card. A copy of this letter must be available.

Military performance planning cards (PPC) may be used, at the discretion of military Pilots, in lieu of the load calculation format.

Helicopter management personnel should be aware that military radios may not be compatible with operation radios and should be checked prior to use.

Military helicopters might not be configured to carry cargo. If they are, use military external load equipment, provided it meets military safety standards.

For further information, refer to the *Military Use Handbook* or local agreements with military authorities such as the National Guard.